

CHAPTER-1: RATIONAL NUMBERS

Assessment Time 1.1

1. a. $\frac{-24}{72}$ HCF of 24 and 72 is 24
 $\frac{-24 \div 24}{72 \div 24} = \frac{-1}{3}$
- b. $\frac{125}{-400}$ HCF of 125 and 400 is 25
 $\frac{125 \div 25}{-400 \div 25} = \frac{5}{-16} \times \frac{-1}{-1} = \frac{-5}{16}$
- c. HCF of 50 and 160 is 10
 $\frac{50 \div 10}{160 \div 10} = \frac{5}{16}$
- d. $\frac{39}{-169}$ HCF of 39 and 169 is 13
 $\frac{39 \div 13}{-169 \div 13} = \frac{3}{-13} \times \frac{-1}{-1} = \frac{-3}{13}$
2. a. The absolute value of $\left| \frac{-8}{13} \right|$ is $\frac{8}{13}$
- b. The absolute value of $\left| \frac{7}{-19} \right|$ is $\frac{7}{19}$
- c. The absolute value of $\left| \frac{-23}{-29} \right|$ is $\frac{23}{29}$
- d. The absolute value of $\left| \frac{-21}{37} \right|$ is $\frac{21}{37}$
3. a. $\frac{6}{13}$ and $\frac{-5}{13}$
 $\frac{6}{13} + \left(\frac{-5}{13} \right) = \frac{6-5}{13} = \frac{1}{13}$
- b. $\frac{-8}{17}$ and $\frac{-3}{17}$
 $\frac{-8}{17} - \frac{3}{17} = \frac{-8-3}{17} = \frac{-11}{17}$
- c. $\frac{21}{37} - \frac{16}{37} = \frac{21-16}{37} = \frac{5}{37}$

$$5. \text{ a. } \frac{5}{8} \text{ and } \frac{16}{25} = \frac{5}{8} \times \frac{16}{25} = \frac{5 \times 16}{8 \times 25} = \frac{2}{5}$$

$$\text{b. } \frac{-3}{10} \text{ and } \frac{-5}{16} = \frac{-3 \times (-5)}{10 \times 16} = \frac{15}{160} = \frac{3}{32}$$

$$\begin{aligned} \text{c. } \frac{4}{17} \text{ and } \frac{34}{60} &= \frac{4}{17} \times \frac{34}{60} = \frac{4 \times 34}{17 \times 60} \\ &= \frac{4 \times 2}{60} = \frac{8}{60} = \frac{4}{30} = \frac{2}{15} \end{aligned}$$

$$6. \text{ a. } \frac{15}{16} \div \frac{10}{32} = \frac{15}{16} \times \frac{32}{10} = \frac{15 \times 2}{10} = \frac{15}{5}$$

$$\begin{aligned} \text{b. } \frac{-17}{10} \div \frac{14}{-15} &= \frac{-17}{10} \times \frac{-15}{14} \\ &= \frac{(-17) \times (-15)}{10 \times 14} = \frac{51}{28} \end{aligned}$$

$$\text{c. } \frac{7}{10} \div \frac{-21}{30} = \frac{7}{10} \times \frac{30}{-21} = \frac{210}{-210} = -1$$

$$7. \text{ Sum of two numbers} = \frac{-5}{8}, \text{ One number} = \frac{-3}{16}$$

Let the other number be x .

According to the questions

$$x + \left(\frac{-3}{16} \right) = \frac{-5}{8}$$

$$x - \frac{3}{16} = \frac{-5}{8}$$

$$x = \frac{-5}{8} + \frac{3}{16} = \frac{2 \times (-5) + 1 \times 3}{16}$$

$$= \frac{-10 + 3}{16} = \frac{-7}{16}$$

Hence, the other number is $\frac{-7}{16}$.

8. Let the other number be x .

$$\text{One number} = \frac{26}{35}, \text{ Product of two number} = \frac{-13}{10}$$

$$x \times \frac{26}{35} = \frac{-13}{10}$$

$$x = \frac{-13 \times 35}{26 \times 10} = \frac{-35}{20} = \frac{-7}{4}$$

Hence, the other number is $\frac{-7}{4}$.

9. Difference of two rational number = $\frac{-16}{25}$

One number = $\frac{-8}{15}$

Let the other number be x

So, $\frac{-8}{15} - x = \frac{-16}{25}$

$$\Rightarrow -x = \frac{-16}{25} + \frac{8}{15} = \frac{-48 + 40}{75}$$

$$\Rightarrow -x = \frac{-8}{75} \quad \Rightarrow \quad x = \frac{8}{75}$$

10. Quotient of two rational numbers = $\frac{16}{30}$

One number = $\frac{-8}{15}$

$$\begin{aligned} \text{So, other number} &= \frac{16}{30} \div \frac{-8}{15} \\ &= \frac{16}{30} \times \frac{-15}{8} = -1 \end{aligned}$$

Assessment Time 1.2

1. a. $\frac{-3}{7} < \frac{-2}{7}$ b. $\frac{-6}{13} < \frac{3}{13}$

c. $\frac{-19}{23} > \frac{-23}{23}$

d. $\frac{5}{7} \nless \frac{7}{5}$ On cross multiplication we get

$$5 \times 5 = 25 \quad \text{and} \quad 7 \times 7 = 49$$

$$\text{Since } 25 < 49, \quad \text{So, } 5 \times 5 < 7 \times 7$$

$$\text{Hence, } \frac{5}{7} < \frac{7}{5}$$

e. $\frac{-6}{13} \square \frac{-4}{26}$

$$\frac{-6}{13} \nless \frac{-4}{26}$$

On cross multiplication, we get

$$-6 \times 26 = -156 \quad \text{and} \quad 13 \times -4 = -52$$

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$$\text{Since } -156 < -52$$

$$\text{So, } -6 \times 26 < 13 \times (-4)$$

$$\text{Hence, } \frac{-6}{13} < \frac{-4}{26}$$

$$\text{f. } \frac{-8}{15} \quad \square \quad \frac{-3}{10}$$

$$\frac{-8}{15} \times \frac{-3}{10}$$

On cross multiplication, we get

$$-8 \times 10 = -80$$

$$\text{and } 15 \times -3 = -45$$

$$\text{Since, } -80 < -45$$

$$\text{So, } -8 \times 10 < 15 \times -3$$

$$\text{Hence, } \frac{-8}{15} < \frac{-3}{10}$$

$$2. \text{ a. } \frac{-5}{3} \text{ or } \frac{-3}{12}$$

LCM of 8 and 12 is 24

$$\frac{-5}{8} \times \frac{3}{3} = \frac{-15}{24}$$

$$\text{and } \frac{-3}{12} \times \frac{2}{2} = \frac{-6}{24}$$

$$\text{Here, } \frac{-15}{24} < \frac{-6}{24}$$

(Since, $-15 < -6$)

$$\text{Hence, } \frac{-5}{8} < \frac{-3}{12}$$

$$\text{b. } \frac{-15}{18} \text{ or } \frac{-7}{19}$$

LCM of 18 and 19 is 342

$$\frac{-15}{18} \times \frac{19}{19} = \frac{-285}{342}$$

$$\frac{-7}{19} \times \frac{18}{18} = \frac{-126}{342}$$

$$\text{Here, } \frac{-285}{342} < \frac{-126}{342}$$

(Since, $-285 < -126$)

$$\text{Hence, } \frac{-15}{18} < \frac{-7}{19}$$

$$\text{c. } \frac{-12}{5} \text{ or } \frac{-3}{1}$$

LCM of 5 and 1 is 5

$$\frac{-12}{5} \times \frac{1}{1} = \frac{-12}{5}$$

$$\frac{-3}{1} \times \frac{5}{5} = \frac{-15}{5}$$

$$\text{Here } \frac{-12}{5} > \frac{-15}{5}$$

(Since, $-12 > -15$)

$$\text{Hence, } \frac{-12}{5} > -3$$

$$\text{d. } \frac{-3}{10} \text{ or } \frac{-5}{18}$$

LCM of 10 and 18 is 90

$$\frac{-3}{10} \times \frac{9}{9} = \frac{-27}{90}$$

$$\text{Here, } \frac{-27}{90} < \frac{-25}{90}$$

$$\text{Hence, } \frac{-3}{10} < \frac{-5}{18}$$

$$\frac{-5}{18} \times \frac{5}{5} = \frac{-25}{90}$$

(Since, $-27 < -25$)

3. a. $\frac{-6}{7}$ or $\frac{-4}{7}$

$$\frac{-6}{7} < \frac{-4}{7}$$

So, $\frac{-6}{7}$ is smaller

b. $\frac{-3}{7}$ or $\frac{-2}{14}$

$$\frac{-3}{7} \times \frac{2}{2} = \frac{-6}{14}$$

LCM of 7 and 14 is 14

$$\frac{-2}{14} \times \frac{1}{1} = \frac{-2}{14}$$

$$\text{Here } \frac{-6}{14} < \frac{-2}{14}$$

(Since, $-6 < -2$)

$$\text{So, } \frac{-3}{7} < \frac{-2}{14}$$

Hence, $\frac{-3}{7}$ is smaller

c. $\frac{-5}{16}$ or $\frac{3}{15}$

LCM of 16 and 15 is 240

$$\frac{-5}{16} \times \frac{15}{15} = \frac{-75}{240} \quad \text{and}$$

$$\frac{-3}{15} \times \frac{16}{16} = \frac{-48}{240}$$

$$\text{Here, } \frac{-75}{240} < \frac{-48}{240}$$

(Since, $-75 < -48$)

$$\text{So, } \frac{-5}{16} < \frac{-3}{15}$$

Hence, $\frac{-5}{16}$ is smaller

d. $\frac{-3}{7}$ or $\frac{-4}{11}$

LCM of 7 and 11 is 77.

$$\frac{-3}{7} \times \frac{11}{11} = \frac{-33}{77} \quad \text{and}$$

$$\frac{-4}{11} \times \frac{7}{7} = \frac{-28}{77}$$

$$\text{Here, } \frac{-33}{77} < \frac{-28}{77},$$

Since, $-33 < -28$

$$\text{So, } \frac{-3}{7} < \frac{-4}{11}$$

Hence, $\frac{-3}{7}$ is smaller

e. $\frac{6}{-11}$ or $\frac{17}{-33}$

LCM of 11 and 33 is 33.

$$\frac{-6}{11} \times \frac{3}{3} = \frac{-18}{33} \quad \text{and}$$

$$\frac{-17}{33} \times \frac{1}{1} = \frac{-17}{33}$$

$$\text{Here, } \frac{-18}{33} < \frac{-17}{33} \quad (\text{Since, } -18 < -17)$$

$$\text{So, } \frac{6}{-11} < \frac{17}{-33} \quad \text{Hence, } \frac{6}{-11} \text{ is smaller.}$$

$$\text{f. } \frac{9}{16} \text{ or } \frac{5}{32} \quad \text{LCM of 16 and 32 is 32.}$$

$$\frac{9}{16} \times \frac{2}{2} = \frac{18}{32} \quad \text{and} \quad \frac{5}{32} \times \frac{1}{1} = \frac{5}{32}$$

$$\text{Here, } \frac{18}{32} > \frac{5}{32} \quad (\text{Since, } 18 > 5)$$

$$\text{So, } \frac{9}{16} > \frac{5}{32} \quad \text{Hence, } \frac{5}{32} \text{ is smaller.}$$

$$4. \text{ a. } \frac{-9}{20}, \frac{-8}{15}, \frac{19}{-30}, \frac{-3}{10}$$

On converting $\frac{19}{-30}$ in the standard form we get

$$\frac{19}{-30} \times \frac{(-1)}{(-1)} = \frac{-19}{30}$$

LCM of 20, 15, 30 and 10 is 60

$$\frac{-9}{20} \times \frac{3}{3} = \frac{-27}{60} \quad \frac{-8}{15} \times \frac{4}{4} = \frac{-32}{60}$$

$$\frac{-19}{30} \times \frac{2}{2} = \frac{-38}{60} \quad \frac{-3}{10} \times \frac{6}{6} = \frac{-18}{60}$$

$$\text{Since, } \frac{-38}{60} < \frac{-32}{60} < \frac{-27}{60} < \frac{-18}{60}$$

$$\text{So, } \frac{-19}{30} < \frac{-8}{15} < \frac{-9}{20} < \frac{-3}{10}$$

$$\text{Hence, ascending order is } \frac{-19}{30}, \frac{-8}{15}, \frac{-9}{20} \text{ and } \frac{-3}{10}.$$

$$\text{b. } \frac{-7}{12}, \frac{-13}{15}, \frac{-13}{18}, \frac{-5}{6} \quad \text{LCM of 12, 15, 18 and 6 is 180.}$$

$$\frac{-7}{12} \times \frac{15}{15} = \frac{-105}{180} \quad \frac{-13}{15} \times \frac{12}{12} = \frac{-156}{180}$$

$$\frac{-13}{18} \times \frac{10}{10} = \frac{-130}{180} \quad \frac{-5}{6} \times \frac{30}{30} = \frac{-150}{180}$$

$$\text{Since, } \frac{-156}{180} < \frac{-150}{180} < \frac{-130}{180} < \frac{-105}{180}$$

$$\text{So, } \frac{-13}{15} < \frac{-5}{6} < \frac{-13}{18} < \frac{-7}{12}$$

Hence, ascending order is $\frac{-13}{15}, \frac{-5}{6}, \frac{-13}{18}$ and $\frac{-7}{12}$.

c. $\frac{-4}{9}, \frac{-11}{18}, \frac{-2}{3}, \frac{-7}{12}$ LCM of 9, 18, 3 and 12 is 36

$$\frac{-4}{9} \times \frac{4}{4} = \frac{-16}{36} \qquad \frac{-11}{18} \times \frac{2}{2} = \frac{-22}{36}$$

$$\frac{-2}{3} \times \frac{12}{12} = \frac{-24}{36} \qquad \frac{-7}{12} \times \frac{3}{3} = \frac{-21}{36}$$

$$\frac{-24}{36} < \frac{-22}{36} < \frac{-21}{36} < \frac{-16}{36}$$

Hence, the ascending order is $\frac{-2}{3}, \frac{-11}{18}, \frac{-7}{12}$ and $\frac{-4}{9}$

d. $\frac{-6}{7}, \frac{-4}{21}, \frac{-15}{42}, \frac{-8}{14}$ LCM of 7, 21, 42 and 14 is 42

$$\frac{-6}{7} \times \frac{6}{6} = \frac{-36}{42} \qquad \frac{-4}{21} \times \frac{2}{2} = \frac{-8}{42}$$

$$\frac{-15}{42} \times \frac{1}{1} = \frac{-15}{42} \qquad \frac{-8}{14} \times \frac{3}{3} = \frac{-24}{42}$$

$$\frac{-36}{42} < \frac{-24}{42} < \frac{-15}{42} < \frac{-8}{42}$$

Hence, the ascending order is $\frac{-6}{7}, \frac{-8}{14}, \frac{-15}{42}, \frac{-4}{21}$

5. a. $\frac{-6}{11}, \frac{-17}{33}, \frac{-9}{22}, \frac{-3}{1}$ LCM of 11, 33, 22 and 1 is 66

$$\frac{-6}{11} \times \frac{6}{6} = \frac{-36}{66} \qquad \frac{-17}{33} \times \frac{2}{2} = \frac{-34}{66}$$

$$\frac{-9}{22} \times \frac{3}{3} = \frac{-27}{66} \qquad \frac{-3}{1} \times \frac{66}{66} = \frac{-198}{66}$$

$$\text{Since, } \frac{-27}{66} > \frac{-34}{66} > \frac{-36}{66} > \frac{-198}{66}$$

Hence, descending order is $\frac{-9}{22}, \frac{-17}{33}, \frac{-6}{11}$ and -3

b. $\frac{-7}{10}, \frac{-3}{8}, \frac{9}{-20}, \frac{-13}{15}$

On converting $\frac{9}{-20}$ into standard form we get

$$\frac{9}{-20} \times \frac{(-1)}{(-1)} = \frac{-9}{20}$$

LCM of 10, 8, 20 and 15 is 120

$$\frac{-7}{10} \times \frac{12}{12} = \frac{-84}{120}$$

$$\frac{-3}{8} \times \frac{15}{15} = \frac{-45}{120}$$

$$\frac{-9}{20} \times \frac{6}{6} = \frac{-54}{120}$$

$$\frac{-13}{15} \times \frac{8}{8} = \frac{-104}{120}$$

$$\text{Since, } \frac{-45}{120} > \frac{-54}{120} > \frac{-84}{120} > \frac{-104}{120}$$

$$\text{So, } \frac{-3}{8} > \frac{-9}{20} > \frac{-7}{10} > \frac{-13}{15}$$

Hence, descending order is $\frac{-3}{8}, \frac{-9}{20}, \frac{-7}{10}$ and $\frac{-13}{15}$

c. $\frac{-3}{5}, \frac{-13}{15}, \frac{-7}{10}, \frac{17}{-25}$ LCM of 5, 15, 10 and 25 is 150

$$\frac{-3}{5} \times \frac{30}{30} = \frac{-90}{150}$$

$$\frac{-13}{15} \times \frac{10}{10} = \frac{-130}{150}$$

$$\frac{-7}{10} \times \frac{15}{15} = \frac{-105}{150}$$

$$\frac{-17}{25} \times \frac{6}{6} = \frac{-102}{150}$$

$$\text{Since, } \frac{-90}{150} > \frac{-102}{150} > \frac{-105}{150} > \frac{-130}{150}$$

$$\text{So, } \frac{-3}{5} > \frac{-17}{25} > \frac{-7}{10} > \frac{-13}{15}$$

Hence, the descending order is $\frac{-3}{5}, \frac{-17}{25}, \frac{-7}{10}$ and $\frac{-13}{15}$

d. $\frac{-10}{11}, \frac{-11}{22}, \frac{-21}{33}, \frac{-18}{44}$

LCM of 11, 22, 33 and 44 is 132

$$\frac{-10}{11} \times \frac{12}{12} = \frac{-120}{132}$$

$$\frac{-11}{22} \times \frac{6}{6} = \frac{-66}{132}$$

$$\frac{-21}{33} \times \frac{4}{4} = \frac{-84}{132}$$

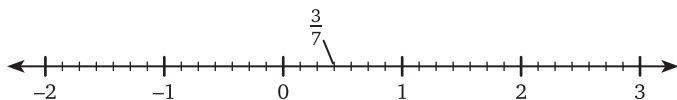
$$\frac{-18}{44} \times \frac{3}{3} = \frac{-54}{132}$$

$$\text{Since, } \frac{-54}{132} > \frac{-66}{132} > \frac{-84}{132} > \frac{-120}{132}$$

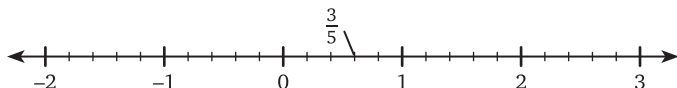
Hence, descending order is $\frac{-18}{44}, \frac{-11}{22}, \frac{-21}{33}$ and $\frac{-10}{11}$

Assessment Time 1.3

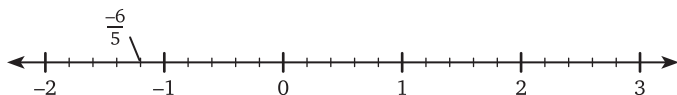
1. a. F b. T c. T d. T
2. a. Divide the each unit into 7 equal parts



- b. Divide each unit into 5 equal parts



- c. Divide each unit into 5 equal parts



- d. Divide each unit into 10 equal parts

**Assessment Time 1.4**

1. a. $\frac{8}{5} + \frac{-6}{10} = \frac{-6}{10} + \frac{8}{5}$
- b. $\frac{-17}{23} + 0 = \frac{-77}{23}$
- c. $\frac{81}{16} + \left(\frac{-81}{16}\right) = 0$
- d. $\frac{4}{5} + \left(\frac{-6}{7} + \frac{1}{3}\right) = \left(\frac{4}{5} + \frac{-6}{7}\right) + \frac{1}{3}$
- e. $\frac{-6}{18} + \left(\frac{6}{18}\right) = 0$
2. a. Let the two rational numbers be $\frac{-3}{8}$ and $\frac{5}{7}$
- $$\frac{-3}{8} \text{ and } \frac{5}{7} = \left(\frac{-3}{8} + \frac{5}{7}\right) = \frac{7 \times (-3) + 8 \times 5}{56}$$
- $$= \frac{-21 + 40}{56} = \frac{19}{56}$$

$$\begin{aligned}\frac{5}{7} \text{ and } \frac{-3}{8} &= \left(\frac{5}{7} + \left(\frac{-3}{8} \right) \right) = \left(\frac{5}{7} - \frac{3}{8} \right) \\ &= \left(\frac{8 \times 5 - 7 \times 3}{56} \right) = \left(\frac{40 - 21}{56} \right) = \frac{19}{56} \\ \frac{-3}{8} + \frac{5}{7} &= \frac{5}{7} + \left(\frac{-3}{8} \right)\end{aligned}$$

$$\begin{aligned}\text{b. } \frac{-4}{19} \text{ and } \frac{-5}{38} &= \left\{ \left(\frac{-4}{19} \right) + \frac{-5}{38} \right\} \\ &= \frac{2 \times (-4) + (-5) \times 1}{38} \\ &= \frac{-8 - 5}{38} = \frac{-13}{38}\end{aligned}$$

$$\begin{aligned}\frac{-5}{38} \text{ and } \frac{-4}{19} &= \left\{ \frac{-5}{38} + \left(\frac{-4}{19} \right) \right\} = \frac{1 \times (-5) + 2 \times (-4)}{38} \\ &= \frac{-5 - 8}{38} = \frac{-13}{38}\end{aligned}$$

$$\text{So, } \frac{-4}{19} + \left(\frac{-5}{38} \right) = \frac{-5}{38} + \left(\frac{-4}{19} \right)$$

$$\begin{aligned}\text{c. } \frac{16}{25} \text{ and } \frac{9}{-35} &= \left(\frac{16}{25} + \frac{9}{-35} \right) = \frac{16 \times 7 + 9 \times (-5)}{175} \\ &= \frac{112 - 45}{175} = \frac{67}{175}\end{aligned}$$

$$\begin{aligned}\text{and } \frac{9}{-35} + \frac{16}{25} &= \frac{9 \times (-5) + 16 \times 7}{175} \\ &= \frac{-45 + 112}{175} = \frac{67}{175}\end{aligned}$$

$$\text{So, } \frac{16}{25} + \left(\frac{9}{-35} \right) = \left(\frac{9}{-35} \right) + \frac{16}{25}$$

$$3. \text{ a. Let the three rational numbers be } \frac{-1}{4}, \frac{-5}{8} \text{ and } \frac{3}{10}$$

$$\begin{aligned}\text{Now, } \left(\frac{-1}{4} + \frac{-5}{8} \right) + \frac{3}{10} &= \left(\frac{-1 \times 2 + (-5) \times 1}{8} \right) + \frac{3}{10} \\ &= \left(\frac{-2 - 5}{8} \right) + \frac{3}{10} = \left(\frac{-7}{8} \right) + \frac{3}{10} \\ &= \frac{-7 \times 5 + 4 \times 3}{40} = \frac{-35 + 12}{40} = \frac{-23}{40}\end{aligned}$$

$$\begin{aligned}
\frac{-1}{4} + \left(\frac{-5}{8} + \frac{3}{10} \right) &= \frac{-1}{4} + \left(\frac{-5 \times 10 + 3 \times 8}{80} \right) \\
&= \frac{-1}{4} + \left(\frac{-50 + 24}{80} \right) = \frac{-1}{4} + \left(\frac{-26}{80} \right) \\
&= \left(\frac{-1 \times 20 + (-26)}{80} \right) \\
&= \left(\frac{-20 - 26}{80} \right) = \frac{-46}{80} = \frac{-23}{40}
\end{aligned}$$

$$\text{So, } \left\{ \frac{-1}{4} + \left(\frac{-5}{8} \right) \right\} + \frac{3}{10} = \frac{-1}{4} + \left(\frac{-5}{8} + \frac{3}{10} \right)$$

- b. Let the three rational numbers be $\frac{6}{14}$, $\frac{-3}{7}$ and $\frac{4}{21}$.

$$\begin{aligned}
\left\{ \frac{6}{14} + \left(\frac{-3}{7} \right) \right\} + \frac{4}{21} &= \left(\frac{1 \times 6 + (-3) \times 2}{14} \right) + \frac{4}{21} \\
&= \left(\frac{6 - 6}{14} \right) + \frac{4}{21} = \frac{0}{14} + \frac{4}{21} = \frac{4}{21}
\end{aligned}$$

$$\begin{aligned}
\frac{6}{14} + \left(\frac{-3}{7} + \frac{4}{21} \right) &= \frac{6}{14} + \left(\frac{-3 \times 3 + 4 \times 1}{21} \right) \\
&= \frac{6}{14} + \left(\frac{-9 + 4}{21} \right) = \frac{6}{14} - \frac{5}{21} \\
&= \frac{6 \times 3 - 5 \times 2}{42} = \left(\frac{18 - 10}{42} \right) \\
&= \frac{8}{42} = \frac{4}{21}
\end{aligned}$$

$$\text{So, } \left\{ \frac{6}{14} + \left(\frac{-3}{7} \right) \right\} + \frac{4}{21} = \frac{6}{14} + \left(\frac{-3}{7} + \frac{4}{21} \right)$$

- c. Let the three rational numbers be $\frac{-3}{17}$, $\frac{8}{34}$ and $\frac{-4}{17}$

$$\begin{aligned}
\left(\frac{-3}{17} + \frac{8}{34} \right) + \frac{-4}{17} &= \left(\frac{-3 \times 2 + 8 \times 1}{34} \right) + \frac{-4}{17} \\
&= \left(\frac{-6 + 8}{34} \right) + \left(\frac{-4}{17} \right) = \left(\frac{2}{34} \right) + \left(\frac{-4}{17} \right) \\
&= \frac{2 \times 1 + (-4) \times 2}{34} = \frac{2 - 8}{34} \\
&= \frac{-6}{34} = \frac{-3}{17}
\end{aligned}$$

$$\frac{-3}{17} + \left(\frac{8}{34} + \left(\frac{-4}{17} \right) \right) = \frac{-3}{17} + \left(\frac{8 \times 1 + (-4) \times 2}{34} \right)$$

$$= \frac{-3}{17} + \left(\frac{8-8}{17} \right) = \frac{-3}{17} + \frac{0}{17}$$

$$= \frac{-3}{17}$$

$$\left(\frac{-3}{17} + \frac{8}{34} \right) + \left(\frac{-4}{17} \right) = \frac{-3}{17} + \left(\frac{8}{34} + \left(\frac{-4}{17} \right) \right)$$

4. a. The additive inverse of $\frac{-5}{7}$ is $\frac{5}{7}$

b. The additive inverse of $\frac{8}{17}$ is $\frac{-8}{17}$

c. The additive inverse of $\frac{-18}{23}$ is $-\left(\frac{-18}{23} \right) = \frac{18}{23}$

d. The additive inverse of $\frac{-19}{-29}$ is $-\left(\frac{-19}{29} \right) = \frac{-19}{29}$

5. a. $\frac{5}{13} + \frac{-15}{26} + \frac{-12}{39} = \frac{5 \times 6 + (-15) \times 3 + (-12) \times 2}{78}$

$$= \frac{30 - 45 - 24}{78} = \frac{30 - 69}{78}$$

$$= \frac{-39}{78} = \frac{-1}{2}$$

b. $\frac{-13}{27} + \frac{8}{36} + \left(\frac{-6}{18} \right) = \frac{(-13) \times 4 + 8 \times 3 + 6 \times (-6)}{108}$

$$= \frac{-52 + 24 - 36}{108} = \frac{-88 + 24}{108}$$

$$= \frac{-64}{108} = \frac{-16}{27}$$

c. $\frac{5}{21} + \frac{-17}{42} + \frac{-9}{14} = \frac{5 \times 2 + (-17) \times 1 + (-9) \times 3}{42}$

$$= \frac{10 - 17 - 27}{42} = \frac{-34}{42} = \frac{-17}{21}$$

6. a. $\frac{8}{13}$ from $\frac{-19}{39}$

$$\frac{-19}{39} - \frac{8}{13} = \frac{-19 - 8 \times 3}{39}$$

$$= \frac{-19 - 24}{39} = \frac{-43}{39}$$

b. -8 from $\frac{-3}{17}$

$$\begin{aligned}\frac{-3}{17} - (-8) &= \frac{-3}{17} + 8 = \frac{-3 + 136}{17} \\ &= \frac{123}{17} = 7\frac{14}{17}\end{aligned}$$

$$\begin{aligned}\text{c. } \frac{-32}{13} \text{ from } \frac{-5}{6} &= \frac{-5}{6} - \left(\frac{-32}{13}\right) \\ &= \frac{-5 \times (+13) - (-32) \times 6}{78} \\ &= \frac{-65 + 192}{78} = \frac{127}{78} = 1\frac{49}{78}\end{aligned}$$

$$\begin{aligned}7. \text{ a. } \frac{-5}{16} + \frac{7}{20} + \frac{-8}{15} + \frac{-6}{12} \\ &= \frac{(-5) \times 15 + 7 \times 12 + 16 \times (-8) + (-6) \times 20}{240} \\ &= \frac{-75 + 84 - 128 - 120}{240} = \frac{-239}{240}\end{aligned}$$

$$\begin{aligned}\text{b. } \frac{7}{8} - \frac{11}{24} + \frac{-3}{18} + \frac{4}{-16} \\ &= \frac{7 \times 18 - 11 \times 6 + 8 \times (-3) + 4 \times (-9)}{144} \\ &= \frac{126 - 66 - 24 - 36}{144} \\ &= \frac{126 - 126}{144} = 0\end{aligned}$$

$$\begin{aligned}\text{c. } \frac{-3}{14} + \frac{-5}{21} + \frac{-9}{28} - \frac{4}{7} \\ &= \frac{(-3 \times 6 + (-5) \times 4 + (-9) \times 3 - 4 \times 12)}{84} \\ &= \frac{-18 - 20 - 27 - 48}{84} \\ &= \frac{-113}{84} = -1\frac{29}{84}\end{aligned}$$

8. Let the required number be x .

$$\begin{aligned}\frac{-3}{10} + x &= \frac{7}{15} \\ x &= \frac{7}{15} - \left(\frac{-3}{10}\right) = \frac{7}{15} + \frac{3}{10}\end{aligned}$$

$$= \frac{7 \times 2 + 3 \times 3}{30} = \frac{14 + 9}{30} = \frac{23}{30}$$

Hence, the required number is $\frac{23}{30}$.

9. Let the required number be x .

$$\begin{aligned}\frac{-8}{21} - x &= \frac{-5}{14} \\ x &= \frac{-8}{21} + \frac{5}{14} \\ &= \frac{(+6) \times (-8) + 3 \times 5}{42} \\ &= \frac{-16 + 15}{42} = \frac{-1}{42}\end{aligned}$$

Hence, the required number is $\frac{-1}{42}$.

10. Let the required number be x .

$$\begin{aligned}\frac{3}{20} - x &= \frac{-7}{25} \\ \Rightarrow \frac{3}{20} + \frac{7}{25} &= x \\ \Rightarrow \frac{5 \times 3 + 4 \times 7}{100} &= x \\ \Rightarrow \frac{15 + 28}{100} &= x \\ \Rightarrow x &= \frac{43}{100}\end{aligned}$$

Critical Thinking Skills

According to the questions

$$\begin{aligned}\left(\frac{4}{34} + \frac{-8}{51}\right) - \left(\frac{3}{17}\right) &= \frac{4 \times 3 - 5 \times 2 - 3 \times 6}{102} \\ &= \frac{12 - 16 - 18}{102} = \frac{-22}{102} = \frac{-11}{51}\end{aligned}$$

Assessment Time 1.5

1. a. $\frac{-5}{13} \times \frac{2}{9} = \frac{2}{9} \times \frac{-5}{13}$ (Commutative Property)
- b. $\frac{3}{13} \times \left(\frac{5}{9} \times \frac{4}{9}\right) = \left(\frac{3}{13} \times \frac{5}{9}\right) \times \frac{4}{9}$ (Associative Property)

c. $\frac{5}{9} \times 0 = 0$ (Property of zero)

d. $\frac{-13}{17} \times 1 = \frac{-13}{17}$ (Multiplicative Identity)

e. $\frac{6}{19} \times \frac{19}{6} = 1$ (Multiplicative Inverse)

2. a. T b. F c. F d. F e. F

3. a. $\left(\frac{3}{5} \times \frac{-2}{7}\right) = \frac{3 \times -2}{5 \times 7} = \frac{-6}{35}$

$$\left(\frac{-2}{7} \times \frac{3}{5}\right) = \frac{-2 \times 3}{7 \times 5} = \frac{-6}{35}$$

So, $\left\{\frac{3}{5} \times \left(\frac{-2}{7}\right)\right\} = \left(\frac{-2}{7} \times \frac{3}{5}\right)$

b. $\left\{\frac{-6}{7} \times \left(\frac{-3}{14}\right)\right\} = \frac{-6 \times (-3)}{7 \times 14} = \frac{18}{98}$

$$\left\{\frac{-3}{14} \times \left(\frac{-6}{7}\right)\right\} = \frac{-3 \times (-6)}{14 \times 7} = \frac{18}{98}$$

So, $\left\{\frac{-6}{7} \times \left(\frac{-3}{14}\right)\right\} = \left\{\frac{-3}{14} \times \left(\frac{-6}{7}\right)\right\}$

c. $\left(\frac{7}{10} \times \frac{3}{20}\right) = \frac{21}{200}$

$$\left(\frac{3}{20} \times \frac{7}{10}\right) = \frac{21}{200}$$

$$\left(\frac{7}{10} \times \frac{3}{20}\right) = \left(\frac{3}{20} \times \frac{7}{10}\right)$$

4. a. $\frac{2}{3}, \frac{-5}{6}$ and $\frac{-7}{9}$

$$\left\{\frac{2}{3} \times \left(\frac{-5}{6}\right)\right\} \times \frac{-7}{9} = \frac{-10}{18} \times \frac{-7}{9} = \frac{70}{162}$$

$$\frac{2}{3} \times \left\{\frac{-5}{6} \times \left(\frac{-7}{9}\right)\right\} = \frac{2}{3} \times \frac{35}{54} = \frac{70}{162}$$

$$\left\{\frac{2}{3} \times \left(\frac{-5}{6}\right)\right\} \times \left(\frac{-7}{9}\right) = \frac{2}{3} \times \left\{\frac{-5}{6} \times \left(\frac{-7}{9}\right)\right\}$$

b. Let the three rational number be $\frac{4}{11}, \frac{-3}{22}$ and $\frac{-1}{4}$

$$\left(\frac{4}{11} \times \frac{-3}{22}\right) \times \frac{-1}{4} = \frac{-12}{132} \times \frac{-1}{4} = \frac{12}{968}$$

$$\frac{4}{11} \times \left(\frac{-3}{22} \times \frac{-1}{4}\right) = \frac{4}{11} \times \frac{3}{88} = \frac{12}{968}$$

$$\text{So, } \left\{\frac{4}{11} \times \left(\frac{-3}{22}\right)\right\} \times \frac{-1}{4} = \frac{4}{11} \times \left\{\frac{-3}{22} \times \left(\frac{-1}{4}\right)\right\}$$

$$\text{c. } \left(\frac{-7}{8} \times \frac{4}{5}\right) \times \left(\frac{-3}{4}\right) = \frac{-28}{40} \times \left(\frac{-3}{4}\right) = \frac{84}{160}$$

$$\frac{-7}{8} \times \left\{\frac{4}{5} \times \left(\frac{-3}{4}\right)\right\} = \frac{-7}{8} \times \left(\frac{-12}{20}\right) = \frac{84}{160}$$

$$\text{So, } \left(\frac{-7}{8} \times \frac{4}{5}\right) \times \left(\frac{-3}{4}\right) = \frac{-7}{8} \times \left\{\frac{4}{5} \times \left(\frac{-3}{4}\right)\right\}$$

$$5. \text{ a. The multiplicative inverse of } \frac{-8}{9} \text{ is } \frac{-9}{8}$$

$$\text{b. The multiplicative inverse of } \frac{5}{13} \text{ is } \frac{13}{5}.$$

$$\text{c. The multiplicative inverse of } 3\frac{1}{3} \text{ or } \frac{10}{3} \text{ is } \frac{3}{10}$$

$$\text{d. The multiplicative inverse of } \frac{-6}{17} \text{ is } \frac{-17}{6}.$$

$$6. \text{ a. } \frac{-7}{12} \times \frac{24}{35} \times \frac{-1}{6} = \frac{-7 \times 24 \times -1}{12 \times 35 \times 6} = \frac{1}{15}$$

$$\text{b. } \frac{-9}{34} \times \frac{51}{54} \times \frac{-8}{6} = \frac{-9 \times 51 \times -8}{34 \times 54 \times 6} = \frac{1}{3}$$

$$\text{c. } \frac{4}{15} \times \frac{25}{22} \times \frac{-33}{10} = -1$$

$$7. \text{ a. } \frac{2}{5} \times \frac{-3}{7} - \frac{1}{6} \times \frac{3}{2} + \frac{1}{10} \times \frac{3}{7}$$

$$= \frac{-6}{35} - \frac{3}{12} + \frac{3}{70}$$

$$= \frac{-6 \times 12 - 3 \times 35 + 3 \times 6}{420}$$

$$= \frac{-72 - 105 + 18}{420} = \frac{-177 + 18}{420}$$

$$= \frac{-161}{420} = \frac{-57}{140}$$

$$\begin{aligned}
 \text{b. } & \frac{-3}{8} \times \frac{1}{5} + \frac{1}{14} - \frac{1}{5} \times \frac{4}{5} \\
 &= \frac{-3}{40} + \frac{1}{14} - \frac{4}{25} \\
 &= \frac{-3 \times 35 + 1 \times 100 - 4 \times 56}{1400} \\
 &= \frac{-105 + 100 - 224}{1400} = \frac{-229}{1400}
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } & \frac{-5}{7} \times \frac{2}{3} + \frac{1}{15} \times \frac{5}{6} - \frac{2}{3} \times \frac{1}{7} \\
 &= \frac{-10}{21} + \frac{5}{90} - \frac{2}{21} = \frac{-10 \times 30 + 5 \times 7 - 2 \times 30}{630} \\
 &= \frac{-300 + 35 - 60}{630} = \frac{-360 + 35}{630} = \frac{-325}{630} = \frac{-65}{126}
 \end{aligned}$$

$$\begin{aligned}
 8. \text{ a. } & \frac{-6}{25} \text{ by } \frac{9}{15} \\
 & \frac{-6}{25} \div \frac{9}{15} = \frac{-6}{25} \times \frac{15}{9} = \frac{-2}{5} \\
 \text{b. } & \frac{4}{9} \text{ by } \frac{-20}{27} = \frac{4}{9} \times \frac{-27}{20} = \frac{-3}{5} \\
 \text{c. } & \frac{13}{14} \div \frac{-52}{70} = \frac{13}{14} \times \frac{70}{-52} = \frac{-5}{4}
 \end{aligned}$$

$$\begin{aligned}
 9. \text{ The reciprocal of } \frac{-9}{28} \text{ is } \frac{-28}{9} \\
 \frac{3}{7} \times \frac{-28}{9} = \frac{-4}{3}
 \end{aligned}$$

10. Let the required rational number be $\frac{a}{b}$.

$$\begin{aligned}
 \frac{-8}{17} \times \frac{a}{b} &= \frac{16}{51} \\
 \frac{a}{b} &= \frac{16}{51} \times \frac{-17}{8} = \frac{-2}{3}
 \end{aligned}$$

Hence, the required rational number is $\frac{-2}{3}$.

11. Let the required rational number be $\frac{a}{b}$.

$$\frac{3}{13} \div \frac{a}{b} = \frac{-6}{39}$$

$$\frac{3}{13} \times \frac{b}{a} = \frac{-6}{39}$$

$$\frac{b}{a} = \frac{-6}{39} \times \frac{13}{3} = \frac{-2}{3}$$

$$\frac{a}{b} = \frac{-3}{2}$$

12. Let the required number be $\frac{a}{b}$.

$$\frac{-3}{8} \div \frac{a}{b} = \frac{6}{14}$$

$$\frac{-3}{8} \times \frac{b}{a} = \frac{6}{14}$$

$$\frac{b}{a} = \frac{6}{14} \times \frac{8}{-3} = \frac{2 \times 4}{7} = \frac{8}{-7}$$

$$\frac{a}{b} = \frac{-7}{8}$$

Critical Thinking Skills

Sum $\frac{3}{14} + \left(\frac{-8}{35}\right) = \frac{3 \times 5 + (-8) \times 2}{70}$

$$= \frac{15 - 16}{70} = \frac{-1}{70}$$

Product $\frac{3}{14} \times \frac{-8}{35} = \frac{-24}{490}$

$$\frac{-1}{70} \div \frac{-24}{490} = \frac{-1}{70} \times \frac{490}{-24} = \frac{7}{24}$$

Assessment Time 1.6

1. Length of a wire = $20\frac{1}{5}$ m

Long piece cut from it = $7\frac{1}{4}$ m

$$\text{Length of remaining piece} = \frac{101}{5} - \frac{29}{4} = \frac{101 \times 4 - 29 \times 5}{20}$$

$$= \frac{404 - 145}{20} = \frac{259}{20} = 12\frac{19}{20} \text{ m}$$

Hence, the length of remaining piece is $12\frac{19}{20}$ m.

2. Weight of a empty jute bag = $2\frac{1}{4}$ kg

$$\text{Weight of rice} = 40\frac{1}{5} \text{ kg}$$

$$\begin{aligned}\text{Weight of filled bag of rice} &= 2\frac{1}{4} + 40\frac{1}{5} \\ &= \frac{9}{4} + \frac{201}{5} = \frac{45 + 804}{20} \\ &= \frac{849}{20} = 42\frac{9}{20} \text{ kg}\end{aligned}$$

Hence, the weight of filled bag is $42\frac{9}{20}$ kg.

3. Suresh walk in 1 hour = $4\frac{1}{3}$ km

$$\begin{aligned}\text{Suresh cover distance in } 3\frac{2}{5} \text{ hour} \\ &= 4\frac{1}{3} \times 3\frac{2}{5} \\ &= \frac{13}{3} \times \frac{17}{5} = \frac{221}{15} = 14\frac{11}{15} \text{ km}\end{aligned}$$

Hence, the distance cover $14\frac{11}{15}$ km

4. Cost of $3\frac{1}{2}$ m of wire = ₹ $57\frac{3}{4}$

$$\begin{aligned}\text{Cost of 1 m of wire} &= 57\frac{3}{4} \div 3\frac{1}{2} \\ &= \frac{231}{4} \div \frac{7}{2} = \frac{231}{4} \times \frac{2}{7} \\ &= \frac{231}{14} = \frac{33}{2} = ₹ 16\frac{1}{2}\end{aligned}$$

Hence, the cost of 1 m of wire is ₹ $16\frac{1}{2}$.

5. Cost of 1 m of rope = ₹ $50\frac{1}{4}$

$$\begin{aligned}\text{Cost of } 12\frac{1}{5} \text{ m of rope} &= 50\frac{1}{4} \div 12\frac{1}{5} \\ &= \frac{21}{4} \times \frac{61}{5} = \frac{21 \times 61}{4 \times 5}\end{aligned}$$

$$= \frac{1281}{20} = ₹ 613 \frac{1}{20}$$

Hence, the cost of $12\frac{1}{5}$ m of wire is ₹ $613\frac{1}{20}$.

6. Cost of 1 toy = ₹ $75\frac{1}{2}$

$$\begin{aligned}\text{Cost of 8 toys} &= ₹ \left(75\frac{1}{2} \times 8\right) \\ &= ₹ \left(\frac{151}{2} \times 8\right) = ₹ 604\end{aligned}$$

Hence, the cost of 8 toys is ₹ 604.

7. Meeta has rope = $20\frac{3}{4}$ m

She divide it into 5 equal parts

$$\begin{aligned}\text{Length of 1 part} &= 20\frac{3}{4} \div 5 \\ &= \frac{4 \times 20 + 3}{4} \div 5 \\ &= \frac{83}{4} \div 5 = \frac{83}{4} \times \frac{1}{5} \\ &= \frac{83}{20} = 4\frac{3}{20} \text{ m.}\end{aligned}$$

Hence, the length of 1 part is $4\frac{3}{20}$ m.

8. Mohit buys almonds = 10 kg

$$\text{He keeps} = \frac{3}{4} \times 10 = \frac{15}{2} \text{ kg}$$

$$\text{Left almonds} = 10 - \frac{15}{2} = \frac{5}{2} \text{ kg}$$

$$\begin{aligned}\text{So, cost of } \frac{5}{2} \text{ kg of almonds} &= ₹ \left(\frac{5}{2} \times 800\frac{1}{4}\right) \\ &= ₹ \left(\frac{5}{2} \times \frac{3201}{4}\right) \\ &= ₹ \frac{16005}{8} = ₹ 2000\frac{5}{8}\end{aligned}$$

Critical Thinking Skills

Geeta has = ₹ 2000

$$\begin{aligned}\text{Cost of 5 kg mangoes} &= ₹ \left(80 \frac{1}{4} \times 5 \right) \\ &= ₹ \left(\frac{321}{4} \times 5 \right) = ₹ \frac{1605}{4}\end{aligned}$$

$$\begin{aligned}\text{Cost of 4 kg apples} &= ₹ \left(120 \frac{1}{5} \times 4 \right) \\ &= ₹ \left(\frac{601}{5} \times 4 \right) = ₹ \frac{2404}{5}\end{aligned}$$

$$\text{Cost of 10 kg oranges} = ₹ \left(\frac{201}{4} \times 10 \right) = ₹ \frac{2010}{4}$$

$$\begin{aligned}\text{Total cost of all fruits} &= ₹ \left(\frac{1605}{4} + \frac{2404}{5} + \frac{2010}{4} \right) \\ &= ₹ \left(\frac{8025 + 9616 + 10050}{20} \right) \\ &= ₹ \frac{27691}{20}\end{aligned}$$

$$\begin{aligned}\text{Left money} &= 2000 - \left(\frac{27691}{20} \right) \\ &= \frac{40000 - 27692}{20} = ₹ \frac{12309}{20} = ₹ 615 \frac{9}{20}\end{aligned}$$

Revision Time

1. a. $\frac{-3}{7}$ and $\frac{-2}{5}$ LCM of 7 and 5 is 35.

$$\frac{-3}{7} \times \frac{5}{5} = \frac{-15}{35} \quad \text{and} \quad \frac{-2}{5} \times \frac{7}{7} = \frac{-14}{35}$$

$$\text{Here, } \frac{-15}{35} < \frac{-14}{35}, \quad \text{Since, } -15 < -14$$

$$\text{Hence, } \frac{-3}{7} < \frac{-2}{5}$$

- b. $\frac{6}{9}$ and $\frac{3}{5}$

$$\frac{6}{9} \times \frac{5}{5} = \frac{30}{45} \quad \text{and} \quad \frac{3}{5} \times \frac{9}{9} = \frac{27}{45}$$

$$\text{Here, } \frac{30}{45} > \frac{27}{45} \quad \text{Since, } 30 > 27$$

$$\text{Hence, } \frac{6}{9} > \frac{3}{5}$$

2. a. $\frac{-3}{7}, \frac{-2}{21}, \frac{-6}{15}, \frac{-13}{28}$ LCM of 7, 21, 15 and 28 is 420

$$\frac{-3}{7} \times \frac{60}{60} = \frac{-180}{420}$$

$$\frac{-2}{21} \times \frac{20}{20} = \frac{-40}{420}$$

$$\frac{-6}{15} \times \frac{28}{28} = \frac{-168}{420}$$

$$\frac{-13}{28} \times \frac{15}{15} = \frac{-195}{420}$$

$$\text{Since, } \frac{-195}{420} < \frac{-180}{420} < \frac{-168}{420} < \frac{-40}{420}$$

Hence, the ascending order of given rational numbers is

$$\frac{-13}{28}, \frac{-3}{7}, \frac{-6}{15} \text{ and } \frac{-2}{21}$$

b. $\frac{-2}{5}, \frac{-4}{15}, \frac{-3}{10}, \frac{-4}{25}$ LCM of 5, 15, 10 and 25 is 150

$$\frac{-2}{5} \times \frac{30}{30} = \frac{-60}{150}$$

$$\frac{-4}{15} \times \frac{10}{10} = \frac{-40}{150}$$

$$\frac{-3}{10} \times \frac{15}{15} = \frac{-45}{150}$$

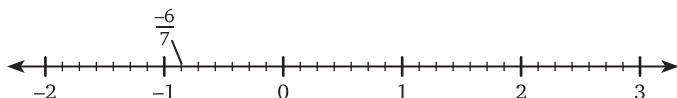
$$\frac{-4}{25} \times \frac{6}{6} = \frac{-24}{150}$$

$$\text{Since, } \frac{-60}{150} < \frac{-45}{150} < \frac{-40}{150} < \frac{-24}{150}$$

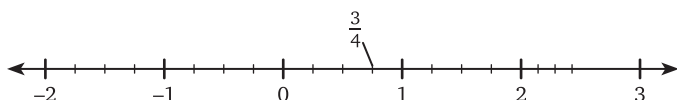
Hence, the ascending order of given rational numbers is

$$\frac{-2}{5}, \frac{-3}{10}, \frac{-4}{15} \text{ and } \frac{-4}{25}$$

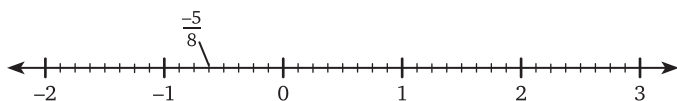
3. a. Divide each unit into 7 equal parts



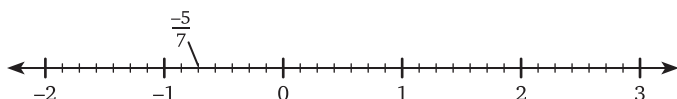
b. Divide each unit into 4 equal parts



c. Divide each unit into 8 equal parts



d. Divide each unit into 7 equal parts



4. $\frac{-2}{5}$ and $\frac{1}{10}$

$$\frac{-2}{5} \times \frac{2}{2} = \frac{-4}{10}$$

$$\frac{1}{10} \times \frac{1}{1} = \frac{1}{10}$$

The four rational number $\frac{-4}{10}$ and $\frac{1}{10}$ are $\frac{-3}{10}, \frac{-2}{10}, \frac{-1}{10}$ and 0.

5. a. The additive inverse of $\frac{-5}{17}$ is $-\left(\frac{-5}{17}\right) = \frac{5}{17}$

b. The additive inverse of $\frac{8}{19}$ is $\frac{-8}{19}$

c. The additive inverse of $\frac{-3}{29}$ is $-\left(\frac{-3}{29}\right) = \frac{3}{29}$

d. The additive inverse of $\frac{-6}{23}$ is $-\left(\frac{-6}{23}\right) = \frac{6}{23}$

6. a.
$$\begin{aligned} & \frac{-3}{14} + \frac{-6}{28} - \frac{4}{7} + \frac{-8}{21} \\ &= \frac{-3 \times 6 + (-6) \times 3 - 4 \times 12 + (-8) \times 4}{84} \\ &= \frac{-18 - 18 - 48 - 32}{84} \\ &= \frac{-116}{84} = \frac{-29}{21} \end{aligned}$$

b.
$$\begin{aligned} & \frac{-7}{10} + \frac{-3}{20} - \frac{6}{15} - \left(\frac{-3}{5}\right) \\ &= \frac{-7 \times 6 + -3 \times 3 - 6 \times 4 + 3 \times 12}{60} \\ &= \frac{-42 - 9 - 24 + 36}{60} \\ &= \frac{-39}{60} = \frac{-13}{20} \end{aligned}$$

7. a. The multiplicative inverse of $\frac{6}{19}$ is $\frac{19}{6}$.

b. The multiplicative inverse of $\frac{-3}{17}$ is $\frac{-17}{3}$.

c. The multiplicative inverse of $\frac{2}{25}$ is $\frac{25}{2}$.

d. The multiplicative inverse of $\frac{-3}{23}$ of $\frac{-23}{3}$.

$$8. \quad a. \quad \frac{-3}{4} \times \frac{16}{21} \times \frac{-7}{8} = \frac{-3 \times 16 \times -7}{4 \times 21 \times 8} = \frac{2}{9}$$

$$b. \quad \frac{-16}{32} \times \frac{5}{35} \times \frac{28}{10} = \frac{-16 \times 5 \times 28}{32 \times 35 \times 10} = \frac{-1}{5}$$

$$\begin{aligned} 9. \quad a. \quad & \frac{5}{7} \times \frac{-2}{10} - \frac{1}{6} \times \frac{3}{5} + \frac{-5}{7} \times \frac{3}{10} \\ &= \frac{5}{7} \times \left(\frac{-2}{10} - \frac{3}{10} \right) - \frac{1}{6} \times \frac{3}{5} \\ &= \frac{5}{7} \times \left(\frac{-5}{10} \right) - \frac{1}{10} = -\frac{5}{14} - \frac{1}{10} \\ &= \frac{-25 - 7}{70} = \frac{-32}{70} = \frac{-16}{35} \end{aligned}$$

$$\begin{aligned} b. \quad & \frac{3}{5} \times \frac{-2}{3} + \frac{1}{7} \times \frac{2}{7} - \frac{3}{7} \times \frac{2}{3} \\ &= \frac{2}{3} \left(-\frac{3}{5} - \frac{3}{7} \right) + \frac{2}{49} = \frac{2}{3} \left(\frac{-21 - 15}{35} \right) + \frac{2}{49} \\ &= \frac{2}{3} \times \frac{-36}{35} + \frac{2}{49} = \frac{-24}{35} + \frac{2}{49} \\ &= \frac{-24 \times 7 + 2 \times 5}{245} = \frac{-168 + 10}{245} = \frac{-158}{245} \end{aligned}$$

$$10. \quad a. \quad \frac{-16}{15} \div \frac{18}{25} = \frac{-16}{15} \times \frac{25}{18} = -\frac{40}{27} = -1 \frac{13}{27}$$

$$b. \quad \frac{3}{17} \div \frac{-6}{34} = \frac{3}{17} \times \frac{34}{-6} = -1$$

$$c. \quad \frac{8}{19} \div \frac{-16}{57} = \frac{8}{19} \times \frac{-57}{16} = \frac{-3}{2}$$

11. Reciprocal of $\frac{-3}{14}$ is $\frac{-14}{3}$

$$\text{Now, } \frac{6}{-19} \times \frac{-14}{3} = \frac{28}{19} = 1 \frac{9}{19}$$

$$\begin{aligned}
 12. \text{ Required number} &= \frac{5}{14} - \left(\frac{-3}{7} \right) = \frac{5}{14} + \frac{3}{7} \\
 &= \frac{5+6}{14} = \frac{11}{14}
 \end{aligned}$$

$$\begin{aligned}
 13. \frac{C}{5} &= \frac{F-32}{9} \\
 \Rightarrow \frac{-16}{5} &= \frac{F-32}{9} \\
 \Rightarrow F-32 &= \frac{-16}{5} \times 9 = \frac{-144}{5} \\
 \Rightarrow F &= \frac{-144}{5} + 32 = -\frac{144+160}{5} = \frac{16}{5}^{\circ}\text{F} = 3.2^{\circ}\text{F}
 \end{aligned}$$

Mental Zone

$$1. \frac{-3}{7} \quad 2. 0 \quad 3. \frac{-8}{9} \quad 4. \frac{10}{3} \quad 5. \frac{-1}{14}$$

Multiple Choice Questions

$$1. (d) \quad 2. (b) \quad 3. (c) \quad 4. (c) \quad 5. (d)$$

CHAPTER-2 : LINEAR EQUATION IN ONE VARIABLE**Assessment Time 2.1**

$$\begin{aligned}
 1. \text{ a. } 5x + 4 &= 9 \\
 5x &= 9 - 4 \\
 5x &= 5 \\
 x &= \frac{5}{5} = 1
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } 5(x-2) &= 7 \\
 5x-10 &= 7 \\
 5x &= 7+10 \\
 5x &= 17 \\
 x &= \frac{17}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } \frac{15}{4} - 7x &= 10 \\
 \frac{15-28x}{4} &= 10 \\
 15-40 &= 28x \\
 -25 &= 28x \\
 x &= \frac{-25}{28}
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } \frac{x}{2} + \frac{2}{5} &= \frac{-3}{10} \\
 \frac{5x+6}{15} &= \frac{-3}{10} \\
 10(5x+6) &= -3 \times 15 \\
 50x+60 &= -45 \\
 50x &= -45-60 \\
 50x &= -105 \\
 x &= \frac{-105}{50} = \frac{-21}{10}
 \end{aligned}$$

e. $2x - 1 = 15 - x$

$2x + x = 15 + 1$

$3x = 16$

$x = \frac{16}{3}$

2. a. $3x + 4 = 2x - 18$

$3x - 2x = -18 - 4$

$x = -22$

b. $2y + \frac{5}{3} = \frac{24}{5} - 3y$

$\frac{6y + 5}{3} = \frac{24 - 15y}{5}$

$5(6y + 5) = 3(24 - 15y)$

$30y + 25 = 72 - 25$

$75y = 47$

$y = \frac{47}{75}$

Verification

$2 \times \frac{47}{75} + \frac{5}{3} = \frac{24}{5} - \frac{3 \times 47}{75}$

$\frac{94}{75} + \frac{5}{3} = \frac{24}{5} - \frac{141}{75}$

$\frac{94 + 5 \times 25}{75} = \frac{24 \times 15 - 141}{75}$

$\frac{94 + 125}{75} = \frac{360 - 141}{75}$

$\frac{219}{75} = \frac{219}{75}$

$\text{LHS} = \text{RHS}$

c. $2m = 5m - \frac{7}{4} \Rightarrow \frac{7}{4} = 5m - 2m$

$\Rightarrow \frac{7}{4} = 3m \Rightarrow m = \frac{7}{3 \times 4} = \frac{7}{12}$

Verification:

$2 \times \frac{7}{12} = 5 \times \frac{7}{12} - \frac{7}{4}$

f. $4z + 6 = 7 + 3z$

$4z - 3z = 7 - 6$

$z = 1$

Verification

$3x - 22 + 4 = 2 \times -22 - 18$

$-66 + 4 = -44 - 18$

$-62 = -62$

$\text{LHS} = \text{RHS}$

$$\begin{aligned}
 &= \frac{14}{12} = \frac{35}{12} - \frac{7}{4} \\
 \Rightarrow \frac{14}{12} &= \frac{35 - 7 \times 3}{12} \\
 \Rightarrow \frac{14}{12} &= \frac{35 - 21}{12} \quad \Rightarrow \quad \frac{14}{12} = \frac{14}{12}
 \end{aligned}$$

LHS = RHS

$$\begin{aligned}
 \text{d. } \frac{x}{2} - \frac{1}{5} &= \frac{x}{4} + \frac{3}{10} \quad \Rightarrow \quad \frac{x}{2} - \frac{x}{4} = \frac{3}{10} + \frac{1}{5} \\
 \frac{2x - x}{4} &= \frac{3 + 2}{10} \\
 \frac{x}{4} = \frac{5}{10} \quad \Rightarrow \quad \frac{x}{4} &= \frac{1}{2} \quad \Rightarrow \quad x = \frac{4}{2} = 2
 \end{aligned}$$

Verification:

$$\begin{aligned}
 \frac{x}{2} - \frac{1}{5} &= \frac{x}{4} + \frac{3}{10} \quad \Rightarrow \quad \frac{2}{2} - \frac{1}{5} = \frac{2}{4} + \frac{3}{10} \\
 1 - \frac{1}{5} &= \frac{1}{2} + \frac{3}{10} \quad \Rightarrow \quad \frac{5-1}{5} = \frac{5+3}{10} \\
 \frac{4}{5} &= \frac{8}{10} \quad \Rightarrow \quad \frac{4}{5} = \frac{4}{5}
 \end{aligned}$$

LHS = RHS

$$\begin{aligned}
 \text{e. } \frac{6x+1}{3} + 2 &= \frac{x-3}{4} \\
 \frac{6x+1+6}{3} &= \frac{x-3}{4} \\
 \frac{6x+7}{3} &= \frac{x-3}{4} \\
 4(6x+7) &= 3(x-3) \\
 24x+28 &= 3x-9 \\
 24x-3x &= -9-28 \\
 21x &= -37 \\
 x &= \frac{-37}{21}
 \end{aligned}$$

Verification:

$$\begin{aligned}
 \frac{6x+1}{3} + 2 &= \frac{x-3}{4} \\
 \frac{6x+7}{3} &= \frac{x-3}{4} \\
 24x+28 &= 3x-9 \\
 24 \times \left(\frac{-37}{21} \right) + 28 &= 3 \times \left(\frac{-37}{21} \right) - 9 \\
 8 \times \frac{-37}{7} + 28 &= \frac{-37}{7} - 9 \\
 \frac{-296}{7} + 28 &= \frac{-37-63}{7} \\
 \frac{-296+196}{7} &= \frac{-100}{7} \\
 \frac{-100}{7} &= \frac{-100}{7} \\
 \text{LHS} &= \text{RHS}
 \end{aligned}$$

f. $3(t - 4) = 5(2t + 1)$

$3t - 12 = 10t + 5$

$3t - 10t = 5 + 12$

$-7t = 17$

$t = \frac{-17}{7}$

Verification:

$3(t - 4) = 5(2t + 1)$

$3t - 12 = 10t + 5$

$3 \times \frac{-17}{7} - 12 = 10 \times \frac{-17}{7} + 5$

$\frac{-51}{7} - 12 = \frac{-170}{7} + 5$

$\frac{-51 - 84}{7} = \frac{-170 - 35}{7}$

$-51 - 84 = -170 + 35$

$-135 = -135$

$\text{LHS} = \text{RHS}$

3. a. $\frac{3x}{4x + 2} = -4$

$3x = -4(4x + 2)$

$3x = -16x - 8$

$3x + 16x = -8$

$19x = -8$

$x = \frac{-8}{19}$

b. $\frac{2m + 1}{3m - 2} = \frac{3}{2}$

$2(2m + 1) = 3(3m - 2)$

$4m + 2 = 9m - 6$

$2 + 6 = 9m - 4m$

$8 = 5m$

$m = \frac{8}{5}$

c. $\frac{7y + 3}{4 - y} = \frac{17}{3}$

$3(7y + 3) = 17(4 - y)$

$21y + 9 = 68 - 17y$

$21y + 9 = 68 - 17y$

$21y + 17y = 68 - 9$

$38y = 59$

$y = \frac{59}{38}$

d. $\frac{3y + 7}{5y - 11} = \frac{-1}{3}$

$3(3y + 7) = -1(5y - 11)$

$9y + 21 = -5y + 11$

$9y + 5y = 11 - 21$

$14y = -10$

$y = \frac{-10}{14} = \frac{-5}{7}$

e. $\frac{7 - 3n}{n + 3} = \frac{1}{5}$

$\Rightarrow 35 - 15n = n + 3$

$\Rightarrow \frac{32}{16} = n$

$\Rightarrow 5(7 - 3n) = n + 3$

$\Rightarrow 32 = 16n$

$\Rightarrow n = 2$

$$\begin{aligned}
 \text{f. } \quad & \frac{7n+4}{n+2} = \frac{-4}{5} \\
 & 5(7n+4) = -4(n+2) \\
 & 35n+20 = -4n-8 \\
 & 35n+4n = -8-20 \\
 & 39n = -28 \\
 & n = \frac{-28}{39}
 \end{aligned}$$

$$\begin{aligned}
 4. \text{ a. } \quad & \frac{2p-(6-5p)}{9p-(3+5p)} = \frac{7}{6} \quad \Rightarrow \quad \frac{2p-6+5p}{9p-3-5p} = \frac{7}{6} \\
 & \frac{7p-6}{4p-3} = \frac{7}{6} \quad \Rightarrow \quad 6(7p-6) = 7(4p-3) \\
 & 42p-36 = 28p-21 \\
 & 42p-28p = -21+36 \\
 & 14p = 15 \quad \Rightarrow \quad p = \frac{15}{14}
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } \quad & \frac{2(4-5x)-3(4-x)}{2-3x} = 2 \\
 & 8-10x-12+3x = 2(2-3x) \\
 & -4-7x = 4-6x \\
 & -4-4 = -6x+7x \\
 & -8 = x
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } \quad & \frac{15(2-y)-5(y+6)}{1-5y} = 10 \\
 & 30-15y-5y-30 = 10-50y \\
 & -20y = 10-50y \\
 & -20y+50y = 10 \\
 & 30y = 10 \\
 & y = \frac{10}{30} = \frac{1}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } \quad & 0.25(4f-3) = 0.05(10f-1) \\
 & 1f-0.75 = 0.5f-0.45 \\
 & 1f-0.5f = -0.45+0.75 \\
 & 0.5f = 0.30 \\
 & f = \frac{0.3}{0.5} = 0.6
 \end{aligned}$$

Critical Thinking Skills

$$4(x + 2)^2 - 2(x - 1)^2 = 28x + 24$$

$$4(x^2 + 4 + 4x) - 2(x^2 + 1 - 2x) = 28x + 24$$

$$4x^2 + 16 + 16x - 2x^2 - 2 + 4x = 28x + 24$$

$$2x^2 + 14 + 20x - 28x - 24 = 0$$

$$2x^2 - 10 - 8x = 0$$

$$2(x^2 - 4x - 5) = 0$$

$$x^2 - 5x + x - 5 = 0$$

$$x(x - 5) + 1(x - 5) = 0$$

$$(x + 1)(x - 5) = 0$$

$$x = -1 \text{ or } 5$$

Assessment Time 2.2

1. Let the two consecutive even natural numbers is $x + 2$, $x + 4$,

$$x + 2 + x + 4 = 86$$

$$2x + 6 = 86$$

$$2x = 86 - 6 = 80$$

$$2x = 80$$

$$x = \frac{80}{2} = 40$$

$$\text{So, } x + 2 = 40 + 2 = 42 \quad \text{and} \quad x + 4 = 40 + 4 = 44$$

Hence, the two consecutive even natural numbers are 42 and 44.

2. Let the three consecutive multiple of 3 are x , $(x + 3)$, $(x + 6)$

$$x + x + 3 + x + 6 = 207$$

$$3x + 9 = 207$$

$$3x = 207 - 9 = 198$$

$$x = \frac{198}{3} = 66$$

$$x = 66, x + 3 = 66 + 3 = 69, x + 6 = 66 + 6 = 72$$

Hence, the three consecutive multiples of 3 are 66, 69 and 72

3. The ratio of three numbers are 2 : 4 : 5

So, numbers be $2x$, $4x$ and $5x$.

According to the given questions,

$$2x + 4x + 5x = 99$$

$$11x = 99$$

$$x = \frac{99}{11} = 9$$

$$2 \times 9 = 18, 4 \times 9 = 36, 5 \times 9 = 45$$

Hence, the numbers be 18, 36 and 45.

4. Let the Arnav's age be x .

According to the given condition,

$$15 + x = 4x \quad \Rightarrow \quad 15 = 4x - x$$

$$15 = 3x \quad \Rightarrow \quad 3x = 15$$

$$x = \frac{15}{3} = 5$$

Hence, the Arav's age is 5 years.

5. Mehul's age = x

Mehul's father age = $3x$

$$x + 5 + 3x + 5 = 66 \quad \Rightarrow \quad 4x + 10 = 66$$

$$4x = 66 - 10 \quad \Rightarrow \quad 4x = 56$$

$$x = \frac{56}{4} = 14$$

Mehul's age $x = 14$ years

Mehul's father age = $14 \times 3 = 42$ years

6. Ratio of 50 rupees notes to 20

Rupee notes = 3 : 5

Let 50 rupees note be $3x$

20 rupees note be $5x$

So, 10 rupees note = $25 - (3x + 5x)$

$$= 25 - 8x$$

Total money = ₹ 590

$$\text{So, } 50 \times 3x + 20 \times 5x + 10(25 - 8x) = 590$$

$$\Rightarrow 150x + 100x + 250 - 80x = 590$$

$$\Rightarrow 170x = 590 - 250$$

$$\Rightarrow 170x = 340$$

$$\therefore x = 2$$

Hence, 50 rupees notes = 6

20 rupees notes = 10

10 rupees notes = 9

7. Let tens place digit be x

$\therefore$ Ones place digit be $5 - x$

$$\begin{aligned}\text{So, number} &= 10x + 5 - x \\ &= 9x + 5\end{aligned}$$

On reversing the digit

$$\begin{aligned}\text{New number} &= 10(5 - x) + x \\ &= 50 - 9x\end{aligned}$$

According to given condition,

$$(9x + 5) - (50 - 9x) = 9$$

$$\Rightarrow 18x = 9 + 45 = 54$$

$$\Rightarrow x = 3$$

$$\text{Hence, number} = 9 \times 3 + 5 = 32$$

8. Let the numerator be $x - 4$

Let the denominator be x

According to the condition

$$\frac{x - 4 + 1}{x} = \frac{2}{5}$$

$$\frac{x - 3}{x} = \frac{2}{5}$$

$$5x - 15 = 2x$$

$$5x - 2x = 15$$

$$3x = 15$$

$$x = \frac{15}{3} = 5$$

$$\text{Hence, the fraction is } \frac{5 - 4}{5} = \frac{1}{5}$$

9. Let the speed of steamer be x km/hrs in still water

So, speed of stream in downstream (in the direction of stream)
 $= (x + 2)$ km/hr

and the speed of stream in upstream (in the opposite direction
of the stream $= (x - 2)$ km/hr

Distance = speed $\times$ time

Distance covered in downstream $= (x + 2) \times 4 = (4x + 8)$ km

Distance covered in upstream $= (x - 2) \times 6 = (6x - 12)$ km

Since, both distance are equal

$$\begin{aligned}
 4x + 8 &= 6x - 12 \\
 \Rightarrow 8 + 12 &= 6x - 4x \\
 \Rightarrow 20 &= 2x \\
 \Rightarrow x &= \frac{20}{2} = 10
 \end{aligned}$$

Hence, the speed of steamer in still water is 10 km/hr.

10. Ratio of length to breadth = 11 : 4

Let the length be $11x$ m

Breadth be $4x$ m

$$\text{Perimeter of land} = \frac{75000}{100} = 750$$

Now, Perimeter of land = $2(L + B)$

$$\begin{aligned}
 \Rightarrow 750 &= 2(11x + 4x) \\
 \Rightarrow 750 &= 30x \\
 \Rightarrow x &= 25
 \end{aligned}$$

Hence, Length = $11 \times 25 = 275$ m

Breadth = $4 \times 25 = 100$ m

Revision Time

1. a. $\frac{x}{4} - 5 = 6$

$$\frac{x-20}{4} = 6 \quad \Rightarrow x-20 = 24$$

$$x = 24 + 20 = 44$$

b. $\frac{t+4}{3} = 9$

$$t+4 = 9 \times 3 \quad \Rightarrow t+4 = 27$$

$$t = 27 - 4 \quad \Rightarrow t = 23$$

c. $\frac{m}{3} + \frac{3m}{4} = 13$

$$\frac{m \times 4 + 3 \times 3m}{12} = 13$$

$$4m + 9m = 13 \times 12$$

$$m = \frac{13 \times 12}{13} = 12$$

$$\text{d. } 4y + \frac{3y}{5} = 2y - \frac{1}{10}$$

$$4y - 2y = -\frac{1}{10} - \frac{3}{5}$$

$$2y = \frac{-1-6}{10} = \frac{-7}{10}$$

$$y = \frac{-7}{20}$$

$$\text{e. } 10p - (4p - 3) = 3(p + 1) + 8$$

$$10p - 4p + 3 = 3p + 3 + 8$$

$$6p + 3 = 3p + 11$$

$$6p - 3p = 11 - 3$$

$$3p = 8$$

$$p = \frac{8}{3}$$

$$\text{f. } 4(x + 3) - 3(x - 1) = 3x + 2$$

$$4x + 12 - 3x + 3 = 3x + 2$$

$$x + 15 = 3x + 2$$

$$15 - 2 = 3x - x$$

$$13 = 2x$$

$$x = \frac{13}{2}$$

$$2. \text{ a. } \frac{6}{2m + 1} = \frac{5}{3m - 6}$$

$$6(3m - 6) = 5(2m + 1)$$

$$18m - 36 = 10m + 5$$

$$18m - 10m = 36 + 5$$

$$8m = 41$$

$$\Rightarrow m = \frac{41}{8}$$

$$\text{b. } \frac{2x + 3}{5} = \frac{4x + 7}{8}$$

$$8(2x + 3) = 5(4x + 7)$$

$$16x + 24 = 20x + 35$$

$$24 - 35 = 20x - 16x$$

$$-11 = 4x$$

$$\Rightarrow x = \frac{-11}{4}$$

$$\text{c. } \frac{17(2-x) - 5(x+12)}{1-6x} = 5$$

$$34 - 17x - 5x - 60 = 5(1 - 6x)$$

$$-26 - 22x = 5 - 30x$$

$$-26 - 5 = -30x + 22x$$

$$-31 = -8x$$

$$x = \frac{31}{8}$$

$$\text{d. } \frac{(2x+3) - 2(4x-6)}{6x+5} = \frac{-5}{3}$$

$$\frac{2x+3-8x+12}{6x+5} = \frac{-5}{3}$$

$$\frac{-6x+15}{6x+5} = \frac{-5}{3}$$

$$3(-6x+15) = -5(6x+5)$$

$$-18x + 30x = -25 - 45$$

$$12x = -70$$

$$x = \frac{-70}{12} = \frac{-35}{6}$$

3. Let the three consecutive odd numbers be x , $x+2$, $x+4$

$$x + x + 2 + x + 4 = 135$$

$$3x + 6 = 135$$

$$3x = 135 - 6$$

$$x = \frac{129}{3} = 43$$

$$x = 43, x + 2 = 43 + 2 = 45, x + 4 = 43 + 4 = 47$$

4. Mishi's present age = x , Neha's present age = $24 + x$
10 years ago

$$24 + x - 10 = 5(x - 10)$$

$$14 + x = 5x - 50$$

$$5x - x = 14 + 50$$

$$4x = 64$$

$$x = \frac{64}{4} = 16$$

Hence, Mishi's present age is 16 years and Neha's present age is
 $24 + 16 = 40$ years

5. Ratio of ages of Tina and Ina = 5 : 7

Let age of Tina be $5x$ years

So, Ina age be $7x$ years

After 4 years,

$$\frac{5x + 4}{7x + 4} = \frac{3}{4}$$

$$20x + 16 = 21x + 12$$

$$21x - 20x = 16 - 12$$

$$x = 4$$

Hence, age of Tina is 20 years and age of Ina is 28 years.

6. Let five rupees coins be x

Then two rupees coin is $3x$

According to questions,

$$3x \times 2 + x \times 5 = 154$$

$$6x + 5x = 154$$

$$11x = 154$$

$$x = \frac{154}{11} = 14$$

Hence, five rupees coin is 14 and two rupees coin is 42.

7. Let numerator be x

Then denominator is $x + 2$

According to question,

$$\frac{x + 3}{x + 2 + 3} = \frac{5}{6}$$

$$6x + 18 = 5x + 25$$

$$6x - 5x = 25 - 18 \quad \Rightarrow \quad x = 7$$

Hence, fraction $\frac{7}{9}$

8. Let ones place digit be x then tens place digit = $2x$.

So, number = $10 \times 2x + x = 21x$

On reversing the digits, new numerator = $10x + 2x = 12x$

According to question,

$$21x - 12x = 36$$

$$9x = 36 \quad \Rightarrow \quad x = 4$$

Hence, number = $21 \times 4 = 84$

9. Let tens place digit be x

Then ones place digit be $= 9 - x$

$$= 10x + 9 - x$$

$$= 9x + 9$$

On reversing the order of digits, new number $= 10(9 - x) + x$

$$= 90 - 9x$$

According to question,

$$(90 - 9x) - (9x + 9) = 27$$

$$\Rightarrow 81 - 18x = 27$$

$$\Rightarrow 81 - 18x = 27$$

$$\Rightarrow 18x = 81 - 27 = 54 \quad \Rightarrow \quad x = 3$$

Hence, number $= 9 \times 3 + 9 = 36$

10. Let total number of sheep be x

No. of sheep grazing $= \frac{x}{2}$

No. of sheep playing near by river $= \frac{3}{4} \times \frac{x}{2} = \frac{3x}{8}$

Now, $\frac{x}{2} + \frac{3x}{8} + 9 = x$

$$9 = x - \frac{x}{2} - \frac{3x}{8}$$

$$= \frac{8x - 4x - 3x}{8} = \frac{x}{8}$$

$$x = 72$$

Mental Zone

1. Linear equation

2. 1

3. changes

4. $\frac{3x}{4} + \frac{x}{6} = 22$

5. $\frac{2x+5}{4x-3} = 2$

$$\frac{9x+2x}{12} = 22$$

$$2x + 5 = 8x - 6$$

$$x = \frac{22 \times 12}{11} = 24$$

$$6x = 11$$

$$x = \frac{11}{6}$$

Multiple Choice Questions

1. (c)

2. (b)

3. (a)

4. (d)

5. (a)

CHAPTER 3 : UNDERSTAND QUADRILATERALS

Assessment Time 3.1

1. Measure of two angles is 78° and 57° .

$$\text{Sum of angles} = 180^\circ$$

$$78^\circ + 57^\circ + x = 180^\circ$$

$$135^\circ + x = 180$$

$$x = 180^\circ - 135^\circ = 45^\circ$$

Hence, the measure of third angle is 45° .

2. Each exterior angle = 72°

$$= \frac{360^\circ}{72^\circ} = 5$$

3. Sum of exterior angle of octagon = $\frac{360^\circ}{8} = 45^\circ$

4. Exterior angle of regular pentagon = $\frac{360^\circ}{5} = 72^\circ$

5. Number of sides of polygon whose each exterior angle is 45° is $\frac{360^\circ}{45^\circ} = 8$

6. Sum of interior angle = $\frac{(n-2) \times 180^\circ}{n}$

$$144 = \frac{(n-2) \times 180^\circ}{n}$$

$$\frac{144n}{180} = (n-2) \Rightarrow \frac{8n}{10} = (n-2)$$

$$\frac{4n}{5} = n-2 \Rightarrow 4n = 5(n-2)$$

$$4n = 5n - 10 \Rightarrow 10 = 5n - 4n$$

$$n = 10$$

Hence, the number of side is 10.

7. Sum of exterior angle of polygon = 360°

$$\frac{360^\circ}{32} = \frac{45}{4} = 11.25$$

No, as 32 does not completely divides the 360° . It is not possible to have a regular polygon with measure of each exterior angle as 32.

8. Minimum side of a polygon = 3

$$\begin{aligned}\text{Each interior angle of a polygon} &= \left\{ \frac{(n-2) \times 180^\circ}{n} \right\} \\ &= \left\{ \frac{(3-2) \times 180^\circ}{3} \right\} \\ &= \frac{180^\circ}{3} = 60^\circ\end{aligned}$$

9. Minimum side of regular polygon = 3

$$\text{Maximum exterior angle of a regular polygon} = \frac{360^\circ}{3} = 120^\circ$$

10. a. Each exterior angle of a regular polygon = $\frac{360^\circ}{10} = 36^\circ$

$$\text{b. Each exterior angle of a regular polygon} = \frac{360^\circ}{18} = 20^\circ$$

11. Ratio of exterior angle to a interior angle of a regular polygon is 1 : 4

$$\frac{360^\circ}{(n-2) \times 180^\circ} = \frac{1}{4}$$

$$\frac{360^\circ \times 4}{(n-2) \times 180^\circ} = 1$$

$$\frac{2 \times 4}{(n-2)} = 1$$

$$8 = n - 2$$

$$n = 8 + 2 = 10^\circ$$

Hence, the number of side of regular polygon is 10.

$$\begin{aligned}\text{12. a. Number of diagonals of polygon} &= \frac{n(n-3)}{2} \\ &= \frac{4(4-3)}{2} = \frac{4}{2} = 2\end{aligned}$$

$$\begin{aligned}\text{b. Number of diagonals of polygon} &= \frac{n(n-3)}{2} \\ &= \frac{8(8-3)}{2} = \frac{8 \times 5}{2} \\ &= \frac{40}{2} = 20\end{aligned}$$

$$\text{c. Number of diagonals of polygon} = \frac{3(3-3)}{2} = 0 \quad (\text{No})$$

13. a. Sum of all angles of quadrilateral = 360°

$$x + 110^\circ + 70^\circ + 100^\circ = 360^\circ$$

$$x + 280^\circ = 360^\circ$$

$$x = 360^\circ - 280^\circ$$

$$= 80^\circ$$

b. $y + 80^\circ = 180^\circ$ (linear pair)

$$y = 180^\circ - 80^\circ = 100^\circ$$

$z + 70^\circ = 180^\circ$ (linear pair)

$$z = 180^\circ - 70^\circ = 110^\circ$$

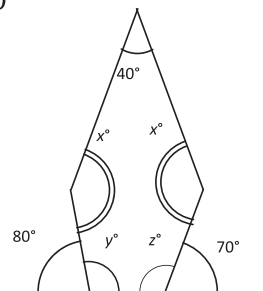
This is a pentagon

$$\therefore 40^\circ + x^\circ + x^\circ + y + z = 540^\circ$$

$$40 + 2x + 100^\circ + 110^\circ = 540^\circ$$

$$2x = 540^\circ - 250^\circ = 290^\circ$$

$$x = \frac{290^\circ}{2} = 145^\circ$$

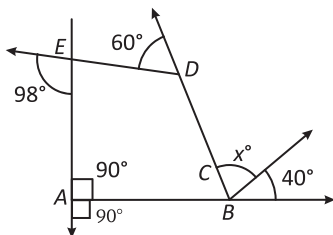


14. Sum of exterior angles is 360° .

$$\therefore x + 40^\circ + 60^\circ + 98^\circ + 90^\circ = 360^\circ$$

$$x = 360^\circ - 288^\circ$$

$$x = 72^\circ$$



15. Sum of exterior angle is 360° .

$$\therefore 50^\circ + 90^\circ + 60^\circ + x + 90^\circ = 360^\circ$$

$$x + 290^\circ = 360^\circ$$

$$x = 360^\circ - 290^\circ = 70^\circ$$

Assessment Time 3.2

1. Given angle = 75°

Let the other angles be x

$$x + 75^\circ = 180^\circ$$

$$x + 75^\circ = 180^\circ$$

$$x = 180^\circ - 75^\circ$$

$$x = 105^\circ$$

Hence, other angles are 105° , 75° , 105° and 75°

2. Lengths of diagonals of a rectangle are equal.

So, length of other diagonal = length of one diagonal = 10 cm

3. Length of all sides of a rhombus are equal.

So, length of all sides is 12 cm 12 cm and 12 cm.

4. Ratio of angles of a parallelogram = 1 : 3

Let angles are x and $3x$.

Now, $x + 3x = 180^\circ$ (Sum of adjacent angles)

$$4x = 180^\circ$$

$$x = 45^\circ$$

Hence, angles are $45^\circ, 135^\circ, 45^\circ, 135^\circ$

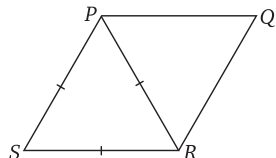
5. a. Rhombus, square b. kite
c. rectangle d. square

6. Since, $PR = PS$

But all sides of a rhombus are equal.

So, $\triangle PSR$ is an equilateral triangle

$\angle S = 60^\circ$ and $\angle R = 60^\circ + 60^\circ = 120^\circ$



7. Let the angle of quadrilateral be $4x, 2x, 3x$ and x

$$4x + 2x + 3x + x = 360^\circ$$

$$6x + 4x = 360x$$

$$10x = 360x$$

$$x = \frac{360^\circ}{10} = 36^\circ$$

$$4x = 4 \times 36 = 144^\circ, 2 \times 36 = 72^\circ, 3 \times 36 = 108^\circ$$

$$x = 36^\circ$$

Hence, the angle of quadrilateral be $144^\circ, 72^\circ, 108^\circ, 36^\circ$

8. No. it is not rectangle. It may be rhombus or parallelogram.

9. Square, since both diagonals are equal.

10. Let other side of kite be x m

Adjacent sides of a kite are equal.

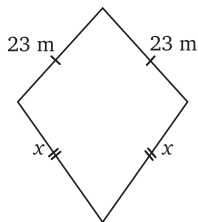
So, $23 + 23 + x + x = 106$

$$2x = 106 - 46 = 60$$

or

$$x = 30$$

Hence, length of other there sides are 23 m, 30, 30 m.



11. a. Adjacent sides : $PQ, QR; QR, RS; RS, SP; SP, PQ$
b. Adjacent angles : $\angle P, \angle Q; \angle Q, \angle R; \angle R, \angle S; \angle S, \angle P$

c. Diagonals : PR and QS

12. a. Square

c. Isosceles trapezium

e. Rhombus

b. Parallelogram

d. Rectangle

f. kite

13. $\angle RQY = 60^\circ$

$$\therefore \angle SRQ = \angle RQY = 60^\circ$$

(alternate interior angles)

$$\angle S + \angle R = 180^\circ$$

(co-interior angles)

$$\angle S = 180^\circ - 60^\circ = 120^\circ$$

$$PQ = SR = 15 \text{ cm}$$

$$QR = SP = 11 \text{ cm}$$

$$PR = 2 \times OP = 2 \times 6 = 12 \text{ cm}$$

(Since diagonals bisect other)

14. $\angle FTI = \angle TIS = 25^\circ$

(alternate interior angles)

In $\triangle OFT$

$$\angle SFT + 110^\circ + 25^\circ = 180^\circ$$

$$\angle SFT = 180^\circ - 135^\circ = 45^\circ$$

$$\angle OTS = \angle FIO = 35^\circ$$

(alternate interior angles)

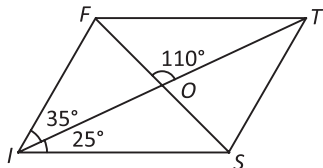
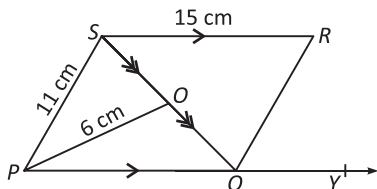
$$\angle TOS = 180^\circ - 110^\circ = 70^\circ$$

In $\triangle TOS$,

$$\angle OST + 70^\circ + 35^\circ = 180^\circ$$

$$\angle OST = 180^\circ - 105^\circ = 75^\circ$$

Hence, $\angle SFT = 45^\circ$, $\angle OST = 75^\circ$, $\angle STO = 35^\circ$



15. $\angle M + \angle O = 180^\circ$

$$\frac{1}{2}(\angle M + \angle O) = 90^\circ$$

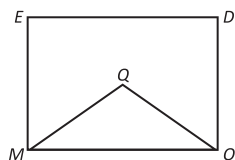
In $\triangle MOQ$,

$$\angle MQO + \frac{1}{2}(\angle M + \angle O) = 180^\circ$$

$$\angle MQO = 180^\circ - 90^\circ = 90^\circ$$

16. $\angle B + \angle D = 180^\circ$

$$130^\circ + \angle D = 180^\circ$$



(adjacent angles)

$$\angle D = 150^\circ - 130^\circ = 50^\circ$$

$$\angle OCD = \angle F = 30^\circ \text{ (opposite angles of a parallelogram)}$$

In $\triangle OCD$,

$$x + 50^\circ + 30^\circ = 180^\circ$$

$$x = 180^\circ - 80^\circ$$

$$x = 100^\circ$$

17. Ratio of angles of a quadrilateral = 5 : 4 : 5 : 4

So, angles are $5x$, $4x$, $5x$ and $4x$

$$\text{Now, } 5x + 4x + 5x + 4x = 360^\circ$$

$$18x = 360^\circ$$

$$x = \frac{360^\circ}{18} = 20^\circ$$

Hence, angles are 100° , 80° , 100° and 80° . It is a parallelogram.

18. Adjacent angles of a rhombus are equal.

Let each equal angle be x° .

$$\therefore x^\circ + x^\circ = 180^\circ$$

$$2x = 180^\circ$$

$$x = 90^\circ$$

Hence, each angle is 90° . It is a square.

19. Kite is a quadrilateral

20. All properties of square are in rhombus but rhombus has not all properties of square.

Revision Time

$$\begin{aligned} 1. \quad a. \quad \text{Sum of angles} &= 30^\circ + 45^\circ + 105^\circ \\ &= 180^\circ \end{aligned}$$

Yes, a triangle can form.

$$\begin{aligned} b. \quad \text{Sum of angles} &= 60^\circ + 90^\circ + 50^\circ \\ &= 200^\circ \neq 180^\circ \end{aligned}$$

No, triangle cannot form.

2. Let each equal angle be x° .

$$\therefore 70^\circ + x^\circ + x^\circ = 180^\circ$$

$$2x = 180^\circ - 70^\circ = 110^\circ$$

$$x = 55^\circ$$

Hence, each equal angle is 55° .

3. All sides of a square are equal.

So, length of other side is 16 cm.

4. Ratio of adjacent angles = 2 : 3

Let angles be $2x$ and $3x$

$$\text{Now, } 2x + 3x = 180^\circ$$

$$5x = 180^\circ$$

$$x = 36^\circ$$

Hence, angles are 72° , 108° , 72° , 108° .

5. a. Sum of two right angles is 180° , third angle can not zero.

So, triangle cannot possible.

b. yes

c. No, sum of two angles cannot more than 180° .

d. Yes

6. In $\triangle ABD$,

$$\angle ABD + \angle BAD + \angle ADB = 180^\circ \quad \dots(1)$$

In $\triangle CBD$,

$$\angle BDC + \angle CBD + \angle BCD = 180^\circ \quad \dots(2)$$

On adding both eqs, we have

$$\begin{aligned} \angle ABD + \angle BAD + \angle ADB + \angle BDC + \angle CBD + \angle BCD \\ = 180^\circ + 180^\circ \\ = 360^\circ \end{aligned}$$

7. Ratio of angles of a quadrilateral = 2 : 5 : 3 : 2

So, angles are $2x$, $5x$, $3x$ and $2x$

$$\text{Now, } 2x + 5x + 3x + 2x = 360^\circ$$

$$12x = 360^\circ$$

$$x = 30^\circ$$

Hence, angles are 60° , 150° , 90° and 60° .

8. Do yourself

9. Sum of adjacent angles = 180°

$$(2x - 4) + (3x - 1) = 180^\circ$$

$$5x - 5 = 180^\circ$$

$$5x = 185^\circ$$

$$x = 37^\circ$$

Hence, angles are $2 \times 37 - 4$

$$= 70^\circ$$

$$\text{and } 3 \times 37 - 1 = 110^\circ$$

10. It may be square or rectangle.

11. a. Adjacent sides : $KI, IT; IT, TE; TE, EK; EK, KI$

b. Adjacent angles : $\angle K, \angle I; \angle I, \angle T; \angle T, \angle E; \angle E, \angle K$

c. Opposite sides : KI, ET and IT, KE

12. $JF = 8x + 4, EG = 24x - 8$

$$\therefore HF = EG$$

$$JF = \frac{1}{2}HF = \frac{1}{2}EG$$

$$8x + 4 = \frac{1}{2}(24x - 8)$$

$$2(8x + 4) = 24x - 8$$

$$16x + 8 = 24x - 8$$

$$16x - 24x = -8 - 8$$

$$-8x = -16$$

$$\text{or } x = 2$$

13. $2y = 120^\circ$ (opposite angles of a parallelogram)

$$y = 60^\circ$$

$$120^\circ + (5x + 10) = 180^\circ \quad (\text{adjacent angles})$$

$$5x = 180^\circ - 130^\circ$$

$$5x = 50^\circ$$

$$x = 10^\circ$$

$$\text{Hence, } x = 10^\circ, y = 60^\circ$$

14. Each exterior angle of a regular pentagon $= \frac{360^\circ}{5} = 72^\circ$

$$\text{Each exterior angle of a decagon} = \frac{360^\circ}{10} = 36^\circ$$

$$\text{Their ratio} = 72^\circ : 36^\circ$$

$$= 2 : 1$$

15. a. $x = 5 \text{ cm}$ (opposite sides of a parallelogram)

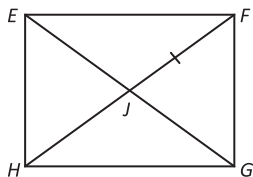
$$y = 6 \text{ cm}$$
 (opposite sides of a parallelogram)

b. $QR = RS = PS = PQ = 4 \text{ cm}$

c. $y^\circ = 80^\circ$ (opposite angles of a || gm)

$$x^\circ + 80^\circ = 180^\circ$$
 (adjacent angles)

$$x = 180^\circ - 80^\circ$$



$$\begin{aligned}
 &= 100^\circ \\
 z = x &= 100^\circ && \text{(opposite angles)} \\
 \text{or } x &= 3 \text{ cm} && \text{(adjacent sides)} \\
 y &= 5 \text{ cm} && \text{(adjacent sides)}
 \end{aligned}$$

Mental Zone

1. Pentagon
2. 180°
3. Nonagon
4. Equilateral triangle
5. kite
6. Each exterior angle $= \frac{360^\circ}{5} = 72^\circ$

$$\text{So, each interior angle} = 180^\circ - 72^\circ = 108^\circ$$

Multiple Choice Questions

1. (b)
2. (a)
3. (d)
4. (d)
5. (c)

CHAPTER-4: DATA HANDLING

Assessment Time 4.1

1. Tabular form of Marks

Marks	Tally Marks	Number of Student
1		1
5		1
6		2
8		1
10	 	6
15		2
19		1
20		1
25		1
30		1
40	 	7
42		1
45		3
48		1

49		1
50		2
		32

2. Tabular form of outcomes

Die Number	Tally Marks	Number of outcomes
1		4
2		4
3		4
4		4
5		4
6		4
		30

3. Tabular form of weight

Weight in (kg)	Tall mark	Number of students
10		1
12		2
15		1
18		2
22		1
25		2
27		2
28		4
29		2
30		2
		20

4. a. 0 b. B
 c. $9 \times 10 = 90$ d. $50 \times 10 = 500$
5. a. 40 b. Friday
 c. $(10 - 2) \times 5 = 40$ d. $40 \times 5 = 200$

6.  = 10 cycle

Days	Cycles
First Week	       
Second Week	      
Third Week	           
Fourth Week	    

7.  = 10 books

Subject	Number of books
Hindi	        
English	              
Maths	           
Science	      
Others	                 

Assessment Time 4.2

1. a. June

b. August

c. Difference = $450 - 200 = 250$

d. Total t-shirts = $350 + 400 + 600 + 450 = 2000$

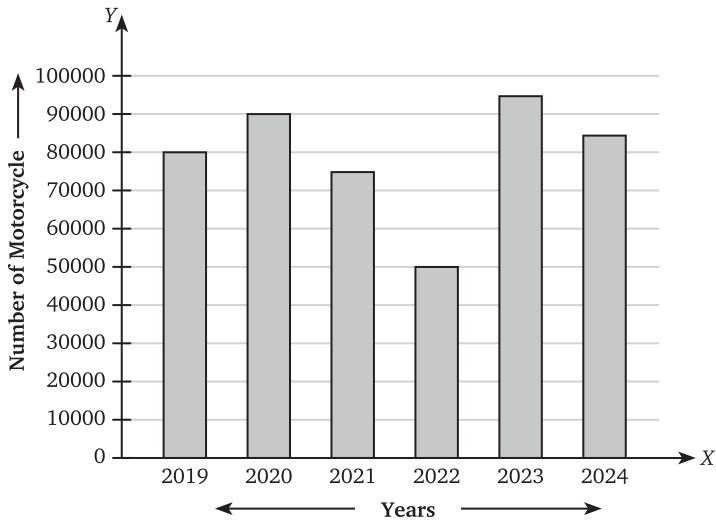
2. a. 130

b. second inning

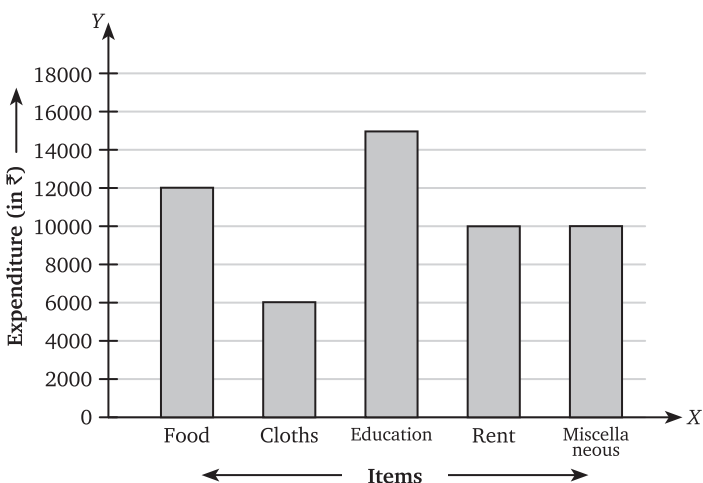
c. 30

d. Total score = $80 + 130 + 30 + 100 + 65 = 405$

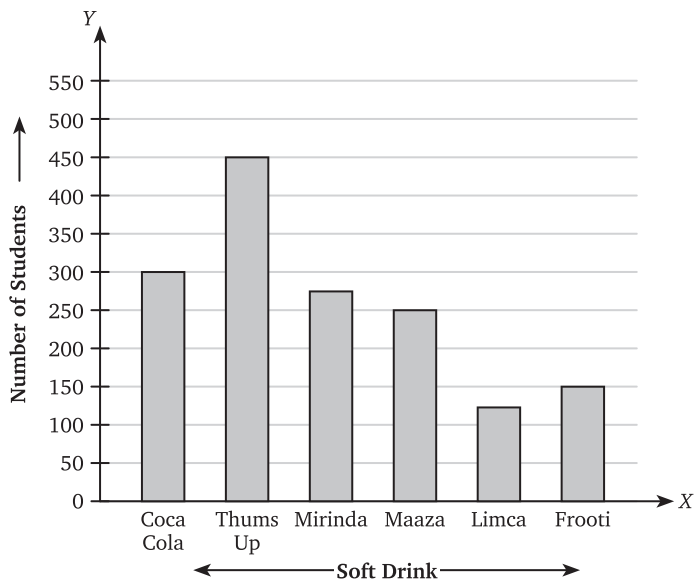
3.



4.



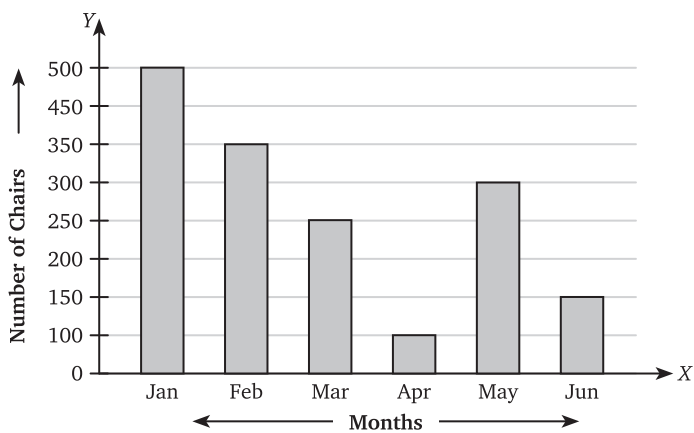
5.



a. Thumsup

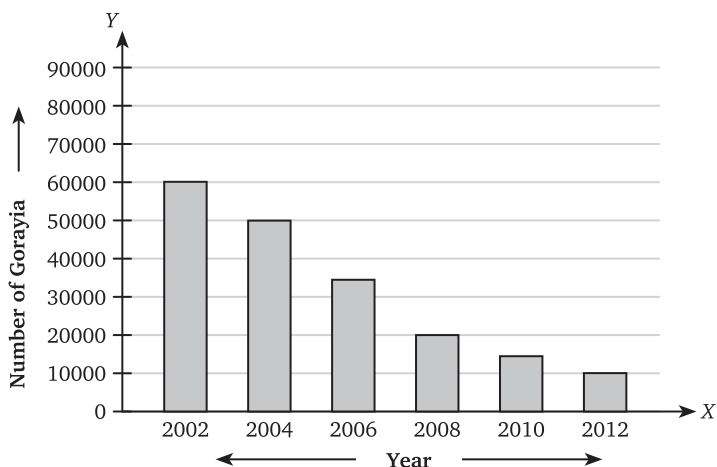
b. Limca

6.



7. SEL-Humanity

a.

**Assessment Time 4.3**

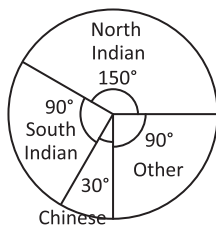
1. Total people = $50 + 30 + 10 + 30 = 120$

Central angle for North Indian = $\left(\frac{50}{120} \times 360\right)^\circ = 150^\circ$

Central angle for South Indian = $\left(\frac{30}{120} \times 360\right)^\circ = 90^\circ$

Central angle for chinese = $\left(\frac{10}{120} \times 390\right)^\circ = 30^\circ$

Central angle for others = $\left(\frac{30}{120} \times 360\right)^\circ = 90^\circ$



2. a. Bus is the common mode of transport.

b. Fraction of children travel by car = $\frac{90}{360} = \frac{1}{4}$

c. $\frac{1}{4}$ of total children = 18

$\therefore$ Total children = $18 \times 4 = 72$

d. Children use taxi = $\frac{30}{360} \times 72 = 6$

e. Cycle and walk.

3. Total number of animals = $42 + 15 + 26 + 24 + 13$
 $= 120$

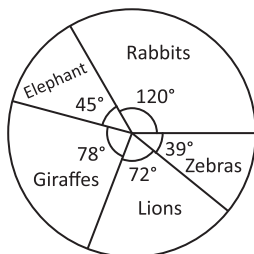
Central angle for rabbits = $\left(\frac{42}{120} \times 360\right)^\circ = 126^\circ$

Central angle for elephants = $\left(\frac{15}{120} \times 360\right)^\circ = 45^\circ$

Central angle for giraffes = $\left(\frac{26}{120} \times 360\right)^\circ = 78^\circ$

Central angle for lions = $\left(\frac{24}{120} \times 360\right)^\circ = 72^\circ$

Central angle for zebras = $\left(\frac{13}{120} \times 360\right)^\circ = 39^\circ$



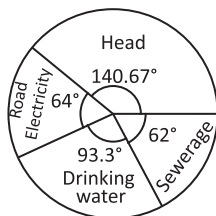
4. Total amount = $42.2 + 19.2 + 28 + 18.6 = 108$

Central angle for head = $\left(\frac{42.2}{108} \times 360\right)^\circ = 140.67^\circ$

Central angle for road electricity = $\left(\frac{19.2}{108} \times 360\right)^\circ = 64^\circ$

Central angle for Drinking water = $\left(\frac{28}{108} \times 360\right)^\circ = 93.3^\circ$

Central angle for sewerage = $\left(\frac{18.6}{108} \times 360\right)^\circ = 62^\circ$



Assessment Time 4.4

1. Total possible outcomes = 2 (T, H)
 Number of favourable outcome = 1 (T)
 So, probability of getting a tail on the coin

$$= \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{1}{2}$$
2. Total possible outcomes = 6 (1, 2, 3, 4, 5, 6)
 Number of favourable outcome = 3 (2, 3, 5)
 So, probability of getting a prime number of die

$$= \frac{\text{Number of favourable outcome}}{\text{Total possible outcomes}} = \frac{3}{6} = \frac{1}{2}$$
3. Total possible outcomes = 6 (1, 2, 3, 4, 5, 6)
 Number of favourable outcome = 3 (1, 3, 5)
 So, probability of getting on odd number on a die

$$= \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{3}{6} = \frac{1}{2}$$
4. Total possible outcomes = 5 (I, N, D, I, A)
 Number of favourable outcome = 1 (D)
 So, probability =
$$\frac{\text{No. of favourable outcomes}}{\text{Total possible outcomes}} = \frac{1}{5}$$
5. Total possible outcomes = 60
 Number of favourable outcomes = 28
 So, probability =
$$\frac{\text{number of favourable outcome}}{\text{Total possible outcomes}} = \frac{28}{60} = \frac{7}{15}$$
6. Total possible outcomes = 6(1, 2, 3, 4, 5, 6)
 - a. Number of favourable outcome = 3(1, 2, 3)
 Probability =
$$\frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{3}{6} = \frac{1}{2}$$
 - b. Total possible outcomes = 6(1, 2, 3, 4, 5, 6)
 Number of favourable outcomes = 2(5, 6)
 Probability =
$$\frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{2}{6} = \frac{1}{3}$$
7. Total possible outcomes = 5(A, E, I, O, U)
 - a. Number of favourable outcomes = 5

Probability of getting a vowel

$$= \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{5}{5} = 1$$

- b. Total possible outcomes = 5 (A, E, I, O, U)

Number of favourable outcome = 1 (U)

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{1}{5}$$

- c. Total possible outcomes = 5 (A, E, I, O, U)

Number of favourable outcomes = 2 (A or I)

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{2}{5}$$

- d. Total possible outcomes = 5 (A, E, I, O, U)

Number of favourable outcomes = 0

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{0}{5} = 0$$

8. a. Total possible outcomes = 20

Number of favourable outcomes = 6

Probability of getting a white ball

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{6}{20} = \frac{3}{10}$$

- b. Total possible outcomes = 20

Number of favourable outcomes = 6 + 6 = 12

Probability of getting a non-red ball

$$= \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{12}{20} = \frac{3}{5}$$

9. a. Total possible outcomes = 8

Number of favourable outcome = 2

Probability of getting a ball

$$= \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{2}{8} = \frac{1}{4}$$

- b. Total possible outcomes = 8

Number of favourable outcomes = 3

Probability of getting a toy car

$$= \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{3}{8}$$

c. Total possible outcomes = 8

Number of favourable outcome = 7

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{7}{8}$$

10. a. Total possible outcomes 20

Number of favourable outcomes = 5

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{5}{20} = \frac{1}{4}$$

b. Total possible outcomes = 20

Number of favourable outcome = 0

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{0}{20} = 0$$

c. Total possible outcomes = 20

Number of favourable outcome = 5

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{5}{20} = \frac{1}{4}$$

$$11. \text{Probability} = \frac{\text{No. of white balls}}{\text{Total balls}}$$

$$= \frac{2}{9} = \frac{x}{36} \quad (\because \text{No. of white balls} = x)$$

$$x = \frac{2 \times 36}{9} = 2 \times 4 = 8$$

$$\text{Yellow balls} = \text{Total balls} - \text{white balls}$$

$$= 36 - 8 = 28$$

12. a. 11

b. (i) Total number of M = 2

$$\text{So required probability} = \frac{2}{11}$$

(ii) Total number of vowels = 4 (a, e, a, i)

$$\text{So, required probability} = \frac{4}{11}$$

(iii) Number of consonants = 7

$$\text{So, required probability} = \frac{7}{11}$$

(iv) Number of $x = 0$

$$\text{So, required probability} = \frac{0}{11} = 0$$

13. Chances of rain = 70%

$$\therefore \text{Probability of rain} = \frac{70}{100} = \frac{7}{10}$$

Revision Time

1. Tabular form of heights

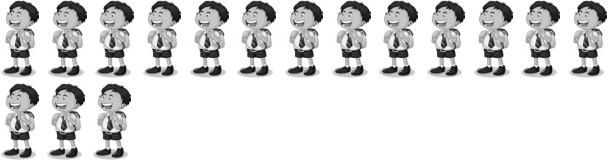
Height	Tally Mark	Number of students
135		2
140		5
144		1
145		3
146		1
150		9
155		3
160		5
165		1
		30

a. 5 student

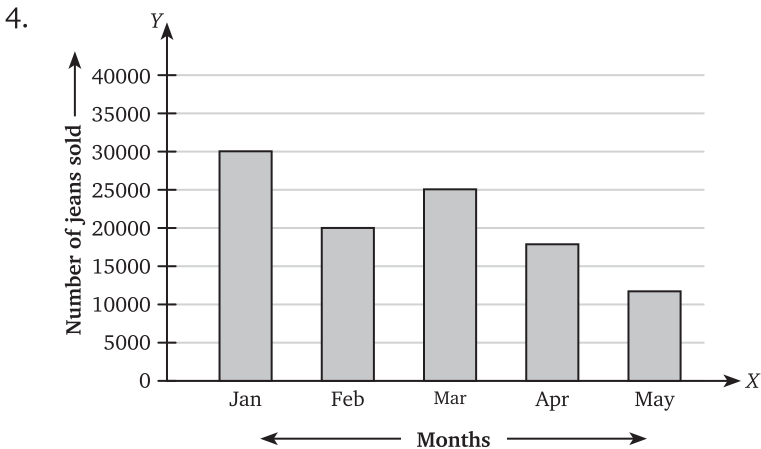
b. 2

2.  = 10

Food Items	Number of students
Pizza	                

Burger	
Patties	
Chowmin	
Veg Rolls	

3. a. Naresh, $15 \times 20 = 300$ baskets
 b. Rahim, $60 \times 20 = 120$ baskets
 c. 20 more baskets



5. a. 120 b. 80 c. class 11 and class V
 d. Total students = $100 + 80 + 120 + 100 + 80$
 $= 200 + 200 + 80 = 480$
6. a. Spent on roads = $10\% \text{ of } 20 = 10 = \frac{10}{100} \times 20 = 2 \text{ crores}$

- b. $\frac{\text{Spent on education}}{\text{Spent on road}} = \frac{25}{10} = 2.5 \text{ times}$
- c. Fraction = $\frac{30}{100} = \frac{3}{10} = 3 : 10$
7. a. May or may not b. May or may not
c. Impossible d. Certain happen
e. Impossible
8. a. Total possible outcomes = 6 (1, 2, 3, 4, 5, 6)
Number of favourable outcomes = 3 (1, 3, 5)
Probability = $\frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}} = \frac{3}{6} = \frac{1}{2}$
- b. Total possible outcome = 6 (1, 2, 3, 4, 5, 6)
Number of favourable outcome = 1 (5)
Probability = $\frac{\text{No. of favourable outcomes}}{\text{Total possible outcome}} = \frac{1}{6}$
- c. Total possible outcome = 6 (1, 2, 3, 4, 5, 6)
Number of favourable outcome = 2 (3, 6)
Probability = $\frac{\text{No. of favourable outcomes}}{\text{Total possible outcome}} = \frac{2}{6} = \frac{1}{3}$
- d. Total possible outcomes = 6 (1, 2, 3, 4, 5, 6)
Number of favourable outcome = 0
Probability = $\frac{\text{No. of favourable outcomes}}{\text{Total possible outcome}} = \frac{0}{6} = 0$
- e. Total possible outcomes = 6 (1, 2, 3, 4, 5, 6)
Number of favourable outcomes = 5
Probability = $\frac{\text{No. of favourable outcomes}}{\text{Total possible outcome}} = \frac{5}{6}$

Mental Zone

1. Row data 2. frequency 3. pictograph
4. different 5. constant 6. $\frac{1}{2}$ 7. 1
8. 0 9. 1 10. 6

Multiple Choice Questions

1. (b) 2. (d) 3. (c) 4. (d) 5. (c)

Case Study Based Questions

1. Children spend at least one hour in playing = 34% of 350

$$= \frac{34}{100} \times 350 = 119$$

2. Children spend more than 2 hours = 36% of 350

$$= \frac{36}{100} \times 350 = 126$$

3. Children spend 3 or less hours = 74% of 350

$$= \frac{74}{100} \times 350 = 259$$

4. Children less than one hour = 30% of 350

$$= \frac{30}{100} \times 350 = 105$$

5. Children 3 hours = 6% of 350

$$= \frac{6}{100} \times 350 = 21$$

CHAPTER 5: SQUARES AND SQUARE ROOTS**Assessment Time 5.1**

1. a. 1000

Since, a number ending with odd number of zero can never be a perfect square.

So, 1000 can not be a perfect square.

- b. 622

Since, a number ended with 2 can never be a perfect square.

So, 622 is not a perfect square.

- c. 528

A number having 8 at the ones place is never a perfect square. So, 528 is not a perfect square.

- d. 625

A number having 5 at the ones place is a perfect square.

So, 625 is a perfect square.

- e. 916, not perfect square.

f. 40000

As 4000 is end with the even number of zeros. So, it is a perfect square.

g. 652

A number having 2 at the ones place is never a perfect square. So, 652 is not a perfect square.

h. 1373

A number having 3 at the ones place is never a perfect square. So, 1373 is not a perfect square.

2. a. 342

Since, 342 is ends with 2. So, the one place digit of it square should be end in 4.

b. 614

Since, 614 is ends with 4. So, the ones place digit of its square should be end in 6.

c. 819

Since, 819 is ends with 9. So, the ones place digit of its square should be ends in 1.

d. 163

Since, 163 is ends with 3. So, the ones place digit of its square would end with 9.

e. 161

Since, 161 is ends with 1. So, the ones place digit of its square would end with 1.

f. 285

Since, 285 is ends with 5. So, the ones place digit of its square would end with 5.

g. 616

Since, 616 is ends with 6. So, the ones place digit of its square would end with 6.

h. 987

Since, 987 is ends with 7. So, the ones place digit of its square would end with 9.

3. a. 225

$$\text{So, } 225 = \overline{3 \times 3} \times \overline{5 \times 5}$$

No, it is not a perfect square of even number.

$$\begin{array}{r|l} 5 & 225 \\ \hline 5 & 45 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

b. 196

$$196 = \overline{2 \times 2} \times \overline{7 \times 7}$$

$$= 2 \times 7 = 14$$

Yes, it is a perfect square of even number.

$$\begin{array}{r|l} 2 & 196 \\ \hline 2 & 98 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

c. 576

$$= \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{3 \times 3}$$

$$= 2 \times 2 \times 2 \times 3 = 24$$

Yes, it is a perfect square of even number.

$$\begin{array}{r|l} 2 & 576 \\ \hline 2 & 288 \\ \hline 2 & 144 \\ \hline 2 & 72 \\ \hline 2 & 36 \\ \hline 2 & 18 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

d. 1936

$$= \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{11 \times 11}$$

$$= 2 \times 2 \times 11 = 44$$

Yes, it is a perfect square of even number.

$$\begin{array}{r|l} 2 & 1936 \\ \hline 2 & 968 \\ \hline 2 & 484 \\ \hline 2 & 242 \\ \hline 11 & 121 \\ \hline & 1 \end{array}$$

e. $1369 = \overline{37 \times 37}$

$$= 37$$

No, it is not a perfect square of even number

$$\begin{array}{r|l} 11 & 11 \\ \hline & 1 \end{array} \quad \begin{array}{r|l} 37 & 1369 \\ \hline 37 & 37 \\ \hline & 1 \end{array}$$

f. $1089 = \overline{3 \times 3} \times \overline{11 \times 11}$

$$= 3 \times 11 = 33$$

No, it is not a perfect square of even number.

$$\begin{array}{r|l} 3 & 1089 \\ \hline 3 & 363 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

g. $3364 = \overline{2 \times 2} \times \overline{29 \times 29}$

$$= 2 \times 29 = 58$$

Yes, it is a perfect square of even number.

$$\begin{array}{r|l} 2 & 3364 \\ \hline 2 & 1682 \\ \hline 29 & 841 \\ \hline 29 & 29 \\ \hline & 1 \end{array}$$

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$$h. \quad 2704 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{13 \times 13}$$

$$= 2 \times 2 \times 13 = 52$$

Yes, it is a perfect square of even number.

2	2704
2	1352
2	676
2	338
13	169
13	13
	1

$$4. \quad a. \quad 625 = \overline{5 \times 5} \times \overline{5 \times 5}$$

$$= 5 \times 5 = 25$$

Yes is is a perfect square of odd number.

5	625
5	125
5	25

$$b. \quad 1521 = 39 \times 39$$

$$= 39$$

Yes, it is a perfect square of odd number.

39	1521
39	39
	1

2	1600
2	800

$$c. \quad 1600 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{5 \times 5}$$

$$= 2 \times 2 \times 2 \times 5 = 40$$

No, it not a perfect square of odd number.

2	400
2	200
2	100
2	50

$$d. \quad 2116 = \overline{2 \times 2} \times \overline{23 \times 23}$$

$$= 2 \times 23 = 46$$

No, it is not a perfect square of odd number.

2	2116
2	1058
23	529
23	23
	1

2	2304
2	1152

$$e. \quad 2304 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{3 \times 3}$$

$$= 2 \times 2 \times 2 \times 2 \times 3 = 16 \times 3 = 48$$

No, it is not a perfect square of odd number.

2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

$$f. \quad 2500 = \overline{2 \times 2} \times \overline{5 \times 5} \times \overline{5 \times 5}$$

$$= 2 \times 5 \times 5 = 50$$

No, it is not a perfect square of odd number.

2	2500
2	1250
5	625
5	125

$$g. \quad 529 = \overline{23 \times 23}$$

$$= 23$$

Yes, it is a perfect square of odd number.

23	529	5	25
23	23	5	5
	1		1

$$h. \quad 361 = 19 \times 19$$

$$= 19$$

Yes, it is a perfect square of odd number.

19	361
19	19
	1

$$5. \quad a. \quad 55^2 - 54^2$$

$$= 2 \times 54 + 1$$

$$= 108 + 1$$

$$= 109$$

$$b. \quad 67^2 - 66^2$$

$$= 2 \times 66 + 1$$

$$= 132 + 1$$

$$= 133$$

$$c. \quad 72^2 - 71^2$$

$$= 2 \times 71 + 1$$

$$= 142 + 1$$

$$= 143$$

$$d. \quad 89^2 - 88^2$$

$$= 2 \times 88 + 1$$

$$= 176 + 1$$

$$= 177$$

$$e. \quad 162^2 - 161^2$$

$$= 2 \times 161 + 1$$

$$= 322 + 1$$

$$= 323$$

$$f. \quad 252^2 - 251^2$$

$$= 2 \times 251 + 1$$

$$= 502 + 1 = 503$$

$$6. \quad a. \quad (34)^2$$

$$= (30 + 4)^2$$

$$= (30 + 4) \times (30 + 4)$$

$$= 30(30 + 4) + 4(30 + 4)$$

$$= 900 + 120 + 120 + 16$$

$$= 1156$$

$$b. \quad 56^2$$

$$= (50 + 6)^2$$

$$= (50 + 6) \times (50 + 6)$$

$$= 50(50 + 6) + 6(50 + 6)$$

$$= 2500 + 300 + 300 + 36$$

$$= 3136$$

c. 83^2

$$= (80 + 3)^2$$

$$= (80 + 3) \times (80 + 3)$$

$$= 80(80 + 3) + 3(80 + 3)$$

$$= 6400 + 240 + 240 + 9$$

$$= 6889$$

d. 95^2

$$= (90 + 5)^2$$

$$= (90 + 5) \times (90 + 5)$$

$$= 90(90 + 5) + 5(90 + 5)$$

$$= 7100 + 450 + 450 + 25$$

$$= 9025$$

e. 87^2

$$= (80 + 7)^2$$

$$= (80 + 7) \times (80 + 7)$$

$$= 80(80 + 7) + 7(80 + 7)$$

$$= 6400 + 560 + 560 + 49$$

$$= 7569$$

7. a. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 =$ Sum of first 8 odd numbers

$$= 8^2 = 8 \times 8 = 64$$

b. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 =$ Sum of first 10 odd numbers.

$$10^2 = 10 \times 10 = 100$$

c. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 =$ Sum of first 11 odd numbers.

$$11^2 = 11 \times 11 = 121$$

d. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 =$ Sum of first 13 odd numbers.

$$13^2 = 13 \times 13 = 169$$

8. a. $25 = 5^2 =$ Sum of first five odd numbers.

$$= 1 + 3 + 5 + 7 + 9$$

- b. $49 = 7^2 = \text{Sum of first 7 odd numbers}$
 $= 1 + 3 + 5 + 7 + 9 + 11 + 13$
- c. $121 = 11^2 = \text{Sum of first 11 odd numbers}$
 $= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21$
- d. $225 = 15^2 = \text{Sum of first 15 odd numbers}$
 $= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29$
- e. $576 = 24^2 = \text{Sum of first 24 odd numbers}$
 $= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29 + 31 + 33 + 35 + 37 + 39 + 41 + 43 + 45 + 47$

9. a. 8 and 9

As we know that number between square of any two consecutive number is $2n$, where n is the smaller number.

So, numbers between square of 8 and $9 = 2 \times 8 = 16$

- b. 11 and 12

As we know that number between square of any two consecutive number is $2n$, where n is the smaller number.

So, numbers between square of 11 and $12 = 2 \times 11 = 22$

- c. 15 and 16

As we know that number between square of any two consecutive number is $2n$, where n is the smaller number.

So, numbers between square of 15 and $16 = 2 \times 15 = 30$

10. a. 8

Let $2a = 8$

$$\text{So, } a = \frac{8}{2} = 4$$

$$a^2 - 1 = 4^2 - 1 = 16 - 1 = 15$$

$$a^2 + 1 = 4^2 + 1 = 16 + 1 = 17$$

So, 15, 8, 17 is a Pythagoras triplet.

- b. $2a = 10$

$$\therefore a = 5$$

$$a^2 - 1 = 5^2 - 1 = 25 - 1 = 24$$

$$a^2 + 1 = 5^2 + 1 = 25 + 1 = 26$$

So, 24, 10, 26 is a Pythagoras triplet.

c. $2a = 18$

$\therefore a = 9$

$a^2 - 1 = 9^2 - 1 = 81 - 1 = 80$

$a^2 + 1 = 9^2 + 1 = 81 + 1 = 82$

So, 80, 18, 82 is a Pythagoras triplet.

d. $2a = 24$

$\therefore a = 12$

$a^2 - 1 = 12^2 - 1 = 144 - 1 = 143$

$a^2 + 1 = 12^2 + 1 = 144 + 1 = 145$

So, 143, 24, 145 is a Pythagoras triplet.

11. a. $625 = \overline{5 \times 5} \times \overline{5 \times 5}$

So, every prime number is in pair.

Hence, 625 is a perfect square.

5	625
5	125
5	25
5	5
	1

b. $1200 = \overline{2 \times 2} \times \overline{2 \times 2} \times 3 \times \overline{5 \times 5}$

Since, 3 is not making pair.

Hence, 1200 is not a perfect square.

2	1200
2	600
2	300
2	150
3	75
5	25
5	5
	1

c. $1849 = 43 \times 43$

Since, prime number is making a pair.

Hence, It is a perfect square.

43	1849
43	43
	1

d. $2401 = 7 \times 7 \times 7 \times 7$

So, every prime number is making pair.

Hence, it is a perfect square.

7	2401
7	343
7	49
7	7
	1

e. $1900 = \overline{2 \times 2} \times \overline{5 \times 5} \times 19$

So, 19 is not making a pair.

Hence, 1900 is not a perfect square.

2	1900
2	950
5	475
5	95
19	19
	1

f. $5184 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2}$
 $\times \overline{3 \times 3} \times \overline{3 \times 3}$

Since, every prime number is in pair.

So, 5184 is a perfect square.

2	5184
2	2592
2	1296
2	648

g. $5625 = \overline{5 \times 5} \times \overline{5 \times 5} \times \overline{3 \times 3}$

Since, every prime number is making a pair.

Hence, 5625 is a perfect square.

5	5625	2	324
5	1125	2	162
5	225	3	81
5	45	3	27
3	9	3	9
3	3	3	3
	1		1

h. $9801 = \overline{3 \times 3} \times \overline{3 \times 3} \times \overline{11 \times 11}$

Since, every prime number is making a pair.

Hence, 9801 is a perfect square.

3	9801
3	3267
3	1089
3	363
11	121
11	11
	1

12. c. $3^2 + 4^2 + x^2 = 13^2$

$$9 + 16 + x^2 = 169$$

$$x^2 = 169 - 25$$

$$= 144$$

$$x = 12$$

$$3^2 + 4^2 + 12^2 = 13^2$$

d. $3^2 + 4^2 + ()^2 = 13^2$

Let the blank space be x

$$3^2 + 4^2 + x^2 = 13^2$$

$$9 + 16 + x = 169$$

$$x^2 = 169 - 25 = 144$$

$$x = \sqrt{144} = 12$$

e. $4^2 + 5^2 + 20^2 = 21^2$

f. $5^2 + 6^2 + 30^2 = 31^2$

Assessment Time 5.2

1. a. $64 - 1 = 63$, $63 - 3 = 60$, $60 - 5 = 55$,
 $55 - 7 = 48$, $48 - 9 = 39$, $39 - 11 = 28$,
 $28 - 13 = 15$, $15 - 15 = 0$

Here, we subtract 8 times to get 0.

So, $\sqrt{64} = 8$

- b. $121 - 1 = 120$, $120 - 3 = 117$, $117 - 5 = 112$,
 $112 - 7 = 105$, $105 - 9 = 96$, $96 - 11 = 85$,
 $85 - 13 = 72$, $72 - 15 = 57$, $57 - 17 = 40$,
 $40 - 19 = 21$, $21 - 21 = 0$

Here, we subtract 11 time to get 0.

So, $\sqrt{121} = 11$

- c. $144 - 1 = 143$, $143 - 3 = 140$, $140 - 5 = 135$,
 $135 - 7 = 128$, $128 - 9 = 119$, $119 - 11 = 108$,
 $108 - 13 = 95$, $95 - 15 = 80$, $80 - 17 = 63$,
 $63 - 19 = 44$, $44 - 21 = 23$, $23 - 23 = 0$

Here, we subtract 12 time to get 0

So, $\sqrt{144} = 12$

- d. $169 - 1 = 168$, $168 - 3 = 165$, $165 - 5 = 160$,
 $160 - 7 = 153$, $153 - 9 = 144$, $144 - 11 = 133$,
 $133 - 13 = 120$, $120 - 15 = 105$, $105 - 17 = 88$,
 $88 - 19 = 69$, $69 - 21 = 48$, $48 - 23 = 25$,
 $25 - 25 = 0$

Here, we subtract 13 time to get 0.

So, $\sqrt{169} = 13$

2. a. $196 = 14 \times 14$

$$\sqrt{196} = \sqrt{2 \times 2 \times 7 \times 7}$$

$$= 2 \times 7 = 14$$

- b. $484 = 2 \times 2 \times 11 \times 11$

$$\sqrt{484} = \sqrt{2 \times 2 \times 11 \times 11}$$

$$= 2 \times 11 = 22$$

2	484	2	196
2	242	2	98
11	121	7	49
11	11	7	7
	1		1

c. $784 = 2 \times 2 \times 2 \times 2 \times 7 \times 7$
 $\sqrt{784} = \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{7 \times 7}}$
 $= 2 \times 2 \times 7$
 $= 28$

2	784
2	392
2	196
2	98
7	49
7	7
	1

d. $1024 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$
 $\times 2 \times 2 \times 2 \times 2$

$\sqrt{1024} = \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}}$
 $= 2 \times 2 \times 2 \times 2 \times 2 = 32$

2	1024
2	512
2	256
2	128

e. $1764 = 2 \times 2 \times 7 \times 7 \times 3 \times 3$
 $\sqrt{1764} = \sqrt{\underline{2 \times 2} \times \underline{7 \times 7} \times \underline{3 \times 3}}$
 $= 2 \times 7 \times 3 = 42$

2	1764
2	882
7	441
7	63
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

f. 3025

$3025 = 5 \times 5 \times 11 \times 11$
 $\sqrt{3025} = \sqrt{\underline{5 \times 5} \times \underline{11 \times 11}}$
 $= 5 \times 11 = 55$

5	3025
5	605
11	121
11	11
	1

g. 4356

$4356 = 2 \times 2 \times 3 \times 3 \times 11 \times 11$
 $\sqrt{4356} = \sqrt{\underline{2 \times 2} \times \underline{3 \times 3} \times \underline{11 \times 11}}$
 $= 2 \times 3 \times 11 = 66$

2	4356
2	2178
3	1089
3	363
11	121
11	11
	1

h. 8281

$$8281 = 7 \times 7 \times 13 \times 13$$

$$\sqrt{8281} = \sqrt{7 \times 7 \times 13 \times 13}$$

$$= 7 \times 13 = 91$$

7	8281
7	1183
13	169
13	13
	1

3. $1458 = 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

Since, prime factor 2 is not making a pair. So, we have to multiply 1458 by 2 to make it perfect square.

So, $1458 \times 2 = 2916$

$$\sqrt{2916} = \sqrt{2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}$$

$$= 2 \times 3 \times 3 \times 3 = 54$$

Hence, the required smallest number is 2 and square root of the number so, obtained is 54.

2	1458
3	729
3	243
3	81
3	27
3	9
3	3
3	1

4. $4418 = 2 \times 47 \times 47$

Since, prime factor 2 is not making a pair,

So, we have to multiply 4418 by 2 to make it a perfect square.

So, $4418 \times 2 = 8836$

$$\sqrt{8836} = \sqrt{2 \times 2 \times 47 \times 47}$$

$$= 2 \times 47 = 94$$

Hence, the required smallest number is 2 and square root of the number so obtained is 94.

2	4418
47	2209
47	47
	1

5. $2800 = 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 7$

Since, prime factor 7 is not making a pair. So, we have to divide 2800 by 7 to make it a perfect square

$$2800 \div 7 = 400$$

$$\text{So, } \sqrt{400} = \sqrt{2 \times 2 \times 5 \times 5 \times 2 \times 2}$$

$$= 2 \times 5 \times 2 = 20$$

Here, 2800 must be divided by 7 to make it a perfect square and square root of the number so obtained is 20.

2	2800
2	1400
2	700
2	350
5	175
5	35
7	7
	1

6. $4802 = 2 \times 7 \times 7 \times 7 \times 7$

Since, prime factor 2 is not making a pair, So we have to divide 4802 by 2 to make it a perfect square.

$$4802 \div 2 = 2401$$

$$\begin{aligned}\sqrt{2401} &= \sqrt{7 \times 7 \times 7 \times 7} \\ &= 7 \times 7 = 49\end{aligned}$$

2	4802
7	2401
7	343
7	49
7	7
	1

Here, 2401 must be divided by 2 to make it a perfect square and square root of the number so obtain is 49.

7. Let we find the LCM of 7, 21, 28 and 56

$$\text{LCM} = 7 \times 2 \times 2 \times 3 \times 2 = 336$$

Here, 3 and 7 are not making pairs, So 336 is not a perfect square therefore, 336 is multiplied by 3 and 7 to making a perfect square.

$$\text{Hence, the required number} = 84 \times 3 \times 7 = 7056$$

7	7, 21, 28, 56
2	1, 3, 4, 8
2	1, 3, 2, 4
	1, 3, 1, 2

8. Let we find the LCM of 10, 15, 25 and 35

$$= 5 \times 2 \times 3 \times 5 \times 7 = 1050$$

Here, 2, 3 and 7 are not making pairs, So, it is not a perfect square. Therefore, it is multiplied by 2, 3 and 7 to make it a perfect square.

$$\text{Hence, the required number} = 1050 \times 2 \times 3 \times 7 = 44100$$

5	10, 15, 25, 35
	2, 3, 5, 7

9. Let the number of rows be x.

So, number of students in each row be x.

$$\text{So, } x \times x = 4225$$

$$x^2 = 4225$$

$$x = \sqrt{4225}$$

$$x = \sqrt{5 \times 5 \times 13 \times 13}$$

$$= 5 \times 13 = 65$$

5	4225
5	845
13	169
13	13
	1

Hence, number of rows is 65 and number of students in each row is 65.

SEL Helping

10. Let the number of families be x .

$$x \times x = 50625$$

$$x^2 = 50625$$

$$x = \sqrt{50625}$$

$$x = \sqrt{5 \times 5 \times 5 \times 5 \times 3 \times 3 \times 3 \times 3}$$

$$= 5 \times 5 \times 3 \times 3$$

$$= 25 \times 9 = 225$$

Hence, the amount and the number of families is 225.

Critical Thinking Skills

$$\sqrt{69 + \sqrt{130 + \sqrt{176 + \sqrt{400}}}}$$

$$= \sqrt{69 + \sqrt{130 + \sqrt{176 + 20}}} = \sqrt{69 + \sqrt{130 + \sqrt{196}}}$$

$$= \sqrt{69 + \sqrt{130 + 14}} = \sqrt{69 + \sqrt{144}}$$

$$= \sqrt{69 + 12} = \sqrt{81} = 9$$

Assessment Time 5.3

1. a. 5776

	76
7	57 76
+7	-49
146	8 76
+6	-8 76
	0

Hence, $\sqrt{5776} = 76$

b. 7921

	89
8	79 21
+8	-64
169	15 21
+9	-15 21
	0

Hence, $\sqrt{7921} = 89$

c. 49284

	222
2	04 92 84
+2	-04
42	0 92
+2	- 84
442	8 84
+2	-8 84
	0

Hence, $\sqrt{49284} = 222$

d. 290521

	539
5	29 05 21
+5	-25
103	4 05
+3	- 3 09
1069	96 21
+9	-96 21
	0

Hence, $\sqrt{290521} = 539$

e. 133225

	365
3	<u>13 32 25</u>
+3	-9
66	4 32
+6	-3 96
725	36 25
+5	-36 25
	0

Hence, $\sqrt{133225} = 365$

f. 9126441

	3021
3	<u>09 12 64 41</u>
+3	-9
60	0 12
+0	-00
602	12 64
+2	-12 04
6041	60 41
+1	-60 41
	0

Hence, $\sqrt{9126441} = 3021$

g. 431649

	657
6	<u>43 16 49</u>
+6	-36
125	7 16
+5	-6 25
1307	91 49
+7	-91 49
	0

Hence, $\sqrt{431649} = 657$

h. 12581209

	3547
3	<u>12 58 12 09</u>
+3	-9
65	3 58
+5	-3 25
704	33 12
+4	-28 16
7087	4 96 09
+7	-4 96 09
	0

Hence, $\sqrt{12581209} = 3547$

2. 2316

	48
4	<u>23 16</u>
+4	-16
88	7 16
+8	-7 04
	12

The remainder is 12. So, 12 must be subtracted from 2316 to make it perfect square.

Hence, the least required number is 12.

3. 4537

$$\begin{array}{r|l}
 & 67 \\
 6 & \overline{45\ 37} \\
 +6 & -36 \\
 \hline
 127 & 9\ 37 \\
 +7 & -8\ 89 \\
 \hline
 & 48
 \end{array}$$

The remainder is 48. So, 48 must be subtracted from 4537 to make it perfect square.
Hence, the least required number is 48.

4. 2596

$$\begin{array}{r|l}
 & 50 \\
 5 & \overline{25\ 96} \\
 +5 & -25 \\
 \hline
 100 & 0\ 96
 \end{array}$$

So, 2596 is greater than $(50)^2$ and the next square is $(51)^2$ or 2601
So, the least number should be added
 $2601 - 2596 = 5$

5. 8963

$$\begin{array}{r|l}
 & 94 \\
 9 & \overline{89\ 63} \\
 +9 & -81 \\
 \hline
 184 & 8\ 63 \\
 +4 & -7\ 36 \\
 \hline
 & 1\ 27
 \end{array}$$

So, 8963 is greater than $(94)^2$ and the next square is $(95)^2$ or 9025
So, the least number should be added
 $9025 - 8963 = 62$

6. The greatest number of five digit is 99999. First we will find the square root of it.

$$\begin{array}{r|l}
 & 316 \\
 3 & \overline{09\ 99\ 99} \\
 +3 & -9 \\
 \hline
 61 & 0\ 99 \\
 +1 & -61 \\
 \hline
 626 & 38\ 99 \\
 +6 & -37\ 56 \\
 \hline
 & 1\ 43
 \end{array}$$

So, the greatest number of five digits which is a perfect square
 $= 99999 - 143 = 99856$

Hence, 99856 is the greatest number of five digits which is the perfect square.

7. The greatest number of seven digit is 9999999. First we will find the square root.

	3162
3	$\overline{09\ 99\ 99\ 99}$
+3	-9
61	0 99
+1	- 61
626	38 99
+6	-37 56
6322	1 43 99
+2	- 1 26 44
	17 55

So, the greatest number of seven digits which is the perfect square = $9999999 - 1755 = 9998244$

Hence, 99,98,244 is the greatest number of seven digits which is the perfect square.

8. The least number of four digit is 1000. If we subtract 39 from 1000, it will form a 4-digit number.

$$(31)^2 < 1000 < (32)^2$$

So, the least number of four digit which is a perfect square = $(32)^2 = 1024$

Hence, the required number is 1024.

	31
3	$\overline{10\ 00}$
+3	-9
61	1 00
+1	- 61
	39

9. The least number of eight digit is 10000000

If we subtract 1756 from a 10000000, it will form a 7 digits number.

$$(3162)^2 < 10000000 < (3163)^2$$

So, the least number of eight digit which is a perfect square = $(3163)^2$
 $= 1,00,04,569$

	3162
3	$\overline{10\ 00\ 00\ 00}$
+3	-9
61	1 00
+1	- 61
626	39 00
+6	-37 56
6322	1 44 00
+2	- 1 26 44
	17 56

SDG-Climate

$$\begin{array}{r|l}
 & 37 \\
 \hline
 3 & \overline{14\ 37} \\
 +3 & -9 \\
 \hline
 67 & 5\ 37 \\
 +7 & -4\ 69 \\
 \hline
 & 68
 \end{array}$$

$$\begin{aligned}
 \text{More plants needed} &= 38^2 - 1437 \\
 &= 1444 - 1437 = 7
 \end{aligned}$$

Assessment Time 5.4

1. a. 12.0409

$$\begin{array}{r|l}
 & 3.47 \\
 \hline
 3 & \overline{12.04\ 09} \\
 +3 & -9 \\
 \hline
 64 & 3.04 \\
 +4 & -2.56 \\
 \hline
 687 & 48\ 09 \\
 +7 & -48\ 09 \\
 \hline
 & 0
 \end{array}$$

Hence, $\sqrt{12.009} = 3.47$

b. 9.3025

$$\begin{array}{r|l}
 & 3.05 \\
 \hline
 3 & \overline{09.30\ 25} \\
 +3 & -9 \\
 \hline
 60 & 0.30 \\
 +0 & -0 \\
 \hline
 605 & 30\ 25 \\
 +5 & -30\ 25 \\
 \hline
 & 0
 \end{array}$$

Hence, $\sqrt{9.3025} = 3.05$

c. 84.8241

$$\begin{array}{r|l}
 & 9.21 \\
 \hline
 9 & \overline{84.82\ 41} \\
 +9 & -81 \\
 \hline
 182 & 3.82 \\
 +2 & -3.64 \\
 \hline
 1841 & 18\ 41 \\
 +1 & -18\ 41 \\
 \hline
 & 0
 \end{array}$$

Hence, $\sqrt{84.8241} = 9.21$

d. 0.374544

$$\begin{array}{r|l}
 & 0.612 \\
 \hline
 6 & \overline{0\ 37\ 45\ 44} \\
 +6 & -36 \\
 \hline
 121 & 1\ 45 \\
 +1 & -1.21 \\
 \hline
 1222 & 24\ 44 \\
 +2 & -24\ 44 \\
 \hline
 & 0
 \end{array}$$

Hence, $\sqrt{0.374544} = 0.612$

e. 554.1316

	23.54
2	<u>05 54.13 16</u>
+2	-4
43	1 54
+3	-1 29
465	25 13
+5	-23 25
4704	1 88 16
+4	- 1 88 16
	0

Hence, $\sqrt{554.1316} = 23.54$

g. 4274.5444

	65.38
6	<u>42 74.54 44</u>
+6	-36
125	6 74
+5	-6 25
1303	49 54
+3	-39 09
13068	10 45 44
+8	- 10 45 44
	0

Hence, $\sqrt{4274.5444} = 65.38$

2. a. 2000000

	1.414
1	<u>02 00 00 00</u>
+1	-1
24	1 00
+4	-96
281	4 00
+1	-2 81
2824	1 19 00
+4	- 1 12 96
	7 04 00

f. 8489.7796

	92.14
9	<u>84 89.77 96</u>
+9	-81
182	3 89
+2	-3 64
1841	25 77
1	-18 41
18424	7 36 96
+4	- 7 36 96
	0

Hence, $\sqrt{8489.7796} = 92.14$

h. 994.7716

	31.54
3	<u>09 94.77 16</u>
+3	-9
61	0 94
+1	-61
625	33 77
+5	-31 25
6304	2 52 16
+4	- 2 52 16
	0

Hence, $\sqrt{994.7716} = 31.54$

b. 5000000

	2.236
2	<u>05 00 00 00</u>
+2	-4
42	1 00
+2	-84
443	16 00
+3	-13 29
4466	2 71 00
+6	- 2 67 96
	4 04

Hence, $\sqrt{2000000} = 1.414$

Hence, $\sqrt{5000000} = 2.236$

c. 3.600000

d. 4.3

	1.897
1	<u>03.60 00 00</u>
+1	-1
28	2 60
+8	-2 24
369	36 00
+9	-33 21
3787	2 79 00
+7	- 2 65 09
	13 91

	2.073
2	<u>04.30 00 00</u>
+2	-4
40	0 30
+0	-0
407	30 00
+7	-28 49
414	1 51 00
+3	- 1 24 29
	26 71

Hence, $\sqrt{3.6} = 1.897$

Hence, $\sqrt{4.3} = 2.073$

3. a. $\sqrt{\frac{1369}{1849}}$

	37
3	<u>13 69</u>
+3	-9
67	4 69
+7	-4 69
	0

	43
4	<u>18 49</u>
+4	-16
83	2 49
+3	-2 49
	0

$$\sqrt{\frac{1369}{1849}} = \frac{37}{43}$$

b. $\sqrt{23\frac{394}{729}} = \sqrt{\frac{17161}{729}}$

	131
1	<u>01 71 61</u>
+1	-1
23	0 71
+3	-69
261	2 61
+1	-2 61
	0

	27
2	<u>7 29</u>
+2	-4
47	3 29
+7	-3 29
	0

$$\sqrt{\frac{17161}{729}} = \frac{131}{27} = 4\frac{23}{27}$$

c. $\sqrt{56\frac{569}{1225}} = \sqrt{\frac{69169}{1225}}$

	263	
2	<u>06 91 69</u>	
+2	-4	
46	<u>2 91</u>	
+6	-2 76	
523	<u>15 69</u>	
+3	-15 69	
	0	

	25	
3	<u>12 25</u>	
+3	-9	
65	<u>3 25</u>	
+5	-3 25	
	0	

$$\sqrt{\frac{69169}{1225}} = \frac{263}{35} = 7\frac{18}{35}$$

d. $\sqrt{21\frac{2797}{3364}} = \sqrt{\frac{53441}{3364}}$

	271	
2	<u>07 34 41</u>	
+2	-4	
47	<u>3 34</u>	
+7	-3 29	
541	<u>5 41</u>	
+1	-5 41	
	0	

	58	
5	<u>33 64</u>	
+5	-25	
108	<u>8 64</u>	
+8	-8 64	
	0	

$$\sqrt{\frac{53441}{3364}} = \frac{271}{58} = 4\frac{39}{58}$$

4. a. $\sqrt{396} \times \sqrt{99}$

$$= \sqrt{396 \times 99}$$

$$= \sqrt{\underline{3 \times 3} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{11 \times 11}}$$

$$= 3 \times 2 \times 3 \times 11$$

$$= 198$$

3	369	3	99
3	132	3	33
2	44	11	11
2	22		1
11	11		
	1		

$$\begin{aligned}
 \text{b. } & \sqrt{243} \times \sqrt{147} \\
 &= \sqrt{243 \times 147} \\
 &= \sqrt{\underline{3 \times 3 \times 3 \times 3 \times 3} \times \underline{3 \times 3 \times 7 \times 7}} \\
 &= 3 \times 3 \times 3 \times 7 \\
 &= 27 \times 7 = 189
 \end{aligned}$$

$$\begin{array}{r|l}
 3 & 243 \\
 \hline
 3 & 81 \\
 \hline
 3 & 27 \\
 \hline
 3 & 9 \\
 \hline
 3 & 3 \\
 \hline
 & 1
 \end{array}
 \quad
 \begin{array}{r|l}
 3 & 147 \\
 \hline
 7 & 49 \\
 \hline
 7 & 7 \\
 \hline
 & 1
 \end{array}$$

$$\begin{aligned}
 \text{c. } & \sqrt{729} \times \sqrt{169} \\
 &= \sqrt{\underline{3 \times 3 \times 3 \times 3 \times 3} \times \underline{13 \times 13}} \\
 &= 3 \times 3 \times 3 \times 13 \\
 &= 27 \times 13 = 351
 \end{aligned}$$

$$\begin{array}{r|l}
 3 & 729 \\
 \hline
 3 & 243 \\
 \hline
 3 & 81 \\
 \hline
 3 & 27 \\
 \hline
 3 & 9 \\
 \hline
 3 & 3 \\
 \hline
 & 1
 \end{array}
 \quad
 \begin{array}{r|l}
 13 & 169 \\
 \hline
 13 & 13 \\
 \hline
 & 1
 \end{array}$$

$$\begin{aligned}
 \text{d. } & \sqrt{162} \times \sqrt{128} \\
 &= \sqrt{162 \times 128} \\
 &= \sqrt{\underline{2 \times 3 \times 3 \times 3 \times 3 \times 2 \times 2 \times 2} \times \underline{2 \times 2 \times 2 \times 2 \times 2}} \\
 &= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \\
 &= 144
 \end{aligned}$$

$$\begin{array}{r|l}
 2 & 162 \\
 \hline
 3 & 81 \\
 \hline
 3 & 27 \\
 \hline
 3 & 9 \\
 \hline
 3 & 3 \\
 \hline
 & 1
 \end{array}
 \quad
 \begin{array}{r|l}
 2 & 128 \\
 \hline
 2 & 64 \\
 \hline
 2 & 32 \\
 \hline
 2 & 16 \\
 \hline
 2 & 8 \\
 \hline
 2 & 4 \\
 \hline
 2 & 2 \\
 \hline
 & 1
 \end{array}$$

5. a.

$$\begin{array}{r|l}
 & 26.7 \\
 \hline
 2 & \overline{07 \ 12.89} \\
 +2 & -4 \\
 \hline
 46 & 3 \ 12 \\
 +6 & -2 \ 76 \\
 \hline
 527 & 36 \ 89 \\
 +7 & -36 \ 89 \\
 \hline
 & 0
 \end{array}$$

$$\begin{array}{r|l}
 & 2.9 \\
 \hline
 2 & \overline{08.41} \\
 +2 & -4 \\
 \hline
 49 & 4 \ 41 \\
 +9 & -4 \ 41 \\
 \hline
 & 0
 \end{array}$$

$$\begin{aligned}
 \therefore & \frac{\sqrt{712.89} + \sqrt{8.41}}{\sqrt{712.89} - \sqrt{8.41}} \\
 &= \frac{26.7 + 2.9}{26.7 - 2.9} = \frac{29.6}{23.8} \\
 &= \frac{296}{238} = \frac{148}{119}
 \end{aligned}$$

b.

$$\begin{array}{r|l}
 & 24.6 \\
 \hline
 2 & \overline{06\ 05.\overline{16}} \\
 +2 & -4 \\
 \hline
 44 & 2\ 05 \\
 +4 & -1\ 76 \\
 \hline
 486 & 29\ 16 \\
 +6 & -29\ 16 \\
 \hline
 & 0
 \end{array}$$

$$\begin{array}{r|l}
 & 4.6 \\
 \hline
 4 & \overline{21.\overline{16}} \\
 +4 & -16 \\
 \hline
 86 & 5\ 16 \\
 +6 & -5\ 16 \\
 \hline
 & 0
 \end{array}$$

$$\begin{aligned}
 \therefore \frac{\sqrt{605.16} - \sqrt{21.16}}{\sqrt{605.16} + \sqrt{21.16}} &= \frac{24.6 - 4.6}{24.6 + 4.6} \\
 &= \frac{20}{29.2} = \frac{200}{292} = \frac{50}{73}
 \end{aligned}$$

6. Let decimal fraction be x

$$\text{So, } x \times x = 0.00130321$$

$$x^2 = 0.00130321$$

$$x = \sqrt{0.00130321}$$

$$= 0.0361$$

$$\begin{array}{r|l}
 & 0.0361 \\
 \hline
 3 & \overline{00.00\ 13\ 03\ 21} \\
 +3 & -9 \\
 \hline
 66 & 4\ 03 \\
 +6 & -3\ 96 \\
 \hline
 721 & 7\ 21 \\
 +1 & -7\ 21 \\
 \hline
 & 0
 \end{array}$$

7. Let decimal fraction be x

$$\text{So, } x \times x = 0.431649$$

$$x^2 = 0.431649$$

$$x = \sqrt{0.431649}$$

$$= 0.657$$

$$\begin{array}{r|l}
 & 0.657 \\
 \hline
 6 & \overline{0.43\ 16\ 49} \\
 +6 & -36 \\
 \hline
 125 & 7\ 16 \\
 +5 & -6\ 25 \\
 \hline
 1307 & 91\ 49 \\
 +7 & -91\ 49 \\
 \hline
 & 0
 \end{array}$$

8. Let decimal fraction be x .

$$\text{So, } x \times x = 13.476241$$

$$x^2 = 13.476241$$

$$x = \sqrt{13.476241}$$

$$= 3.671$$

$$\begin{array}{r|l}
 & 3.671 \\
 \hline
 3 & \overline{13.47\ 62\ 41} \\
 +3 & -9 \\
 \hline
 66 & 4\ 47 \\
 +6 & -3\ 96 \\
 \hline
 727 & 51\ 62 \\
 +7 & -50\ 89 \\
 \hline
 7341 & 0\ 73\ 41 \\
 +1 & -73\ 41 \\
 \hline
 & 0
 \end{array}$$

Critical Thinking Skills

$$\sqrt{0.053361} = 0.231$$

$$\begin{aligned}\text{So, } \sqrt{5.3361} + \sqrt{533.61} \\ = 2.31 + 23.1 = 25.41\end{aligned}$$

	0.231
2	<u>0.05 33 61</u>
+2	-4
43	1 33
+3	-1 29
461	4 61
+1	-4 61
	0

Assessment Time 5.5

1. Area of square park = 4225 m²

$$\text{Side}^2 = 4225 \text{ m}^2$$

$$\text{Side} = \sqrt{4225} = 65 \text{ m}$$

$$\text{Perimeter of square} = 4 \times \text{side}$$

$$= 4 \times 65 \text{ m} = 260 \text{ m}$$

Hence, the perimeter of square park is 260 m.

	65
6	<u>42 25</u>
+6	-36
125	6 25
+5	-6 25
	0

2. Area of square park = 33124 m²

$$\text{Side}^2 = 33124 \text{ m}^2$$

$$\text{Side} = \sqrt{33124} = 182 \text{ m}$$

$$\text{Perimeter of square park} = 4 \times \text{side}$$

$$= 4 \times 182 = 728 \text{ m}$$

$$\text{Cost of fencing it} = ₹ (728 \times 4.85)$$

$$= ₹ 3530.80$$

	182
1	<u>03 31 24</u>
+1	-1
28	2 31
+8	-2 24
362	7 24
+2	-7 24
	0

3. Area of square park = $\frac{\text{Total cost}}{\text{per meter cost}}$
 $= ₹ \frac{962361}{2.25} = ₹ 427716 \text{ m}^2$

$$\text{So, area of the square field} = 427716$$

$$\text{Side}^2 = 427716$$

$$\text{Side} = \sqrt{427716} = 654 \text{ m}$$

$$\begin{array}{r|l}
 & 654 \\
 \hline
 6 & 42 \overline{77} \overline{16} \\
 +6 & -1 \\
 \hline
 125 & 6 \overline{77} \\
 +5 & -6 \overline{25} \\
 \hline
 1304 & 52 \overline{16} \\
 +4 & -52 \overline{16} \\
 \hline
 & 0
 \end{array}$$

Perimeter of square field = $4 \times \text{side}$

$$= 4 \times 654 = 2616 \text{ m}$$

4. Total cost of grassing = ₹ 144074.70

Cost of grassing per m^2 = ₹ 7.70

$$\begin{aligned}
 \text{Area of square field} &= \frac{\text{Total cost}}{\text{Per } \text{m}^2 \text{ cost}} \\
 &= \frac{144074.70}{2.70} = \frac{14407470}{270} \\
 &= 53361 \text{ m}^2
 \end{aligned}$$

Area of square field = 53361 m^2

$$\text{side}^2 = 53361 \text{ m}^2$$

$$\text{Side} = \sqrt{53361} = 231 \text{ m}$$

$$\begin{array}{r|l}
 & 231 \\
 \hline
 2 & 05 \overline{53} \overline{61} \\
 +2 & -4 \\
 \hline
 43 & 1 \overline{53} \\
 +3 & -1 \overline{29} \\
 \hline
 461 & 4 \overline{61} \\
 +61 & -4 \overline{61} \\
 \hline
 & 0
 \end{array}$$

Length of wire required to fencing four side

$$= 4 \times (\text{perimeter of the field})$$

$$= 4 \times (4 \times \text{length of the side})$$

$$= 4 \times (4 \times 231)$$

$$= 4 \times 924 = 3696 \text{ m}$$

So, the cost of wire = ₹ (3696×3.15) = ₹ 11642.40

Hence, the cost of wire is ₹ 11642.40

5. Area of the square park = 7225 m^2	85
Side ² = 7225 m^2	8 72 25
Side = $\sqrt{7225} \text{ m} = 85$	+8 -64
	165 8 25
	+5 -8 25
	0

Perimeter of the square = $4 \times \text{side}$

$= 4 \times 85 \text{ m} = 340 \text{ m}$

Distance covered in 1 round = perimeter of the park

Distance covered in 10 round = $(340 \times 10) = 3400 \text{ m}$

Speed = 15 km/hr

$= \frac{15 \times 1000}{60 \times 60} \text{ m/s}$

$= 4.17 \text{ m/s}$

Time = $\frac{\text{Distance}}{\text{Speed}}$

$= \frac{3400}{4.16} = \frac{340000}{416}$

$= 817.3 = 818 \text{ second}$

Since, 60 seconds = 1 minute

$818 \text{ second} = (817.3 \div 60) \text{ second}$

$= 13.6 \text{ minutes}$

Critical Thinking Skills

Let number of temples be x .

So, number of flowers in a temple = x

Total flowers, she needs = 144×25

So, $x \times x = 144 \times 25$

$x^2 = 144 \times 25$

$x = \sqrt{144 \times 25}$

$= 12 \times 5 = 60$

Hence, number of temples in the city is 60.

Revision Time

1. a. 342

Since, 342 is ends with 2. So, the ones place digit of its square should be end in 4.

b. 961

Since, 961 is ends with 1. So, the ones place digit of its square should be end in 1.

c. 843

Since, 843 is ends with 3. So, the ones place digit of its square should be end in 9.

d. 1967

Since, 1967 is ends with 7. So, the ones place digit of its square should be end in 9.

2. a. 3364

Since, 3364 is ends with 4. So, the ones place digit of the square root should be ends in 8.

b. 4225

Since, 4225 is ends with 5. So, the ones place digit of the square root should be ends in 5.

c. 4761

Since, 4761 is ends with 1. So, the ones place digit of the square root should be ends in 9.

d. 7744

Since, 7744 is ends with 4. So, the ones place digit of the square root should be ends in 8.

3. a. $29 = (20 + 9)^2$

$$= (20 + 9)(20 + 9)$$

$$= 20(20 + 9) + 9(20 + 9)$$

$$= 400 + 180 + 180 + 81 = 841$$

b. $43 = (40 + 3)^2$

$$= (40 + 3)(40 + 3)$$

$$= 40(40 + 3) + 3(40 + 3)$$

$$= 1600 + 120 + 120 + 9 = 1849$$

c. $64 = (60 + 4)^2$

$$= (60 + 4)(60 + 4)$$

$$= 60(60 + 4) + 4(60 + 4)$$

$$= 3600 + 240 + 240 + 16 = 4096$$

$$\begin{aligned}
 \text{d. } 92 &= (90 + 2)^2 \\
 &= (90 + 2)(90 + 2) \\
 &= 90(90 + 2) + 2(90 + 2) \\
 &= 8100 + 180 + 180 + 4 = 8464
 \end{aligned}$$

$$\begin{aligned}
 4. \text{ a. } 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 19 \\
 &= \text{Sum of first 9 odd number} = 9^2 \\
 &= 9 \times 9 = 81
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 19 + 21 + 23 \\
 &= \text{Sum of first 12 odd number} = 12^2 \\
 &= 12 \times 12 = 144
 \end{aligned}$$

$$5. \text{ a. } 66^2 - 65^2 = 2 \times 65 + 1 = 130 + 1 = 131$$

$$\text{b. } 78^2 - 77^2 = 2 \times 77 + 1 = 154 + 1 = 155$$

$$\text{c. } 84^2 - 83^2 = 2 \times 83 + 1 = 166 + 1 = 167$$

$$\text{d. } 94^2 - 93^2 = 2 \times 93 + 1 = 186 + 1 = 187$$

$$6. \text{ a. } 1225$$

$$\text{So, } 1225 = \overline{5 \times 5} \times \overline{7 \times 7}$$

Since, every prime number is in pair.

Hence, 1225 is a perfect square

5	1225
5	245
7	49
7	7
	1

$$\text{b. } 6362 = 2 \times 3181$$

Since, it has not pairs.

Hence it is not a perfect square.

2	6362
	3181

$$\text{c. } 4761 = \overline{3 \times 3} \times \overline{23 \times 23}$$

Since, every number is in pair.

Hence, 4761 is a perfect square.

3	4761
3	1587
23	529
23	23
	1

$$\text{d. } 7921 = \overline{89 \times 89}$$

Since, it is in pair.

Hence, 7921 is a perfect square.

89	7921
89	89
	1

7. a. 81

$$\begin{array}{lll}
 81 - 1 = 80, & 80 - 3 = 77, & 77 - 5 = 72, \\
 72 - 7 = 65, & 65 - 9 = 56, & 56 - 11 = 45, \\
 45 - 13 = 32, & 32 - 15 = 17, & 17 - 17 = 0
 \end{array}$$

Hence, we subtract 9 time to get 0. So, $\sqrt{81} = 9$

b. 100

$$\begin{array}{lll}
 100 - 1 = 99, & 99 - 3 = 96, & 96 - 5 = 91, \\
 91 - 7 = 84, & 84 - 9 = 75, & 75 - 11 = 64, \\
 64 - 13 = 51, & 51 - 15 = 36, & 36 - 17 = 19 \\
 19 - 19 = 0
 \end{array}$$

Hence, we subtract 10 time to get 0. So, $\sqrt{100} = 10$

c. 196

$$\begin{array}{lll}
 196 - 1 = 195, & 195 - 3 = 192, & 192 - 5 = 187, \\
 187 - 7 = 180, & 180 - 9 = 171, & 171 - 11 = 160, \\
 160 - 13 = 147, & 147 - 15 = 132, & 132 - 17 = 115, \\
 115 - 19 = 96, & 96 - 21 = 75, & 75 - 23 = 52, \\
 52 - 25 = 27, & 27 - 27 = 0
 \end{array}$$

Hence, we subtract 14 time to get 0. So, $\sqrt{196} = 14$

d. 225

$$\begin{array}{lll}
 225 - 1 = 224, & 224 - 3 = 221, & 221 - 5 = 216, \\
 216 - 7 = 209, & 209 - 9 = 200, & 200 - 11 = 189, \\
 189 - 13 = 176, & 176 - 15 = 161, & 161 - 17 = 144, \\
 144 - 19 = 125, & 125 - 21 = 104, & 104 - 23 = 81, \\
 81 - 25 = 56, & 56 - 27 = 29, & 29 - 29 = 0
 \end{array}$$

Hence, we subtract 15 time to get 0. So, $\sqrt{225} = 15$

8. a. 361

$$\begin{array}{l}
 361 = 19 \times 19 \\
 \sqrt{361} = \sqrt{19 \times 19} \\
 \sqrt{361} = 19
 \end{array}$$

$$\begin{array}{r|l}
 19 & 361 \\
 19 & 19 \\
 \hline
 & 1
 \end{array}$$

$$\begin{array}{r|l}
 2 & 576 \\
 2 & 288 \\
 2 & 144 \\
 2 & 72 \\
 2 & 36 \\
 2 & 18 \\
 3 & 9 \\
 3 & 3 \\
 \hline
 & 1
 \end{array}$$

b. 576

$$\begin{array}{l}
 576 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \\
 \sqrt{576} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3} \\
 \sqrt{576} = 2 \times 2 \times 2 \times 3 = 24
 \end{array}$$

c. 1444

$$1444 = 2 \times 2 \times 19 \times 19$$

$$\sqrt{1444} = \sqrt{2 \times 2 \times 19 \times 19}$$

$$= 2 \times 19 = 38$$

d. 5476

$$5476 = 2 \times 2 \times 37 \times 37$$

$$\sqrt{5476} = \sqrt{2 \times 2 \times 37 \times 37}$$

$$\sqrt{5476} = 2 \times 37 = 74$$

2	1444
2	722
19	361
19	19
	1

2	5476
2	2738
37	1369
37	37
	1

9. a. 9604

	98
9	<u>96 04</u>
+9	-81
188	15 04
+8	-15 04
	0

$$\sqrt{9604} = 98$$

b. 66564

	258
2	<u>06 65 64</u>
+2	-4
45	2 65
+5	-2 25
508	40 64
+8	-40 64
	0

$$\sqrt{66564} = 258$$

c. 2125764

	1458
1	<u>02 12 57 64</u>
+1	-1
24	1 12
+4	-96
285	16 57
+5	-14 25
2908	2 32 64
+8	-2 32 64
	0

$$\sqrt{2125764} = 1458$$

b. 6610041

	2571
2	<u>06 61 00 41</u>
+2	-4
45	2 61
+5	-2 25
507	36 00
+7	-35 49
5141	51 41
+1	-51 41
	0

$$\sqrt{6610041} = 2571$$

10. a. 10.4976

	3.24
3	<u>10.49 76</u>
+3	-9
62	1 49
+2	<u>-1 24</u>
644	25 76
+4	<u>-25 76</u>
	0

$$\sqrt{10.4976} = 3.24$$

b. 157.7536

	12.56
1	<u>01 57.75 36</u>
+1	-1
22	0 57
+2	<u>-44</u>
245	13 75
+5	<u>-12 25</u>
2506	1 50 36
+6	<u>-1 50 36</u>
	0

$$\sqrt{157.7536} = 12.56$$

c. 0.00054756

	0.0234
0	<u>00. 00 05 47 56</u>
+0	-00
02	0 05
+2	<u>-4</u>
43	1 47
+3	<u>-1 29</u>
464	18 56
+4	<u>-18 56</u>
	0

$$\sqrt{0.00054756} = 0.0234$$

d. 0.070225

	0.265
2	<u>0.07 02 25</u>
+2	-4
46	3 02
+6	<u>-2 76</u>
525	26 25
+5	<u>-26 25</u>
	0

$$\sqrt{0.070225} = 0.265$$

11. a. $\sqrt{\frac{5184}{4761}}$

$$\sqrt{\frac{5184}{4761}} = \frac{72}{69} = \frac{24}{23}$$

	72		69
7	<u>51 84</u>	6	<u>47 61</u>
+7	-49	+6	-36
142	2 84	129	11 61
+2	<u>-2 84</u>	+9	<u>-11 61</u>
	0		0

$$b. \sqrt{23 \frac{394}{729}} = \sqrt{\frac{17161}{729}}$$

$$\sqrt{\frac{17161}{729}} = \frac{131}{27} = 4 \frac{23}{27}$$

1	131	2	27
+1	01 71 61	+2	07 29
23	-1	47	-4
+3	0 71	+7	3 29
261	-69		-3 29
+1	2 61		0
	-2 61		
	0		

$$c. \sqrt{288} \times \sqrt{1250}$$

$$= \sqrt{288} \times \sqrt{1250} = \sqrt{255 \times 1250}$$

$$= \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5} \times \underline{5 \times 5}}$$

$$= 2 \times 2 \times 2 \times 3 \times 5 \times 5 = 600$$

2	288	2	1250
2	144	5	625
2	72	5	125
2	36	5	25
2	18	5	5
3	9		1
3	3		
	1		

12. a. 6

	2.45
2	06.00 00
+2	-4
44	2 00
+4	-1 76
485	24 00
+5	-24 25

$$\sqrt{6} = 2.45$$

12. b. 1.37

	1.17
1	01.37 00 00
+1	-1
21	0 37
+1	-21
227	16 00
+7	-15 89
	11 00

$$\sqrt{1.37} = 1.17$$

c. 0.216

	0.464
4	<u>00.21 60 00</u>
+4	-16
86	5 60
+6	-5 16
924	44 00
+4	-36 96
	7 04

$$\sqrt{0.216} = 0.464$$

d. 9.134

	3.022
3	<u>09.13 40</u>
+3	-9
60	0 13
+0	-00
602	13 40
+2	-12 04
6042	1 36 00
+2	-1 20 84
	15 16

$$\sqrt{9.134} = 3.022$$

$$13. 82140 = \overline{2 \times 2} \times 5 \times 3 \times \overline{37 \times 37}$$

Since, prime factor 5 and 3 is not making a pair.

So, 82140 must be divided by 15 to make it a perfect square

$$= 82140 \div 15 = 5476$$

$$\sqrt{5476} = \sqrt{\overline{2 \times 2} \times \overline{37 \times 37}}$$

$$= 2 \times 37 = 74$$

2	82140
2	41070
3	20535
5	6845
37	1369
37	37
	1

14. The remainder is 106. So, 106 must be subtracted from 2915 to make it a perfect square.

	53
5	<u>29 15</u>
+5	-25
103	4 15
+3	-3 09
	1 06

15. So, 8496 is greater than $(92)^2$ and the next perfect square is $(93)^2$ or 8649.

So, the least number should be added

$$= 8649 - 8496 = 153$$

Hence, 153 should be added to 8496 to make it a perfect square.

	53
9	<u>84 96</u>
+9	-81
183	3 96
+3	-3 64
	32

16. First we find LCM of 8, 24, 30 and 45

So, $\text{LCM} = 2 \times 2 \times 2 \times 3 \times 3 \times 5$

Here, 2 and 5 are not making pairs.

Hence the required number

$$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5$$

$$= 3600$$

2	8, 24, 30, 45
2	4, 12, 15, 45
2	2, 6, 15, 45
3	1, 3, 15, 45
3	1, 1, 5, 15
5	1, 1, 5, 5
	1, 1, 1, 1

17. Let number of soldier be x .

Let rows of soldier be x .

$$\text{So, } x \times x = 4356$$

$$x^2 = 4356$$

$$x = \sqrt{4356}$$

$$x = \sqrt{2 \times 2 \times 3 \times 3 \times 11 \times 11}$$

$$= 2 \times 3 \times 11 = 66$$

Hence, number of rows is 66 and number of soldier in each is 66.

2	4356
2	2178
3	1089
3	363
11	121
11	11
	1

18. Let the decimal fraction be x .

$$x \times x = 0.00016129$$

$$x^2 = 0.00016129$$

$$x = \sqrt{0.00016129}$$

$$= 0.0127$$

Hence, the required decimal fraction is 0.0127.

	0.0237
0	00. 00 01 61 29
+0	-00
01	0 01
+1	-1
23	0 61
+3	-22
467	17 29
+7	-17 29
	0

19. Let the side of square be x .

Area of square = Area of rectangular field.

$$(\text{Side})^2 = \text{Length} \times \text{breadth}$$

$$(\text{Side})^2 = 72 \times 32$$

$$= 2304$$

$$\text{Side} = \sqrt{2304}$$

$$= 48 \text{ m}$$

	48
4	23 04
+4	-16
88	7 04
+8	-7 04
	0

20. Total cost of grassing = ₹ 22620.16

Cost of grassing per $\text{m}^2 = 2.56$ per m^2

Area of the square = ₹ $\frac{22620.16}{2.56}$

$$= 8836$$

Area of square field = 8836

$$(\text{Side})^2 = 8836$$

$$\text{Side} = \sqrt{8836}$$

$$= 94 \text{ m}$$

Length of the wire required to fence two side

$$= 2 \times (\text{perimeter of field})$$

$$= 2 \times (4 \times 94) \text{ m}$$

$$= 8 \times 94 \text{ m} = 752 \text{ m}$$

So, the cost of wire = ₹ $(752 \times 4.95) = ₹ 3722.40$

	94
9	88 36
+9	-81
184	7 36
+4	-7 36
	0

Mental Zone

1. $(43)^2 = (40 + 3)^2$

$$= 40^2 + 2 \times 40 \times 3 + 3^2$$

$$= 1600 + 240 + 9$$

$$= 1849$$

2. 19

3. $\sqrt{24 + \sqrt{144}} = \sqrt{24 + 12} = \sqrt{36} = 6$

4. $\sqrt{1\frac{9}{16}} = \sqrt{\frac{25}{16}} = \frac{5}{4}$

5. $\sqrt{16.36}$

$$\sqrt{16.36} = 4.04$$

	4.04
4	16.36
+4	-16
80	0 36
+0	-0
804	36 00
+4	32 16
	3 84

Multiple Choice Questions

1. (c)

2. (d)

3. (c)

4. (c)

5. (c)

6. (b)

7. (a)

CHAPTER-6 : CUBE AND CUBE ROOTS

Assessment Time 6.1

1. a. $6^3 = 6 \times 6 \times 6 = 216$
Sum of first 6 odd number = $31 + 33 + 35 + 37 + 39 + 41 = 216$
- b. $8^3 = 512 = 57 + 59 + 61 + 63 + 65 + 67 + 69 + 71$
- c. $10^3 = 1000 = 91 + 93 + 95 + 97 + 99 + 101 + 103 + 105 + 107 + 109$
- d. $13^3 = 157 + 159 + 161 + 163 + 165 + 167 + 169 + 171 + 173 + 175 + 177 + 179 + 181 = 2197$
2. a. $6^3 - 5^3$

$$(m + 1)^3 - m^3 = 1 + (m + 1) \times m \times 3$$

$$= 1 + 6 \times 5 \times 3$$

$$= 1 + 90 = 91$$
- b. $8^3 - 7^3$

$$= 1 + 8 \times 7 \times 3$$

$$= 1 + 168 = 169$$
- c. $12^3 - 11^3$

$$= 1 + 12 \times 11 \times 3$$

$$= 1 + 132 \times 3$$

$$= 1 + 396 = 397$$
- d. $15^3 - 14^3$

$$= 1 + 15 \times 14 \times 3$$

$$= 1 + 630 = 631$$
3. a. $\left(\frac{-2}{5}\right)^3 = \left(\frac{-2}{5}\right) \times \left(\frac{-2}{5}\right) \times \left(\frac{-2}{5}\right)$

$$= \frac{-8}{125}$$
- b. $\left(\frac{5}{12}\right)^3 = \frac{5}{12} \times \frac{5}{12} \times \frac{5}{12} = \frac{125}{1728}$
- c. $\left(\frac{6}{13}\right)^3 = \frac{6}{13} \times \frac{6}{13} \times \frac{6}{13} = \frac{216}{2197}$
- d. $\left(\frac{9}{-17}\right)^3 = \left(\frac{9}{-17}\right) \times \left(\frac{9}{-17}\right) \times \left(\frac{9}{-17}\right) = \frac{-729}{4913}$

4. a. 2744

$$2744 = \overline{2 \times 2 \times 2} \times \overline{7 \times 7 \times 7}$$

Every factor is in the group of 3. So 2744 is a perfect cube.

2	2744
2	1372
2	686
7	343
7	49
7	7
	1

b. 15360

2	15360		2	120
2	7680		2	60
2	3840		2	30
2	1920		3	15
2	960		5	5
2	480			1
2	240			

$$15360 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times 2 \times 3 \times 5$$

Every number is not in group of three.

So, 15360 is not a perfect cube.

c. 32768

2	32768		2	256		2	4
2	16384		2	128		2	2
2	8192		2	64			1
2	4096		2	32			
2	2048		2	16			
2	1024		2	8			
2	512						

$$32768 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2}$$

Every number is in the group of three.

So, 32768 is a perfect cube

$$\begin{aligned} \text{d. } 3375 &= \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5} \\ &= 3 \times 5 = 15 \end{aligned}$$

Every number is in group of three.

So, 3375 is a perfect cube

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

e. 91125

3	91125	
3	30375	
3	10125	
5	3375	
5	675	
5	135	
		3
		27
		3
		9
		3
		3
		1

$$91125 = \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}$$

Every number is in the group of three.

So 91125 is a perfect cube.

f. 46656

3	46656	
3	15552	
3	5184	
2	1728	
2	864	
2	432	
2	216	
		2
		108
		2
		54
		3
		27
		3
		9
		3
		3
		1

$$46656 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

Every number is in group of three.

So, 46656 is a perfect cube.

g. 175616

2	175616		2	1372
2	87808		2	686
2	43904		7	343
2	21952		7	49
2	10976		7	7
2	5488			1
2	2744			

$$175616 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{7 \times 7 \times 7}$$

Every number is in the group of three.

So, 175616 is a perfect cube.

h. 27962

$$27962 = 2 \times 11 \times 31 \times 41$$

Every number is not in the group of three.

So, 27962 is not a perfect cube.

2	27962
11	13981
31	1271
41	41
	1

5. 46305

3	46305
3	15435
3	5145
5	1715
7	343
7	49
7	7
	1

Here, the prime factor of 5 is not in the group of three.

So, we need to more 5(25) to make it a perfect cube.

Hence, 46305 must be multiplied by 25 to make it a perfect cube.

6. 12348

$$12348 = 2 \times 2 \times 3 \times 3 \times \overline{7 \times 7 \times 7}$$

Hare, the prime factor 2 and 3 is not in the group of three. So, we need one more 2 and 3 to make it a perfect cube.

Hence, 12348 must be multiplied by $2 \times 3 = 6$ to make it a perfect cube.

2	12348
2	6174
3	3087
3	1029
7	343
7	49
7	7
	1

7. $128625 = \overline{5 \times 5 \times 5} \times 3 \times \overline{7 \times 7 \times 7}$

3	128625
5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

Prime factor 3 is not in the group of three.

So, 128625 must be divided by 3.

Hence, 128625 must be divided by 3 to make it a perfect cube.

8. 703040

2	703040		5	10985
2	351520		13	2197
2	175760		13	169
2	87880		13	13
2	43940			1
2	21970			

$703040 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times 2 \times 5 \times \overline{13 \times 13 \times 13}$

Prime factor 2 and 5 is not in the group of three.

So, 703040 must be divided by 10.

Hence, 703040 must be divided by 10 to make it a perfect cube.

Assessment Time 6.2

1. a. $5832 = \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}$

2	5832		3	27
2	2916		3	9
2	1458		3	3
3	729			1
3	243			
3	81			

$$\begin{aligned} \sqrt[3]{5832} &= \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}} \\ &= 2 \times 3 \times 3 = 18 \end{aligned}$$

b. 15625

5	15625		5	25
5	3125		5	5
5	625			1
5	125			

$$\begin{aligned}\sqrt[3]{15625} &= \sqrt[3]{\underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5}} \\ &= 5 \times 5 = 25\end{aligned}$$

c. 32768

2	32768		2	256		
2	16384		2	128		
2	8192		2	64		
2	4096		2	32		
2	2048		2	16		2
2	1024		2	8		2
2	512					1

$$\begin{aligned}32768 &= \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \\ \sqrt[3]{32768} &= \sqrt[3]{\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}} \\ &= 2 \times 2 \times 2 \times 2 \times 2 = 32\end{aligned}$$

d. 39304

$$39304 = 2 \times 2 \times 2 \times 17 \times 17 \times 17$$

$$\begin{aligned}\sqrt[3]{39304} &= \sqrt[3]{\underline{2 \times 2 \times 2} \times \underline{17 \times 17 \times 17}} \\ &= 2 \times 17 = 34\end{aligned}$$

2	39304
2	19652
2	9826
17	4913
17	289
17	17
	1

e. 27000

2	27000		5	125
2	13500		5	25
2	6750		5	5
3	3375			1
3	1125			
3	375			

$$27000 = \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}$$

$$\begin{aligned}\sqrt[3]{27000} &= \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}} \\ &= 2 \times 3 \times 5 = 30\end{aligned}$$

f. 74088

2	74088	→	3	1029
2	37044		7	343
2	18522		7	49
3	9261		7	7
3	3087			1

$$74088 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7$$

$$\begin{aligned}\sqrt[3]{74088} &= \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{7 \times 7 \times 7}} \\ &= 2 \times 3 \times 7 = 42\end{aligned}$$

g. 250047

3	250047	→	7	343
3	83349		7	49
3	27783		7	7
3	9261			1
3	3087			
3	1029			

$$250047 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7$$

$$\begin{aligned}\sqrt[3]{250047} &= \sqrt[3]{\overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3} \times \overline{7 \times 7 \times 7}} \\ &= 3 \times 3 \times 7 = 63\end{aligned}$$

h. 531441

3	531441	→	3	2187	→	3	27
3	177147		3	729		3	9
3	59049		3	243		3	3
3	19683		3	81			1
3	6561						

$$531441 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

$$\begin{aligned}\sqrt[3]{531441} &= \sqrt[3]{\overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}} \\ &= 3 \times 3 \times 3 \times 3 = 81\end{aligned}$$

2. a. $\sqrt[3]{32} \times \sqrt[3]{2000} = \sqrt[3]{32 \times 2000}$

2	32
2	16
2	8
2	4
2	2
	1

2	2000
2	1000
2	500
2	250
5	125

5	25
5	5
	1

$$= \sqrt[3]{\underbrace{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5}_{2 \times 2 \times 2 \times 5}} = 40$$

b. $\sqrt[3]{729} \times \sqrt[3]{8000} = \sqrt[3]{729 \times 8000}$

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	8000
2	4000
2	2000
2	1000
2	500
2	250

5	125
5	25
5	5
	1

$$= \sqrt[3]{\underbrace{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5}_{3 \times 3 \times 2 \times 2 \times 5}} = 180$$

c. $\sqrt[3]{432} \times \sqrt[3]{4000} = \sqrt[3]{432 \times 4000}$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

2	4000
2	2000
2	1000
2	500
2	250

5	125
5	25
5	5
	1

$$= \sqrt[3]{\underbrace{2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5}_{2 \times 2 \times 2 \times 3 \times 5}} = 120$$

3. a. $-35937 = -\sqrt[3]{35937}$

3	35937	}	11	121
3	11979		11	11
3	3993			1
11	1331			

Hence, $-\sqrt[3]{35937} = -\sqrt[3]{3 \times 3 \times 3 \times 11 \times 11 \times 11}$
 $= -3 \times 11 = -33$

b. $-74088 = -\sqrt[3]{74088}$

2	74088	}	7	343
2	37044		7	49
2	18522		7	7
3	9261			1
3	3087			
3	1029			

Hence, $-\sqrt[3]{74088} = -\sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7}$
 $= -2 \times 3 \times 7 = -42$

c. $\frac{-39304}{6859}$

2	39304	19	6859
2	19652	19	361
2	9826	19	19
17	4913		1
17	289		
17	17		
	1		

$-\sqrt[3]{\frac{39304}{6859}} = \frac{-\sqrt[3]{39304}}{\sqrt[3]{6859}}$
 $= \frac{-\sqrt[3]{2 \times 2 \times 2 \times 17 \times 17 \times 17}}{\sqrt[3]{19 \times 19 \times 19}}$
 $= \frac{-2 \times 17}{19} = \frac{-34}{19}$

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64

2	32
2	16
2	8
2	4
2	2
	1

7	117649
7	16807
7	2401
7	343
7	49
7	7
	1

4. a. 74.088

$$\sqrt[3]{74.088} = \sqrt[3]{\frac{74088}{1000}}$$

2	74088
2	37044
2	18522
3	9261
3	3087
3	1029

7	343
7	49
7	7
	1

2	1000
2	500
2	250
5	125
5	25
5	5
	1

Hence, $\sqrt[3]{74.088} = 4.2$

b. 32.768

$$\sqrt[3]{32.768} = \sqrt[3]{\frac{32768}{1000}}$$

2 32768	→	2 256		2 1000
2 16384		2 128		2 500
2 8192		2 64		2 250
2 4096		2 32	→	5 125
2 2048		2 16		5 25
2 1024		2 8	→	5 5
2 512				1 1

$$= \sqrt[3]{\frac{32768}{1000}}$$

$$= \sqrt[3]{\frac{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}{2 \times 2 \times 2 \times 5 \times 5 \times 5}}$$

$$= \frac{2 \times 2 \times 2 \times 2 \times 2}{2 \times 5} = \frac{32}{10} = 3.2$$

c. 46.656

$$\sqrt[3]{46.656} = \sqrt[3]{\frac{46656}{1000}}$$

2 46656	→	3 243		2 1000
2 23328		3 81		2 500
2 11664		3 27		2 250
2 5832		3 9		5 125
2 2916		3 3		5 25
2 1458			→	5 5
3 729				1 1

$$= \sqrt[3]{\frac{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}{2 \times 2 \times 2 \times 5 \times 5 \times 5}}$$

$$= \frac{2 \times 2 \times 3 \times 3}{2 \times 5} = \frac{36}{10} = 3.6$$

d. 274.625

$$\sqrt[3]{274.625} = \sqrt[3]{\frac{274625}{1000}}$$

5	274625
5	54925
5	10985
13	2197
13	169
13	13
	1

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$= \sqrt[3]{\frac{274625}{1000}}$$

$$= \frac{\sqrt[3]{5 \times 5 \times 5 \times 13 \times 13 \times 13}}{\sqrt[3]{2 \times 2 \times 2 \times 5 \times 5 \times 5}}$$

$$= \frac{5 \times 13}{2 \times 5} = \frac{65}{10} = 6.5$$

5. $\frac{\sqrt[3]{6859}}{\sqrt[3]{-4096}} = -\sqrt[3]{\frac{6859}{4096}}$

19	6859
19	361
19	19
	1

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64

2	32
2	16
2	8
2	4
2	2
	1

$$\begin{aligned}\frac{\sqrt[3]{6859}}{\sqrt[3]{-4096}} &= \frac{\sqrt[3]{19 \times 19 \times 19}}{-\sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}} \\ &= \frac{19}{-16} \text{ and } -\sqrt[3]{\frac{6859}{4096}} = \frac{-19}{16}\end{aligned}$$

6. 5832

2	5832			
2	2916	→	3	27
2	1458		3	9
3	729		3	3
3	243			1
3	81			

$$\begin{aligned}\sqrt[3]{5832} &= \sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3} \\ &= 2 \times 3 \times 3 = 18\end{aligned}$$

$$\begin{aligned}\text{Now, } \sqrt[3]{5.832} + \sqrt[3]{-0.005832} &= 1.8 + (-0.18) \\ &= 1.62\end{aligned}$$

Revision Time

1. a. $5^3 - 4^3$
 $= 1 + 5 \times 4 \times 3$
 $= 1 + 60 = 61$
- b. $7^3 - 6^3$
 $= 1 + 7 \times 6 \times 3$
 $= 1 + 126 = 127$
- c. $10^3 - 9^3$
 $= 1 + 10 \times 9 \times 3$
 $= 1 + 270 = 271$
- d. $13^2 - 12^2$
 $= 1 + 13 \times 12 \times 3$
 $= 1 + 468 = 469$
2. a. $\left(\frac{-3}{7}\right)^3 = \left(\frac{-3}{7}\right) \times \left(\frac{-3}{7}\right) \times \left(\frac{-3}{7}\right) = \frac{-27}{343}$
- b. $\left(\frac{2}{11}\right)^3 = \left(\frac{2}{11}\right) \times \left(\frac{2}{11}\right) \times \left(\frac{2}{11}\right) = \frac{8}{1331}$
- c. $\left(\frac{-8}{13}\right)^3 = \left(\frac{-8}{11}\right) \times \left(\frac{-8}{11}\right) \times \left(\frac{-8}{11}\right) = \frac{-512}{2197}$
- d. $\left(\frac{-11}{5}\right)^3 = \left(\frac{-11}{5}\right) \times \left(\frac{-11}{5}\right) \times \left(\frac{-11}{5}\right) = \frac{-1331}{125}$
3. a. 91125
 $91125 = \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}$

Since every number is in group of 3. So, 91125 is a perfect cube.

3	91125	→	3	375
3	30375		5	125
3	10125		5	25
3	3375		5	5
3	1125			1

b. 39304

$$39304 = \overline{2 \times 2 \times 2} \times \overline{17 \times 17 \times 17}$$

Since, every number is in group of 3.

So, 39304 is a perfect cube.

2	39304
2	19652
2	9826
17	4913
17	289
17	17
	1

c. 13720

$$13720 = \overline{2 \times 2 \times 2} \times 5 \times \overline{7 \times 7 \times 7}$$

Every number is not in the group of three.

So, 13720 is not a perfect cube.

2	13720
2	6860
2	3430
5	1715
7	343
7	49
7	7
	1

d. 157464

2	157464		3	243
2	78732		3	81
2	39366		3	27
3	19683		3	9
3	6561		3	3
3	2187			1
3	729			

$$157464 = \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}$$

Every number is in the group of 3.

So, 157464 is a perfect cube.

2	17576
2	8788
2	4394
13	2197
13	169
13	13
	1

4. a. 17576

$$\sqrt[3]{17576} = \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{13 \times 13 \times 13}}$$

$$= 2 \times 13 = 26$$

b. 46656

2	46656	→	3	243
2	23328		3	81
2	11664		3	27
2	5832		3	9
2	2916		3	3
2	1458			1
3	729			

$$\sqrt[3]{46656} = \sqrt[3]{\underbrace{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}} \\ = 2 \times 2 \times 3 \times 3 = 36$$

c. 262144

2	262144	→	2	1024	
2	131072		2	512	
2	65536		2	256	
2	32768		2	128	→
2	16384		2	64	2
2	8192		2	32	2
2	4096		2	16	2
2	2048				1

$$\sqrt[3]{262144} = \sqrt[3]{\underbrace{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2} \\ \times \underbrace{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}} \\ = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$$

d. 195112

$$\sqrt[3]{195112} = \sqrt[3]{\underbrace{2 \times 2 \times 2 \times 29 \times 29 \times 29}} \\ = 2 \times 29 = 58$$

2	195112
2	97556
2	48778
29	24389
29	841
29	29
	1

5. a. $\sqrt[3]{\frac{512}{729}} = \frac{\sqrt[3]{512}}{\sqrt[3]{729}}$

2	512
2	256
2	128
2	64
2	32

2	16
2	8
2	4
2	2
	1

3	729
3	243
3	81
3	27
3	9
3	3
	1

$$= \frac{\sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}}{\sqrt[3]{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}}$$

$$= \frac{2 \times 2 \times 2}{3 \times 3} = \frac{8}{9}$$

b. $\sqrt[3]{\frac{-1728}{2744}} = -\sqrt[3]{\frac{1728}{2744}}$

2	1728
2	864
2	432
2	216
2	108

2	54
3	27
3	9
3	3
	1

2	2744
2	1372
2	686
7	343
7	49
7	7
	1

$$= \frac{-\sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3}}{\sqrt[3]{2 \times 2 \times 2 \times 7 \times 7 \times 7}}$$

$$= -\frac{2 \times 2 \times 3}{2 \times 7} = \frac{-12}{14} = \frac{-6}{7}$$

c. $\sqrt[3]{\frac{3375}{5832}}$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27

3	9
3	3
	1

$$= \frac{\sqrt[3]{3 \times 3 \times 3 \times 5 \times 5 \times 5}}{\sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}} \\ = \frac{3 \times 5}{2 \times 3 \times 3} = \frac{15}{18} = \frac{5}{6}$$

d. $\sqrt[3]{\frac{-2197}{6859}} = \frac{-\sqrt[3]{2197}}{\sqrt[3]{6859}}$

13	2197
13	169
13	13
	1

19	6859
19	361
19	19
	1

$$= \frac{-\sqrt[3]{13 \times 13 \times 13}}{\sqrt[3]{19 \times 19 \times 19}} = \frac{-13}{19}$$

6. a. $3.375 = \sqrt[3]{3.375} = \sqrt[3]{\frac{3375}{1000}}$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$= \frac{\sqrt[3]{3 \times 3 \times 3 \times 5 \times 5 \times 5}}{\sqrt[3]{2 \times 2 \times 2 \times 5 \times 5 \times 5}} = \frac{3 \times 5}{2 \times 5} = \frac{15}{10} = 1.5$$

b. 19.683

$$\sqrt[3]{19.683} = \frac{\sqrt[3]{19683}}{\sqrt[3]{1000}}$$

3	19683
3	6561
3	2187
3	729
3	243

3	81
3	27
3	9
3	3
	1

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$= \frac{\sqrt[3]{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}}{\sqrt[3]{2 \times 2 \times 2 \times 5 \times 5 \times 5}}$$

$$= \frac{3 \times 3 \times 3}{2 \times 5} = \frac{27}{10} = 2.7$$

c. 39.304

$$\sqrt[3]{39.304} = \sqrt[3]{\frac{39304}{1000}} = \frac{\sqrt[3]{39304}}{\sqrt[3]{1000}}$$

2	39304
2	19652
2	9826
17	4913
17	289
17	17
	1

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$= \frac{\sqrt[3]{2 \times 2 \times 2 \times 17 \times 17 \times 17}}{\sqrt[3]{2 \times 2 \times 2 \times 5 \times 5 \times 5}} = \frac{2 \times 17}{2 \times 5} = \frac{34}{10} = 3.4$$

$$d. 1606.624 = \frac{1906624}{1000}$$

2	1906624
2	953312
2	476656
2	238328
2	119164
2	59582
31	29791

31	961
31	31
	1

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$\text{So, } \sqrt[3]{\frac{1906624}{1000}} = \frac{2 \times 2 \times 31}{10} = \frac{124}{10} = 12.4$$

$$7. 185200 = 2 \times 2 \times 5 \times \overline{3 \times 3 \times 3} \times \overline{7 \times 7 \times 7}$$

Hence, the prime factor 2 and 5 is not in group of three.

So, we need one more (2) and two more (5) to make it a perfect cube.

Hence, 185220 must be multiply by 50 to make it a perfect cube.

2	185220
2	92610
3	46305
3	15435
3	5145
5	1715
7	343
7	49
7	7
	1

$$8. 819200$$

2	819200
2	409600
2	204800
2	102400
2	51200
2	25600
2	12800

2	6400
2	3200
2	1600
2	800
2	400
2	200

2	100
2	50
5	25
5	5
	1

$$819200 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times 5 \times 5$$

Hence, the prime factor 5 is not in group of three.

So, we need one more 5 to make it a perfect cube.

Hence, 819200 must be divided by 25 to make it a perfect cube.

$$9. \frac{\sqrt[3]{-4096}}{\sqrt[3]{2197}} = \sqrt[3]{\frac{-4096}{2197}}$$

2	4096	→	2	32	13	2197
2	2048		2	16	13	169
2	1024		2	8	13	13
2	512		2	4		1
2	256		2	2		
2	128			1		
2	64					

$$\frac{\sqrt[3]{-4096}}{\sqrt[3]{2197}} = \frac{-2 \times 2 \times 2 \times 2}{13} = \frac{-16}{13}$$

$$\text{and } \sqrt[3]{\frac{-4096}{2197}} = \frac{-16}{13}$$

H.P.

$$10. \frac{\sqrt[3]{-5832}}{\sqrt[3]{-2744}} = \sqrt[3]{\frac{5832}{2744}}$$

2	5832	→	2	2744	2	2744
2	2916		3	81	2	1372
2	1458		3	27	2	686
3	729		3	9	7	343
3	243		3	3	7	49
3	81			1	7	7
					1	

$$\sqrt[3]{\frac{5832}{2744}} = \frac{-2 \times 3 \times 3}{-2 \times 7} = \frac{18}{14} = \frac{9}{7}$$

$$\text{and } \sqrt[3]{\frac{5832}{2744}} = \frac{18}{14} = \frac{9}{7}$$

H.P.**Mental Zone**

1. Even

2. odd

3. negative

4. 3

5. 11

Multiple Choice Questions

1. (b)

2. (b)

3. (a)

4. (a)

5. (d)

CHAPTER-7 : PERCENTAGE AND ITS APPLICATIONS

Assessment Time 7.1

1. Original salary = ₹ 25,000

New salary = ₹ 30,000

Increase in salary = ₹ (30,000 – 25,000) = ₹ 5,000

$$\begin{aligned}\text{Increase percentage} &= \left(\frac{\text{Increase in value}}{\text{Original value}} \right) \times 100 \\ &= \left(\frac{5,000}{25,000} \right) \times 100 = \frac{1}{5} \times 100 = 20\%\end{aligned}$$

Hence, increase percentage in salary is 20%

2. Original price = ₹ 22,000

New price = ₹ 18,000

Decrease in price = ₹ (22,000 – 18,000) = ₹ 4000

$$\begin{aligned}\text{Decrease percentage} &= \left(\frac{\text{Decrease in value}}{\text{Original value}} \right) \times 100 \\ &= \left(\frac{4,000}{22,000} \right) \times 100 = 18.18\%\end{aligned}$$

Hence, the decrease percentage in the price of LED TV is 18.18%

3. Price of motorcycle last year = ₹ 75,000

Increase in price = ₹ (8% of 75000)

$$= ₹ \left(\frac{8}{100} \times 75000 \right) = ₹ 6000$$

So, new price of motorcycle = ₹ (75000 + 6000)

$$= ₹ 81000$$

Hence, the new price of motorcycle is ₹ 81,000

4. Percentage of girls = 30%

Percentage of boys = (100-30)% = 70%

Let the total no. of student be x .

Number of boys = 560

70% of x = 560

$$x = \left(\frac{560 \times 100}{70} \right) = 800$$

Hence, the total number of student is 800.

Number of girls = 30% of 800

$$= \left(\frac{30}{100} \times 800 \right) = 240$$

Hence, the total number of girls is 240.

5. Let the money before spending be x .

$$\text{Left \%} = (100 - 70) = 30 \%$$

$$(30\% \text{ of } x) = ₹ 4800$$

$$\left(\frac{30}{100} \times x \right) = 4800$$

$$x = \left(\frac{4800 \times 100}{30} \right) = ₹ 16,000$$

6. Total weight of fruits = 300 kg

Weights of apples = 30% of 300

$$= \frac{30}{100} \times 300 = 90 \text{ kg}$$

$$\text{Weight of oranges} = \frac{20}{100} \times 300 = 60 \text{ kg}$$

$$\text{Weight of watermelon} = \frac{15}{100} \times 300 = 45 \text{ kg}$$

$$\begin{aligned} \text{Weight of pears} &= (300 \text{ kg} - 90 \text{ kg} - 60 \text{ kg} - 45 \text{ kg}) \\ &= 300 \text{ kg} - 195 \text{ kg} = 105 \text{ kg} \end{aligned}$$

Hence, the weight of oranges is 60 kg, watermelon is 45 kg, apples is 90 kg and pears is 105 kg.

7. Let the original quantity of mangoes be x .

$$(100 - 80)\% = 20\%$$

$$20\% \text{ of } x = 5 \text{ kg}$$

$$\frac{20}{100} \times x = 5$$

$$x = \frac{5 \times 100}{20} = \frac{500}{20} = 25 \text{ kg}$$

Hence, the original quantity of mangoes is 25 kg.

8. Drum contained oil = 80 L

$$\text{Oil after leaked} = (80 - 5) \text{ L} = 75 \text{ L}$$

$$\text{Percentage decrease} = \frac{\text{Decrease value}}{\text{Original value}} \times 100$$

$$= \left(\frac{75}{80} \times 100 \right) = \frac{750}{8} = 93.75\%$$

Hence, the percentage of oil remained in the drum is 93.75%.

9. Students weak in Maths = 40% of 60

$$= \frac{40}{100} \times 60 = 24 \text{ students}$$

Students good in Maths = $60 - 24 = 36$ students

Hence, 36 students are good in Maths.

SEL-Helping

10. Percentage of money left with Manoj = $(100 - 20 - 35 - 15)\%$
 $= (100 - 70)\% = 30\%$

Let monthly salary be x .

So, 30% of $x = ₹ 12,000$

$$\frac{30}{100} \times x = 12000$$

$$x = \frac{12000 \times 100}{30} = ₹ 40,000$$

Hence, his monthly salary is ₹ 40,000.

Critical Thinking Skills

Sides of rectangle are 30 cm and 20 cm

Side increase = 10% of 30

$$= 30 \times \frac{10}{100} = 3 \text{ cm}$$

New side (l) = $30 \text{ cm} + 3 \text{ cm} = 33 \text{ cm}$

Side increase (b) = 10% of 20

$$= \frac{10}{100} \times 20 = 2 \text{ cm}$$

New breadth = $20 + 2 = 22 \text{ cm}$

Original area = $30 \times 20 = 600 \text{ cm}^2$

New area = $33 \times 22 = 726 \text{ cm}^2$

Increase in area = $726 - 600 = 126 \text{ cm}^2$

$$\begin{aligned} \text{Percentage \%} &= \frac{126}{600} \times 100 \\ &= 21\% \end{aligned}$$

Assessment Time 7.2

1. a. Cost price b. Profit c. Loss
d. Transportation charge, repairing charge, labour charges.

2. Cost of a bike = ₹ 3,000

Money spent on accessories = ₹ 500

Total cost of a bike = ₹ (3,000 + 500)

= ₹ 3,500

Selling price of it = ₹ 5,000

Here, SP > CP, so there is a profit.

Profit (SP – CP) = ₹ (5,000 – 3,500) = ₹ 1,500

$$\begin{aligned}\text{Profit \%} &= \frac{\text{Profit}}{\text{CP}} \times 100 \\ &= \frac{1500}{3500} \times 100 = 42.85\%\end{aligned}$$

Hence, Manoj makes a profit of 42.85% on bike.

3. SP of chair = ₹ 432, Loss = 4%

$$\begin{aligned}\text{So, CP} &= \left(\frac{100}{100 - L\%} \right) \times \text{SP} \\ &= \left(\frac{100}{100 - 4} \right) \times 432 \\ &= \frac{100}{96} \times 432 \\ &= \frac{43200}{96} = 450\end{aligned}$$

$$\begin{aligned}\text{New SP of chair as to gain 15\%} &= \left(\frac{100 + p\%}{100} \right) \times \text{CP} \\ &= \left(\frac{100 + 15}{100} \right) \times 450 \\ &= \left(\frac{115}{100} \times 450 \right) \\ &= \left(\frac{115 \times 9}{2} \right) = 517.50\end{aligned}$$

Hence, he sells it for ₹ 517.50

4. SP of scooter = ₹ 2700, Loss = 10%

$$\text{CP} = \left(\frac{100}{100 - L\%} \right) \times \text{SP}$$

$$\begin{aligned}
 &= \left(\frac{100}{100 - 10} \right) \times 2700 = \left(\frac{100}{90} \times 2700 \right) \\
 &= 100 \times 30 = 3,000
 \end{aligned}$$

$$\begin{aligned}
 \text{New SP of hair as to gain 8\%} &= \left(\frac{100 + p\%}{100} \right) \times \text{CP} \\
 &= \left(\frac{100 + 8}{100} \right) \times 3000 \\
 &= \left(\frac{108}{100} \times 3000 \right) \\
 &= 108 \times 30 = 3240
 \end{aligned}$$

Hence, he sell the scooter for ₹ 3240.

5. Let CP of the toy car be ₹ x .

$$\begin{aligned}
 \text{SP of 16\% profit} &= \left(\frac{100 + 16}{100} \right) \times x \\
 &= ₹ \frac{116}{100} \times x \\
 \text{SP at 20\% profit} &= \left(\frac{100 + 20}{100} \right) \times x \\
 &= ₹ \frac{120x}{100}
 \end{aligned}$$

According to questions,

$$\begin{aligned}
 \frac{120x}{100} - \frac{116x}{100} &= 100 \\
 \frac{4x}{100} &= 100 \\
 x &= \frac{100 \times 100}{4} \\
 x &= ₹ 2500
 \end{aligned}$$

6. CP of one jeans = ₹ 500

$$\text{CP of 100 jeans} = ₹ (500 \times 100) = ₹ 50,000$$

$$\begin{aligned}
 \text{SP at 25\%} &= \left(\frac{100 + 25}{100} \right) \times 50,000 \\
 &= ₹ (125 \times 500) = ₹ 62,500
 \end{aligned}$$

$$\text{Selling price of 20 jeans} = ₹ (300 \times 20) = ₹ 6000$$

$$\therefore \text{SP of 80 jeans} = 62,500 - 6000 = ₹ 56,500$$

$$\therefore \text{Cost of 1 jeans} = ₹ \frac{56,500}{80} = ₹ 706.25$$

$$7. \text{ CP of 50 kg tea leaves at ₹ 150 per kg} = ₹ (50 \times 150) \\ = ₹ 7500$$

$$\text{CP of 50 kg tea leaves at ₹ 50 per kg} = ₹ (50 \times 50) \\ = ₹ 2500$$

$$\text{Total CP of 100 kg tea leaves} = ₹ (7500 + 2500) \\ = ₹ 10,000$$

$$\text{SP of 100 kg tea leaves} = ₹ (130 \times 100) \\ = ₹ 13,000$$

$$\text{So, Profit} = \text{SP} - \text{CP} \\ = ₹ (13000 - 10000) \\ = ₹ 3000$$

$$\text{P\%} = \frac{3000}{10000} \times 100 = 30\%$$

$$8. \text{ Let CP of one buffalo be ₹ } x.$$

$$\text{So, CP of other buffalo} = ₹ (80000 - x)$$

$$\text{SP at 20\% gain} = \text{SP at 20\% loss}$$

$$\left(\frac{100 + 20}{100} \right) \times x = \left(\frac{100 - 20}{100} \right) \times (80000 - x)$$

$$120x = 6400000 - 80x$$

$$200x = 6400000$$

$$x = \frac{6400000}{200} = 32000$$

$$\text{Hence, CP of one buffalo is ₹ 32,000 and CP of other buffalo is} \\ = ₹ 48,000$$

$$9. \text{ Cost price of 1 copy} = ₹ 1$$

$$\text{So, CP of 10 copies} = ₹ 10$$

$$\text{SP of 8 copies} = \text{CP of 10 copies} = ₹ 10$$

$$\text{SP of 1 copy} = ₹ \left(\frac{10}{8} \right) = ₹ \left(\frac{5}{4} \right)$$

$$\text{Profit} = \text{SP} - \text{CP} = ₹ \left(\frac{5}{4} - 1 \right)$$

$$= ₹ \left(\frac{5 - 4}{4} \right) = ₹ \frac{1}{4}$$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100 = \frac{1}{4} \times 100 = 25\%$$

$$\text{Hence, the profit on one copy is 25\%.$$

SDG-Good Health

10. Total books = 2,00,000

$$\begin{aligned} 20\% \text{ of } 2,00,000 &= \frac{20}{100} \times 200000 \\ &= 40,000 \end{aligned}$$

$$\begin{aligned} \text{Cost of } 40,000 \text{ books} &= 40,000 \times 60 \\ &= ₹ 24,00,000 \end{aligned}$$

$$\text{Profit on one book} = \frac{30}{100} \times 60 = ₹ 18$$

$$\begin{aligned} \text{Profit on } 1,60,000 \text{ books} &= ₹ (160000 \times 18) \\ &= ₹ 28,80,000 \end{aligned}$$

$$\text{Net profit} = ₹ (28,80,000 - 24,00,000) = ₹ 4,80,000$$

$$\begin{aligned} \text{Net p\%} &= \frac{480000}{\text{Total cost of } 20,000 \text{ books}} \times 100 \\ &= \frac{480000}{12000000} = 4\% \end{aligned}$$

Assessment Time 7.3

1. Market price of the shoes (MP) = ₹ 1,500

Selling price of the shoes (SP) = ₹ 1,200

Discount = MP - SP

$$= ₹ (1,500 - 1,200) = ₹ 300$$

$$\begin{aligned} \text{Discount \%} &= \frac{\text{Discount}}{\text{MP}} \times 100 \\ &= \frac{300}{1500} \times 100 = 20\% \end{aligned}$$

Hence, the discount is 20%

2. Market price of a desert cooler = ₹ 8,000, Discount = 15%

$$\begin{aligned} \text{SP} \times \text{MP} &= \left(1 - \frac{\text{D\%}}{100}\right) \times \text{MP} \\ &= \left(1 - \frac{15}{100}\right) \times 8,000 \\ &= 85 \times 80 = ₹ 6800 \end{aligned}$$

Hence, the selling price is ₹ 6,800.

3. Discount = 20%, SP = ₹ 1200

$$= \left(1 - \frac{\text{D\%}}{100}\right) \times \text{MP}$$

$$\begin{aligned}
 &= \left(\frac{SP \times 100}{1 - D\%} \right) = MP \\
 &= \left(\frac{1200 \times 100}{100 - 20} \right) = MP \\
 &= \frac{120000}{80} = MP
 \end{aligned}$$

$$MP = ₹ 1500$$

Hence, the marked price is ₹ 1500.

4. Let CP of 1 article = ₹ 100

$$\begin{aligned}
 MP &= ₹ (100 + 40\% \text{ of } 100) \\
 &= ₹ \left(100 + \frac{40}{100} \times 100 \right) \\
 &= ₹ (100 + 40) = ₹ 140
 \end{aligned}$$

Discount = 15%

$$\begin{aligned}
 SP &= \left(1 - \frac{D\%}{100} \right) \times MP \\
 &= ₹ \left(1 - \frac{15}{100} \right) \times 140 \\
 &= ₹ \left(\frac{100 - 15}{100} \right) \times 140 \\
 &= ₹ \left(\frac{85}{100} \times 140 \right) = ₹ \left(\frac{85}{5} \times 7 \right) \\
 &= ₹ (17 \times 7) = ₹ 119
 \end{aligned}$$

So,

$$\begin{aligned}
 \text{Profit} &= SP - CP \\
 &= ₹ (119 - 100) = ₹ 19
 \end{aligned}$$

$$\begin{aligned}
 \text{Profit \%} &= \frac{\text{Profit}}{CP} \times 100 \\
 &= ₹ \left(\frac{19}{100} \times 100 \right) \% = 19\%
 \end{aligned}$$

Hence, shopkeeper makes a profit of 19%.

5. Let MP of the almirah be x .

$$\begin{aligned}
 SP &= \left(\frac{100 - D\%}{100} \right) \times MP \\
 &= \left(\frac{100 - 10}{100} \right) \times x \\
 &= \frac{90}{100} x = ₹ \frac{9}{10} x
 \end{aligned}$$

$$\begin{aligned}
 SP &= \left(\frac{100 + p\%}{100} \right) \times CP \\
 ₹ \frac{9}{10}x &= ₹ \left(\frac{100 + 20}{100} \right) \times 900 \\
 ₹ \frac{9}{10}x &= ₹ \left(\frac{120}{100} \times 900 \right) \\
 ₹ \frac{9}{10}x &= ₹ 1080 \\
 x &= ₹ \frac{1080 \times 10}{9} = ₹ 1200
 \end{aligned}$$

6. 50% discount is better.

Let MP be ₹ 100

$$SP \text{ after 50\% discount} = \left(1 - \frac{50}{100} \right) \times 100 = ₹ 50$$

$$\begin{aligned}
 SP \text{ after 25\% and 25\% discount} &= \left(1 - \frac{25}{100} \right) \left(1 - \frac{25}{100} \right) \times 100 \\
 &= ₹ 56.25
 \end{aligned}$$

7. CP of a table = ₹ 3,000

$$\text{Sale tax 12\% on ₹ 3000} = ₹ \left(\frac{12}{100} \times 3,000 \right) = ₹ 360$$

$$\begin{aligned}
 \text{So, price of table after sale tax} &= ₹ (3,000 + 360) \\
 &= ₹ 3,360
 \end{aligned}$$

Hence, the price of a table inclusive sales tax is ₹ 3,360.

8. Sale tax of a cooler = ₹ (10,000 – 9,500) = ₹ 500

Let the rate of sale tax of a cooler be x .

$$₹ \left(\frac{x}{100} \times 9500 \right) = ₹ 500$$

$$x \times 95 = ₹ 500$$

$$95x = 500$$

$$x = \frac{500}{95} = \frac{100}{19} = 5.26\%$$

Hence, the rate of sale tax is 5.26%.

9. Cost of a microwave including GST = ₹ 15,400

Let the price of a microwave before GST be ₹ x .

$$x + 10\% \text{ of } x = ₹ 15,400$$

$$x + \frac{10}{100} \times x = ₹ 15,400$$

$$\frac{100x + 10x}{100} = 15,400$$

$$110x = 15400 \times 100$$

$$x = \frac{15400 \times 100}{110} = ₹ 14000$$

Hence, the cost of a microwave before GST is ₹ 14,000.

10. Cost of a motorcycle including GST = ₹ 70,000.

Let the price of a motorcycle before GST be ₹ x .

$$x + 12\% \text{ of } x = ₹ 70,000$$

$$x + \frac{12}{100} \times x = 70,000$$

$$\frac{100x + 12x}{100} = 70,000$$

$$112x = 70,000 \times 100$$

$$x = \frac{70,000 \times 100}{112} = ₹ 62500$$

Hence, the cost of a motorcycle before GST is ₹ 62,500.

Critical Thinking Skills

11. Let reduced price be ₹ x

$$x + 5\% \text{ of } x = 735$$

$$x + \frac{5}{100} \times x = 735$$

$$\frac{105x}{100} = 735$$

$$x = \frac{73500}{105} = ₹ 700$$

Hence, reduction in price ₹ 735 – ₹ 700 = ₹ 35

Revision Time

1. Original weight = 50 kg, New weight = 60 kg

Increase in weight = $(60 - 50)\text{kg} = 10 \text{ kg}$

$$\begin{aligned} \text{Increase percent} &= \left(\frac{\text{Increase in weight}}{\text{Original weight}} \right) \times 100 \\ &= \left(\frac{10}{50} \times 100 \right) = 20\% \end{aligned}$$

Hence, the percentage increase is 20%.

2. Price of microwave last year = ₹ 20,000

Decrease in price = (12% of ₹ 20,000)

$$= \frac{12}{100} \times 20,000 = ₹ 2,400$$

So, new price of the motorcycle = ₹ (20,000 – 2,400)
= ₹ 17,600

Hence, the new price of motorcycle is ₹ 17,600.

3. Present population = 50,000, Population increase = 8%

Increase in population = (8% of 50,000)

$$= \frac{8}{100} \times 50,000$$

$$= 500 \times 8 = 4,000$$

So, the population increase = (50,000 + 4,000)
= 54,000

Hence, the population after one year is 54,000.

4. Fruit seller bought fruit = 200 kg

Fruit rotten = 10% of 200 kg

$$= \left(\frac{10}{100} \times 200 \right) = 20 \text{ kg}$$

Fruits remained = (200 – 20) kg = 180 kg

Hence, 180 kg of fruits are remained.

5. CP of 1 articles = 15, CP of 13 articles = 15

SP of 12 articles = CP of 15 articles = ₹ 15

$$\text{SP of 1 article} = ₹ \left(\frac{15}{12} \right) = ₹ \left(\frac{5}{4} \right)$$

Profit = SP – CP

$$= ₹ \left(\frac{5 - 4}{3} \right) = ₹ \frac{1}{4}$$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100$$

$$= \frac{1}{4} \times 100 = 25\%$$

Hence, the gain percent is 25%

6. CP of 7 toffees = ₹ 1

$$\text{CP of 1 toffee} = ₹ \frac{1}{7}$$

$$\text{SP of 4 toffees} = ₹ 1$$

$$\text{SP of 1 toffee} = ₹ \frac{1}{4}$$

$$\begin{aligned} \text{So, profit} &= \frac{1}{4} - \frac{1}{7} \\ &= \frac{7-4}{28} = \frac{3}{28} \end{aligned}$$

$$\text{So, gain \%} = \frac{\frac{3}{28}}{\frac{1}{7}} \times 100 = \frac{3}{4} \times 100 = 75\%$$

$$7. \text{ SP of sofa at 10\% loss} = ₹ 18,000$$

$$\begin{aligned} \text{CP of sofa at 10\% loss} &= \left(\frac{100}{100 - L\%} \right) \times \text{SP} \\ &= \left(\frac{100}{100 - 10} \right) \times 18000 \\ &= ₹ \frac{100}{90} \times 18000 = ₹ 20,000 \end{aligned}$$

$$\begin{aligned} \text{So, SP at 20\% gain} &= \left(\frac{100 + 20}{100} \right) \times \text{CP} \\ &= \frac{120}{100} \times 2000 \\ &= ₹ 24,000 \end{aligned}$$

$$8. \text{ Let CP of the almirah be ₹ } x.$$

$$\begin{aligned} \text{SP at 16\% gain} &= \left(\frac{100 + 16}{100} \right) \times x \\ &= \frac{116}{100} x \end{aligned}$$

$$\text{SP at 20\% gain} = \left(\frac{100 + 20}{100} \right) \times x = \frac{120x}{100}$$

According to question,

$$\frac{120x}{100} - \frac{116x}{100} = 2000$$

$$\frac{120x + 116x}{100} = 2000$$

$$4x = 2000 \times 100$$

$$x = \frac{200000}{4} = ₹ 50,000$$

9. CP of 80 kg apples = ₹ $(70 \times 80) = ₹ 5600$

$$60\% \text{ of } 80 \text{ kg} = \frac{60}{100} \times 80 = 48 \text{ kg}$$

$$\text{SP of } 48 \text{ kg apples} = ₹ (48 \times 90) = ₹ 4320$$

$$\text{SP of remaining } 32 \text{ kg apples} = ₹ (32 \times 65) = ₹ 2080$$

$$\text{Total SP of } 80 \text{ kg apples} = ₹ (4320 + 2080) = ₹ 6400$$

$$\text{Profit} = ₹ (6400 - 5600) = ₹ 800$$

$$P\% = \frac{800}{5600} \times 100 = 14.28\%$$

10. Let CP of mobile for Sonu be ₹ x .

$$\text{SP of Sonu} = \text{CP for Tanu}$$

$$= \left(\frac{100 + 10}{100} \right) \times x$$

$$= \frac{11}{10}x$$

$$\text{SP for Tanu} = \text{CP for Mahesh}$$

$$2336.40 = \left(\frac{100 + 18}{100} \right) \times \frac{11}{10}x$$

$$\frac{2336.40 \times 1000}{118 \times 11} = x$$

$$x = ₹ 1800$$

11. Let MP be ₹ 100

$$\text{SP} = 100 \left(1 - \frac{D_1}{100} \right) \left(1 - \frac{D_2}{100} \right)$$

$$= 100 \left(1 - \frac{20}{100} \right) \left(1 - \frac{10}{100} \right)$$

$$= 100 \times \frac{80}{100} \times \frac{90}{100} = ₹ 72$$

So, discount = ₹ $(100 - 72) = ₹ 28$

$$\text{Discount \%} = \frac{28}{100} \times 100 = 28\%$$

12. MP = ₹ 2000, D% = 10% P% = 20%

$$\text{SP} = \text{MP} \left(1 - \frac{D}{100} \right)$$

$$= 2000 \left(1 - \frac{10}{100} \right)$$

$$= ₹ \left(2000 - \frac{90}{100} \right) = ₹ 1800$$

Now,

$$\begin{aligned} \text{CP} &= \left(\frac{100}{100 + P\%} \right) \times \text{SP} \\ &= \left(\frac{100}{100 + 20} \right) \times 1500 \\ &= ₹ \left(\frac{100}{120} \times 1500 \right) = ₹ 1500 \end{aligned}$$

13.

$$\begin{aligned} \text{SP} &= \text{MP} \left(1 - \frac{D_1}{100} \right) \left(1 - \frac{D_2}{100} \right) \\ &= 12000 \left(1 - \frac{20}{100} \right) \left(1 - \frac{5}{100} \right) \\ &= 12000 \times \frac{80}{100} \times \frac{95}{100} \\ &= ₹ 9120 \end{aligned}$$

14. Let price of the saree before GST be ₹ x .

$$x + 10\% \text{ of } x = ₹ 6600$$

$$x + \frac{10}{100} \times x = 6600$$

$$\frac{11x}{10} = 6600$$

$$x = \frac{6600 \times 10}{11} = ₹ 6000$$

15. CP of shirt = ₹ 1200

$$\text{GST on shirt} = ₹ (10\% \text{ of } 1200)$$

$$= ₹ \left(\frac{10}{100} \times 1200 \right) = ₹ 120$$

$$\text{Total cost of shirt with GST} = ₹ (1200 + 120) = ₹ 1320$$

$$\text{GST on jeans} = ₹ \left(\frac{8}{10} \times 800 \right) = ₹ 64$$

$$\text{Total cost of jeans with GST} = ₹ 864$$

$$\text{Total cost of both} = ₹ (1320 + 864) = ₹ 2184$$

Mental Zone

1. $30\% \text{ of } 80 = \frac{30}{100} \times 80 = 24$

2. Profit = SP - CP = ₹ (700 - 650) = ₹ 50

3. Customer

$$4. \text{ Loss} = \text{CP} - \text{SP} = ₹ (550 - 500) = ₹ 50$$

$$5. 100$$

Multiple Choice Questions

$$1. (c) \quad 2. (a) \quad 3. (b) \quad 4. (b)$$

$$5. 60\% \text{ of } 80 = \frac{60}{100} \times 80 = 48 \quad (a)$$

$$6. (d)$$

$$7. (b) P\% = \frac{2}{10} \times 100 = 20\%$$

$$8. (a) D\% = \frac{200}{1000} \times 100 = 20\%$$

$$9. (c) \left(\frac{100}{100 - D\%} \right) \times \text{SP}$$

$$10. (b)$$

CHAPTER-8: COMPOUND INTEREST

Assessment Time 8.1

$$1. \text{ Principal for the 1st year} = ₹ 4,000$$

$$\text{Rate } (R) = 6\%, \text{ Time } (T) = 10 \text{ years}$$

$$\begin{aligned} \text{Interest for 1st year} &= \frac{P \times R \times T}{100} \\ &= ₹ \frac{4000 \times 6 \times 1}{100} = ₹ 240 \end{aligned}$$

$$\text{Amount} = (\text{Principal} + \text{Interest}) = ₹ 4000 + ₹ 240$$

$$\text{Principal for the 2nd year} = ₹ 4,240, \text{ Rate} = 6\%$$

$$\text{Time } (T) = 1 \text{ year}$$

$$\text{Interest for 2nd year} = ₹ \frac{4240 \times 1 \times 6}{100} = ₹ 254.40$$

$$\begin{aligned} \text{Amount} &= \text{Principal} + \text{Interest} \\ &= ₹ (4240 + 254.40) = ₹ 4494.40 \end{aligned}$$

$$\begin{aligned} \text{Compound Interest} &= A - P \\ &= ₹ (4494.40 - 4000) = ₹ 494.40 \end{aligned}$$

Hence, compound interest for 2 years is ₹ 494.40

$$2. \text{ Principal for 1st year} = ₹ 10,000$$

Rate (R) = 5%, Time (T) = 1 year

$$\begin{aligned}\text{Interest for 1st year} &= \frac{P \times R \times T}{100} \\ &= \frac{10,000 \times 5 \times 1}{100} = ₹ 500\end{aligned}$$

$$\begin{aligned}\text{Amount} &= \text{Principal} + \text{Interest} \\ &= ₹ (10,000 + 500) = ₹ 10,500\end{aligned}$$

Principal for second year = ₹ 10,500, Rate (R) = 5%,
Time (T) = 1 year

$$\begin{aligned}\text{Interest for 2nd year} &= \frac{P \times R \times T}{100} \\ &= \frac{10500 \times 5 \times 1}{100} = ₹ 525\end{aligned}$$

$$\begin{aligned}\text{Amount} &= \text{Principal} + \text{Interest} \\ &= 10500 + 525 = ₹ 11,025\end{aligned}$$

$$\begin{aligned}\text{Principal for 3rd year} &= \frac{P \times R \times T}{100} \\ &= \frac{11025 \times 5 \times 1}{100} = ₹ 551.25\end{aligned}$$

$$\begin{aligned}\text{Amount} &= \text{Principal} + \text{Interest} \\ &= 11025 + 551.25 = ₹ 11576.25\end{aligned}$$

$$CI = A - P$$

$$= ₹ (11,576.25 - 10,000) = ₹ 1,576.25$$

3. Principal for 1st year = ₹ 20,000, Rate (R) = 8%

Time (T) = 4 years

$$\begin{aligned}\text{Interest} &= \frac{P \times R \times T}{100} \\ &= \frac{20,000 \times 8 \times 4}{100} = ₹ 6400\end{aligned}$$

Compound Interest on ₹ 6400

$$\begin{aligned}\text{Amount} &= (\text{Principal} + \text{Interest}) \\ &= (20,000 + 6400) = ₹ 26,400\end{aligned}$$

Principal for 2nd year = ₹ 26,400, Rate (R) = 8%

Time (T) = 1 year

$$\begin{aligned}\text{Interest for 2nd year} &= \frac{26,400 \times 8 \times 1}{100} = ₹ 2112 \\ \text{Amount} &= (\text{Principal} + \text{Interest})\end{aligned}$$

$$= (21600 + 1728) = ₹ 23328$$

Principal for 3rd year = 23328, Rate (R) = 8%

Time (T) = 1 year

$$\text{Interest for 3rd year} = \frac{23,328 \times 8 \times 1}{100} = ₹ 1866.24$$

Amount = (Principal + Interest)

$$= (23328 + 1866.24) = ₹ 25194.24$$

Principal for 4th year = 25194.24, Rate (R) = 8%

Time (T) = 1 year

$$\text{Interest for 4th year} = \frac{25,194.24 \times 8 \times 1}{100} = 2015.5392$$

$$= ₹ 2015.54$$

Amount = (Principal + Interest)

$$= 25194.24 + 2015.54 = ₹ 27209.78$$

Hence, the compound interest for 4 years is ₹ 27209.78

4. $SI = ₹ 1800$, Rate (R) = 6%, Time (T) = 3 years

$$SI = \frac{P \times R \times T}{100}$$

$$1800 = \frac{P \times 6 \times 3}{100}$$

$$P = \frac{1800 \times 100}{6 \times 3}$$

$$= \frac{180000}{18} = 10000$$

Computing compound interest on ₹ 10,000

$$\begin{aligned}\text{Interest for the 1st year} &= ₹ \left(\frac{10,000 \times 10 \times 1}{100} \right) \\ &= ₹ 1,000\end{aligned}$$

Principal for the 2nd year = ₹ (10,000 + 1,000) = ₹ 11,000

$$\begin{aligned}\text{Interest for the 2nd year} &= ₹ \left(\frac{11,000 \times 10 \times 1}{100} \right) \\ &= ₹ 1100\end{aligned}$$

Principal for the 3rd year = 11000 + 1100 = ₹ 12100

$$\begin{aligned}\text{Interest for the 3rd year} &= ₹ \left(\frac{12100 \times 10 \times 1}{100} \right) \\ &= ₹ 1210\end{aligned}$$

Amount after three year = $12100 + 1210 = ₹ 13310$

$$CI = A - P$$

$$= 13310 - 10000 = ₹ 3310$$

Hence, the compound interest for 3 years is ₹ 3,310.

5. Principal on 1st year = ₹ 25,000, Rate (R) = 5%,

Time (T) = 1 year

$$\begin{aligned} \text{Interest for 1 year} &= \frac{P \times R \times T}{100} \\ &= \left(\frac{25,000 \times 5 \times 1}{100} \right) = 1,250 \end{aligned}$$

Amount = (Principal + Interest)

$$= ₹ (25,000 + 1,250) = ₹ 26,250$$

Principal on 2nd year = ₹ 26,250, Rate (R) = 6%

Time (T) = 1 year

$$\begin{aligned} \text{Interest for 2nd year} &= \left(\frac{P \times R \times T}{100} \right) \\ &= ₹ \left(\frac{26,250 \times 6 \times 1}{100} \right) = ₹ 1575 \end{aligned}$$

Amount = (Principal + Interest)

$$= ₹ (26,250 + 1,575) = ₹ 27,825$$

Principal for 3rd year = ₹ 27,825, Rate (R) = 8%,

Time (T) = 1 year

$$\begin{aligned} \text{Interest for 3rd year} &= \left(\frac{P \times R \times T}{100} \right) \\ &= ₹ \left(\frac{27,825 \times 8 \times 1}{100} \right) = ₹ 2,226 \\ &= ₹ 30,051 \end{aligned}$$

Compound Interest = $A - P$

$$= 30,051 - 25,000 = ₹ 5,051$$

Hence, the amount is ₹ 30,051 and the compound interest is ₹ 5,051

6. Principal (P) = ₹ 50,000, Rate (R) = 12%, Time (T) = ₹ year

$$\begin{aligned} SI &= \left(\frac{P \times R \times T}{100} \right) \\ &= \frac{50,000 \times 12 \times 1}{100} = ₹ 6000 \end{aligned}$$

$$\text{Amount} = (\text{Principal} + \text{Interest})$$

$$= ₹ (50,000 + 6,000) = ₹ 56,000$$

Principal for second year = ₹ 56,000, Rate (R) = 12%

Time (T) = 1 year

$$\begin{aligned} SI &= \left(\frac{P \times R \times T}{100} \right) \\ &= \frac{56,000 \times 12 \times 1}{100} = ₹ 6720 \end{aligned}$$

$$\text{Amount} = (\text{Principal} + \text{Interest})$$

$$= ₹ (56,000 + 6,720) = ₹ 62,720$$

Principal for third year = ₹ 62,720, Rate (R) = 12%

Time (T) = 1 year

$$\begin{aligned} SI &= \left(\frac{P \times R \times T}{100} \right) \\ &= \frac{62720 \times 12 \times 1}{100} = ₹ 7526.40 \end{aligned}$$

$$\text{Amount} = (\text{Principal} + \text{Interest})$$

$$= ₹ (62,720 + 7526.40) = ₹ 70246.40$$

$$\text{Compound Interest} = A - P$$

$$= 70246.40 - 50,000 = 20246.40$$

7. Principal (P) = ₹ 24,000, Rate (R) = 8%, Time (T) = 3 years

$$\begin{aligned} SI &= \left(\frac{P \times R \times T}{100} \right) \\ &= \frac{24,000 \times 8 \times 3}{100} \\ &= 240 \times 24 = ₹ 5760 \end{aligned}$$

Computing Compound Interest

$$\begin{aligned} \text{Interest for the 1st year} &= ₹ \left(\frac{24,000 \times 8 \times 1}{100} \right) \\ &= ₹ 1920 \end{aligned}$$

$$\begin{aligned} \text{Principal for the 2nd year} &= ₹ (24000 + 1920) \\ &= ₹ 25,920 \end{aligned}$$

$$\begin{aligned} \text{Interest for the 2nd year} &= ₹ \left(\frac{25920 \times 8 \times 1}{100} \right) \\ &= ₹ 2073.60 \end{aligned}$$

$$\text{Principal for the 3rd year} = ₹ (25920 + 2073.60)$$

$$= ₹ 27993.60$$

$$\text{Interest for the 3rd year} = ₹ \left(\frac{27993.60 \times 8 \times 1}{100} \right)$$

$$= ₹ 2239.48$$

$$\text{Amount} = ₹ (27993.60 + 2239.48) = ₹ 30233.08$$

$$\text{Compound Interest} = ₹ (30233.08 - 24000) = ₹ 6233.08$$

$$\text{So, difference between CI and SI} = ₹ (6233.08 - 5760) \\ = 473.08$$

SDG-Good Quality

$$\text{Saving for Shalini} = 40\% \text{ of } 3,00,000$$

$$= ₹ \left(\frac{40}{100} \times 3,00,000 \right)$$

$$= ₹ 1,20,000$$

$$\text{Here, } P = ₹ 1,20,000, R = 8\%,$$

$$\text{SI for 1 year} = \frac{120000 \times 8 \times 1}{100} = ₹ 9600$$

$$\text{Amount} = ₹ (120000 + 9600) = ₹ 1,29,600$$

$$\text{So, principal for next year} = ₹ (1,29,600 + 120000) \\ = ₹ 2,49,600$$

$$\text{SI for 2nd year} = \frac{249600 \times 8 \times 1}{100} = ₹ 19968$$

$$\text{Amount} = ₹ (2,49,600 + 19668) = ₹ 269568$$

$$\text{Principal for third year} = ₹ (269568 + 120000) \\ = ₹ 389568$$

$$\text{SI for third year} = \frac{389568 \times 8 \times 1}{100} \\ = ₹ 31,615.44$$

$$\text{Amount} = ₹ (389568 + 31165.44) = ₹ 420733.44$$

$$\text{Principal for fourth year} = ₹ (420733.44 + 120000) \\ = ₹ 5,40,7340$$

$$\text{SI} = \frac{540733.44 \times 8 \times 1}{100} \\ = ₹ 43285.68$$

$$\text{Amount at the end fourth year} = ₹ (540733.44 + 43255.68) \\ = ₹ 5,83,992.12$$

Assessment Time 8.2

1. Principal (P) = ₹ 15,000, Rate (R) = 12%, Time (T) = 2 year

$$\begin{aligned} A &= P \left(1 + \frac{r}{100} \right)^n \\ &= 15000 \left(1 + \frac{12}{100} \right)^2 = 15000 \left(\frac{112}{100} \right)^2 \\ &= 15000 \times \frac{112}{100} \times \frac{112}{100} = 18816 = ₹ 18816 \end{aligned}$$

$$\begin{aligned} CI &= A - P \\ &= ₹ (18816 - 15000) = ₹ 3816 \end{aligned}$$

2. Principal (P) = ₹ 5000, Rate (R) = 10%, Time (T) = $\frac{7}{2}$ years

Rate will 10% for 3 years, but for $\frac{1}{2}$ years it will be $\frac{1}{2} \times 10 = 5\%$

$$\begin{aligned} \text{Amount (A)} &= P \left(1 + \frac{r_1}{100} \right)^3 \left(1 + \frac{r_2}{100} \right)^1 \\ &= 50000 \left(1 + \frac{10}{100} \right)^3 \left(1 + \frac{10}{100} \right)^1 \\ &= 50000 \left(\frac{110}{100} \right)^3 \left(\frac{105}{100} \right)^1 \\ &= 50000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} \times \frac{105}{100} \\ &= ₹ (20963.25) \end{aligned}$$

$$CI = ₹ (20,963.25 - 15000) = ₹ 5963.25$$

3. Principal (P) = ₹ 40,000, Rate (R) = $\frac{25}{2}\%$, Time (T) = 4 years

$$\begin{aligned} A &= P \left(1 + \frac{r}{100} \right)^n \\ &= 40,000 \left(1 + \frac{25}{2 \times 100} \right)^4 = 40,000 \left(\frac{225}{200} \right)^4 \\ &= 40,000 \left(\frac{9}{8} \right)^4 \\ &= 40,000 \times \frac{9}{8} \times \frac{9}{8} \times \frac{9}{8} \times \frac{9}{8} \\ &= ₹ 64072.26 \end{aligned}$$

4. Principal (P) = ₹ 1,50,000, Rate (R) = 10%

Rate will be 10% p.a. for 3 years but for $\frac{1}{2}$ year, it will be $\frac{1}{2} \times 10\% = 5\%$

$$\begin{aligned}
 \text{Amount (A)} &= P \left(1 + \frac{r_1}{100}\right)^3 \left(1 + \frac{r_2}{100}\right)^1 \\
 &= 1,50,000 \left(1 + \frac{10}{100}\right)^3 \left(1 + \frac{5}{100}\right)^1 \\
 &= 1,50,000 \left(\frac{110}{100}\right)^3 \left(\frac{105}{100}\right)^1 \\
 &= 1,50,000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} \times \frac{105}{100} \\
 &= ₹ 2,09,632.50
 \end{aligned}$$

5. $SI = ₹ 5200$, $T = 2$ Years, $R = 6\frac{1}{2}\%$ p.a.

$$\begin{aligned}
 P &= \frac{SI \times 100}{T \times R} \\
 &= \frac{5200 \times 100}{2 \times \frac{13}{2}} = ₹ 40,000
 \end{aligned}$$

$$\begin{aligned}
 A &= P \left(1 + \frac{r}{100}\right)^n \\
 &= 40000 \left(1 + \frac{13}{200}\right)^2 = ₹ 45,369
 \end{aligned}$$

$$\begin{aligned}
 CI &= A - P \\
 &= ₹ (45369 - 40000) = ₹ 5369
 \end{aligned}$$

6. $A = ₹ 31,492.80$, $R = 8\%$, $T = 3$ years

$$\begin{aligned}
 A &= P \left(1 + \frac{R}{100}\right)^n \\
 31,492.80 &= \left(1 + \frac{8}{100}\right)^3 \\
 P &= (1.08)^3 \\
 P &= \frac{31492.50}{1.08 \times 1.08 \times 1.08} \\
 P &= ₹ 25,000
 \end{aligned}$$

7. Here, $P = ₹ 90,000$, $r_1 = 10\%$, $r_2 = 12\%$

$$A = P \left(1 + \frac{r_1}{100}\right)^2 \left(1 + \frac{r_2}{100}\right)^2$$

$$\begin{aligned}
 &= 90000 \left(1 + \frac{10}{100}\right)^2 \left(1 + \frac{12}{100}\right)^2 \\
 &= 90000 (1.1)^2 (1.12)^2 \\
 &= ₹ 1,36,604.16
 \end{aligned}$$

$$CI = ₹ (136604.16 - 90000) = ₹ 46,604.16$$

8. Here, $P = ₹ 9000$, $A = ₹ 10240$, $n = 2$, $r = ?$

$$\begin{aligned}
 A &= P \left(1 + \frac{r}{100}\right)^n \\
 10240 &= 9000 \left(1 + \frac{r}{100}\right)^2 \\
 \frac{10240}{9000} &= \left(1 + \frac{r}{100}\right)^2 \\
 \frac{1024}{900} &= \left(1 + \frac{r}{100}\right)^2 \\
 \left(\frac{32}{30}\right)^2 &= \left(1 + \frac{r}{100}\right)^2 \\
 \frac{32}{30} &= 1 + \frac{r}{100} \\
 \frac{r}{100} &= \frac{32}{30} - 1 = \frac{2}{30} \\
 r &= \frac{2}{30} \times 100 = \frac{200}{30} = 6\frac{2}{3}
 \end{aligned}$$

Hence, $r = 6\frac{2}{3}\%$

9. Here, $P = ₹ 1600$, $A = ₹ 1852.20$, $R = 5\%$ p.a.

$$\begin{aligned}
 A &= P \left(1 + \frac{r}{100}\right)^n \\
 1852.20 &= 1600 \left(1 + \frac{5}{100}\right)^n \\
 \frac{185220}{160000} &= \left(\frac{21}{20}\right)^n \\
 \frac{9261}{8000} &= \left(\frac{21}{20}\right)^n \\
 \left(\frac{21}{20}\right)^3 &= \left(\frac{21}{20}\right)^n
 \end{aligned}$$

On comparing, $n = 3$

Hence, time is 3 years.

$$10. P = ₹ 1,00,000, r = 8\frac{3}{4} = \frac{35}{4}\%, n = 3$$

$$\begin{aligned} A &= P \left(1 + \frac{r}{100} \right)^n \\ &= 100000 \left(1 + \frac{35}{400} \right)^3 \\ &= 100000 \left(\frac{435}{400} \right)^3 \\ &= ₹ 1,28,613.86 \end{aligned}$$

$$CI = ₹ (128613.86 - 100000) = ₹ 28613.86$$

He donates = 20% of 28613.86

$$\begin{aligned} &= ₹ \left(\frac{20}{100} \times 28613.86 \right) \\ &= ₹ 5722.77 \end{aligned}$$

Assessment Time 8.3

$$1. P = ₹ 3,50,000, n = 4, r = 6\%$$

$$\begin{aligned} \text{Value of car after 4 years} &= 350000 \left(1 - \frac{6}{100} \right)^4 \\ &= 350000 \left(\frac{94}{100} \right)^4 \\ &= ₹ 2,73,262.14 \end{aligned}$$

$$2. \text{ Here, } P = ₹ 2,00,000, r_1 = 10\%, r_2 = 7.5\%$$

$$\begin{aligned} \text{Value of machine after 3 years} &= 200000 \left(1 - \frac{10}{100} \right) \left(1 - \frac{7.5}{100} \right)^2 \\ &= ₹ 1,54,012.50 \end{aligned}$$

$$3. \text{ Here, } P = 20 \text{ lakhs, } r = 3.5 \%, n = 2$$

$$\begin{aligned} \text{Population after 2 years} &= 20 \left(1 + \frac{3.5}{100} \right)^2 \\ &= 21.4245 \text{ lakhs} \end{aligned}$$

$$4. P = ₹ 25 \text{ lakh, } r = 30\%, n = 3$$

$$\begin{aligned} \text{Value of flat after 3 years} &= 25 \left(1 + \frac{30}{100} \right)^3 \\ &= 25 \left(\frac{130}{100} \right)^3 \\ &= 54.925 \text{ lakhs} \end{aligned}$$

5. Population in 2010 = 2,20,000, $r = 4\%$

a. Let population of town in 2007 be x .

$$220000 = x \left(1 + \frac{4}{100} \right)^3$$

$$220000 = x \left(\frac{104}{100} \right)^3$$

$$\begin{aligned} x &= 220000 \left(\frac{100}{104} \right)^3 \\ &= 1,95,579.19 = 1,95,579 \text{ (approx)} \end{aligned}$$

$$\begin{aligned} \text{b. Population in 2014} &= 220000 \left(1 + \frac{4}{100} \right)^4 \\ &= 220000 \left(\frac{104}{100} \right)^4 \\ &= 2,57,368.88 = 2,57,368 \text{ (approx)} \end{aligned}$$

6. Here, $P = 60$ lakh, $r = 4\%$, $n = 3$

$$\begin{aligned} \text{Value of machine after 3 years} &= 60 \left(1 - \frac{4}{100} \right)^3 \\ &= 60 \left(\frac{96}{100} \right)^3 = 53.08 \text{ lakh} \end{aligned}$$

Value of machine after 3 years at 10% depreciation

$$\begin{aligned} &= 60 \left(1 - \frac{10}{100} \right)^3 \\ &= 60 \left(\frac{9}{10} \right)^3 = 43.74 \end{aligned}$$

$$\begin{aligned} \text{Saving} &= 53.08 - 43.74 \\ &= 9.34 \text{ lakhs} \end{aligned}$$

He distribute = 50% of 9.34

$$= \frac{50}{100} \times 9.34 = 4.67 \text{ lakhs}$$

Critical Thinking Skills

$P = 10$ lakh, net rate (r) = $5 - 2.5 = 2.5\%$ p.a., $n = 2$

$$\begin{aligned} \text{Population after 2 years} &= 10 \left(1 + \frac{2.5}{100} \right)^2 \\ &= 10 \left(\frac{102.5}{100} \right)^2 \\ &= 10.51 \text{ lakh (approx)} \end{aligned}$$

Revision Time

1. Here, $P = ₹ 18,000$, $r = 8\%$ p.a., $n = 2$

$$\begin{aligned} A &= P \left(1 + \frac{r}{100} \right)^n \\ &= 18000 \left(1 + \frac{8}{100} \right)^2 = 18000 \left(\frac{108}{100} \right)^2 \\ &= ₹ 20,995.20 \end{aligned}$$

$$CI = A - P$$

$$= ₹ (20,995.20 - 18000) = ₹ 2,995.20$$

2. Here, $P = ₹ 80,000$, $r_1 = 10\%$, $r_2 = 12\%$, $r_3 = 15\%$

$$\begin{aligned} A &= P \left(1 + \frac{r_1}{100} \right) \left(1 + \frac{r_2}{100} \right) \left(1 + \frac{r_3}{100} \right) \\ &= 80000 \left(1 + \frac{10}{100} \right) \left(1 + \frac{12}{100} \right) \left(1 + \frac{15}{100} \right) \\ &= 80000 \times \frac{110}{100} \times \frac{112}{100} \times \frac{115}{100} = ₹ 1,13,344 \end{aligned}$$

$$CI = ₹ (1,13,344 - 80,000)$$

$$= ₹ 33,344$$

3. $P = ₹ 18000$, $A = ₹ 20,480$, $n = 2$

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$\Rightarrow 20480 = 18000 \left(1 + \frac{r}{100} \right)^2$$

$$\Rightarrow \frac{20480}{18000} = \left(1 + \frac{r}{100} \right)^2 \Rightarrow \frac{1024}{900} = \left(1 + \frac{r}{100} \right)^2$$

$$\Rightarrow \left(\frac{32}{30} \right)^2 = \left(1 + \frac{r}{100} \right)^2 \Rightarrow \frac{32}{30} = 1 + \frac{r}{100}$$

$$\frac{r}{100} = \frac{32}{30} - 1 = \frac{2}{30} = \frac{1}{15}$$

$$r = \frac{100}{15} = 6.67\%$$

Hence, $r = 6.67\%$

4. Here, $A = ₹ 20,480$, $r = \frac{20}{3}\%$ p.a., $n = 2$

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$20480 = P \left(1 + \frac{20}{300} \right)^2$$

$$20480 = P \left(1 + \frac{320}{300} \right)^2$$

$$P = \frac{20480 \times 300 \times 300}{320 \times 320} = ₹ 18,000$$

5. Let $P = ₹ 100$, $A = ₹ 900$, $n = 2$, $r = ?$

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$900 = 100 \left(1 + \frac{r}{100} \right)^2 \Rightarrow 9 = \left(1 + \frac{r}{100} \right)^2$$

$$\Rightarrow 3^2 = \left(1 + \frac{r}{100} \right)^2 \Rightarrow 3 = 1 + \frac{r}{100}$$

$$\Rightarrow \frac{r}{100} = 3 - 1$$

$$r = 2 \times 100 = 200\%$$

6. Here, $P = ₹ 1,25,000$, $r = 10\%$, $n = 4$

$$\begin{aligned} \text{Value of motor cycle after 4 years} &= 125000 \left(1 - \frac{10}{100} \right)^4 \\ &= 125000 \left(\frac{9}{10} \right)^4 = ₹ 82,012.50 \end{aligned}$$

7. Here, $P = 1,40,530$, $r = 3.2\%$

Values after 3 hours or in the starting of fourth hour

$$= 140530 \left(1 - \frac{3.2}{100} \right)^3$$

$$= 140530 \left(\frac{103.2}{100} \right)^3$$

$$= 1,54,457 \text{ (approx)}$$

Mental Zone

1. compound interest

2. compound interest

3. $P \left[\left(1 + \frac{r}{100} \right)^n - 1 \right]$

4. n

5. $P \left(1 - \frac{r}{100} \right)^n$

MCQs

1. (a)

$$4356 = 3600 \left(1 + \frac{10}{100} \right)^n$$

$$= \frac{4356}{3600} = \left(\frac{11}{100}\right)^n$$

$$(1.1)^2 = (1.1)^n$$

$$n = 2$$

2. (a)

$$CI = P \left[\left(1 + \frac{r}{100}\right)^n - 1 \right]$$

$$328 = P \left[\left(1 + \frac{5}{100}\right)^2 - 1 \right]$$

$$328 = P \{0.1025\}$$

$$P = \frac{328}{0.1025} = ₹ 3170$$

$$SI = \frac{3470 \times 2 \times 5}{100} = ₹ 317$$

3. (b)

$$P = ₹ 1000, A = ₹ 1331, n = 3$$

$$A = P \left(1 + \frac{r}{100}\right)^n$$

$$1331 = 1000 \left(1 + \frac{r}{100}\right)^3$$

$$\left(\frac{11}{10}\right)^3 = \left(1 + \frac{r}{100}\right)^3$$

$$1 + \frac{r}{100} = \frac{11}{10}$$

$$r = \frac{1}{10} \times 100 = 10\%$$

4. (a)

$$\text{Value of machine after 2 years} = 16000 \left(1 - \frac{5}{100}\right)^2$$

$$= 16000 \left(\frac{19}{20}\right)^2 = ₹ 14440$$

Case Study Based Questions

1. 10% p.a. compound interest
2. 12% simple interest
3. Do yourself

CHAPTER-9: ALGEBRAIC EXPRESSIONS AND IDENTITIES

Assessment Time 9.1

1. a. Positive, negative b. monomial
c. two terms d. three or 3
2. a. $15x^2 - 3y^2 + 2xy$
The terms are : $15x^2$, $3y^2$ and $2xy$
b. $6xy + 4y^2$
The terms are : $6xy$, $4y^2$
c. $8y^2 + 18xy - 4$
The terms are : $8y^2$, $18xy$ and 4
d. $2m^2 + n^2 - 2mn + 5m^2n$
The terms are $2m^2$, n^2 , $2mn$, $5m^2n$
3. a. The like terms are $5x^2y$, $3x^2y - 6yx^2$; $3x^2y^2$, $4x^2y^2$; $14xy$, $-9yx$
b. The like terms are : $4mn$, $7mn$, $8mn$; $5m^2$, $-3m^2$; $-7n^2$, $4n^2$; $6m^2n$, $-8nm^2$
4. a. $4m^2n + 16n^2$
This algebraic expression has two terms.
So, it is a binomial
b. $-16mn + 4n^2 + 12n^2m$
This algebraic expression has three terms.
So, it is a trinomial.
c. $\frac{-15yz}{17}$
This algebraic expression has only one term.
So, it is a monomial.
d. $\frac{8x^2y}{13}$
This algebraic expression has only one term.
So, it is a monomial.
e. $5y^2z - 64$
This algebraic expression has only two terms.
So, it is a binomial.

f. $-4x^2 + 5y^2 + 12xy + 13$

This algebraic expression has more than two terms.

So, it is a polynomial.

5. a. $6x^2 + 5xy - 3xy - 3y^2$ The degree is 2.

b. $8y^2 + 6x^2y^2 + 4y^5$ The degree is 5.

c. $4m^2n^3 + 3mn + 5n^2$ The degree is 5.

d. $\frac{3}{5}a^2b^2c^3 + 2a^5c^4 - 6ab^2$ The degree is 9.

6. a. $(5x^2 + 6xy + 4y^2) + (-16xy + 7x^2 - 9y^2)$
 $= 5x^2 + 6xy + 4y^2 - 16xy + 7x^2 - 9y^2$
 $= (5x^2 + 7x^2) + (4y^2 - 9y^2) + (6xy - 16xy)$
 $= 12x^2 - 5y^2 - 10xy$

b. $3mn + 4n^2 + 6m^2$ and $-5m^2 - 8n^2 + 5mn$
 $= (3mn + 4n^2 + 6m^2) + (-5m^2 - 8n^2 + 5mn)$
 $= 3mn + 4n^2 + 6m^2 - 5m^2 - 8n^2 + 5mn$
 $= (3mn + 5mn) + (4n^2 - 8n^2) + (6m^2 - 5m^2)$
 $= 8mn - 4n^2 + m^2$

7. a. On arrange the like terms in column, we get

$$\begin{array}{r} 6m^2 + 5n^2 - 6mn \\ 4m^2 - 6n^2 + 8mn \\ -10m^2 - 3n^2 + 4mn \\ \hline -4n^2 + 6mn \end{array}$$

b. On arranging the terms in column.

$$\begin{array}{r} 16y^2 - 8x^2 + 5xy \\ -9y^2 + 4x^2 + 3xy \\ (+) 12y^2 - 6x^2 + 4xy \\ \hline 19y^2 - 10x^2 + 12xy \end{array}$$

8. a. $(7x^2 + 3xy - 2y^2) - (4y^2 + 2xy - 9x^2)$
 $= 7x^2 + 3xy - 2y^2 - 4y^2 - 2xy + 9x^2$
 $= 7x^2 + 9x^2 + 3xy - 2xy - 2y^2 - 4y^2$
 $= 16x^2 + xy - 6y^2$

$$\begin{aligned} \text{b. } & (-3m^2 - 8n^2 - 3mn) - (6mn + 5m^2 + 2n^2) \\ & = -3m^2 - 8n^2 - 3mn - 6mn - 5m^2 - 2n^2 \\ & = -10n^2 - 8m^2 - 9mn \end{aligned}$$

$$9. \text{ a. } -7x^2 - 3xy + 4y^2 \text{ from } -6y^2 + 4xy - 3x^2$$

On arranging the terms in column, we get

$$\begin{array}{r} -6y^2 + 4xy - 3x^2 \\ 4y^2 - 3xy - 7x^2 \\ (-) - \quad + \quad + \\ \hline -10y^2 + 7xy + 4x^2 \end{array}$$

$$\text{b. } 5mn + 6m^2n - 3n^2m \text{ from } 5m^2n + 2n^2m - 15mn$$

On arranging the terms in column, we get

$$\begin{array}{r} 5m^2n + 2n^2m - 15mn \\ 6m^2n - 3n^2m + 5mn \\ (-) - \quad + \quad - \\ \hline -m^2n + 5n^2m - 20mn \end{array}$$

$$\begin{aligned} 10. \text{ a. } & 4a^2 + 5b^2 - 6ab + 2a^2 - 6b^2 + 7ab + 12a^2 \\ & = (4a^2 + 2a^2 + 12a^2) + (5b^2 - 6b^2) + (-6ab + 7ab) \\ & = 18a^2 - b^2 + ab \end{aligned}$$

$$\begin{aligned} \text{b. } & -6mn + 2m^2 + 4n^2 - 2mn + 8mn - 6m^2 - 8n^2 \\ & = (-6mn - 2mn + 8mn) + (2m^2 - 6m^2) + (4n^2 - 8n^2) \\ & = -4m^2 + 4n^2 \end{aligned}$$

Assessment Time 9.2

$$1. \text{ a. } 5x^2 \text{ by } 6x^3y^2$$

$$\begin{aligned} 5x^2 \times 6x^3y^2 &= (5 \times 6) \times (x^2 \times x^3 \times y^2) \\ &= 30 \times x^{2+3} \times y^2 \\ &= 30 \times x^5 \times y^2 \\ &= 30x^5y^2 \end{aligned}$$

$$\text{b. } (-6m^2n^2p) \text{ by } (7m^3n^2)$$

$$\begin{aligned} (-6m^2n^2p) \times (7m^3n^2) &= (-6 \times 7) \times (m^2 \times m^3 \times n^2 \times n^2 \times p) \\ &= -42 \times (m^{2+3}n^{2+2}p) \\ &= -42m^5n^4p \end{aligned}$$

$$\begin{aligned}
 \text{c. } \left(\frac{-5}{16}x^2yt^2\right) \text{ by } \left(\frac{4}{25}y^2t^3\right) &= \left(\frac{-5}{16} \times \frac{4}{25}\right) \times (x^2yt^2 \times y^2t^3) \\
 &= \frac{-1}{20} \times (x^2 \times y^{1+2} \times t^{2+3}) \\
 &= \frac{-1}{20} x^2y^3t^5 = \frac{-x^2y^3t^5}{20}
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } \left(\frac{-18}{5}a^2b^3c^2\right) \text{ by } \left(\frac{-25}{27}a^3b^4c^7\right) &= \left(\frac{-18}{5} \times \frac{-25}{27}\right) (a^2b^3c^2 \times a^3b^4c^7) \\
 &= \frac{10}{3} (a^{2+3}b^{3+4}c^{2+7}) \\
 &= \frac{10}{3} a^5b^7c^9
 \end{aligned}$$

$$\begin{aligned}
 2. \text{ a. } (-7ab^2c) \times (4a^2b^3c^2) &= (-7 \times 4)(a^{1+2}b^{2+3}c^{1+2}) \\
 &= -28 a^3b^5c^3 \\
 &= -28 (-2)^3 \times \left(\frac{-1}{2}\right)^5 \times (-3)^3 \\
 &= -28 \times (-8) \times \left(\frac{-1}{32}\right) \times (-27)^3 \\
 &= (7 \times 27) = 189
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } \left(\frac{-7}{5}m^2n\right) \times \left(\frac{10}{14}n^2p\right) &= \left(\frac{-7}{5} \times \frac{10}{14}\right) \times (m^2n^{1+2}p) \\
 &= \frac{-1}{4} \times (2)^2 \times (-1)^3 \times 3 \\
 &= \frac{-1}{4} \times 4 \times (-1) \times 3 \\
 &= \frac{+12}{4} = 3
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } \left(\frac{-5}{7}mn\right) \times \left(\frac{10}{17}n^2p\right) \times \left(\frac{-28}{25}m^2p^2\right) \\
 &= \left(\frac{-5}{7} \times \frac{10}{17} \times \frac{-28}{25}\right) \times (m^{2+1} \times n^{1+2} \times p^{2+1}) \\
 &= \frac{4}{7} \times (m^3n^3p^3) \\
 &= \frac{4}{7} \times [(2)^3 \times (-1)^3 \times (3)^3] \\
 &= \frac{4}{7} \times 8 \times (-1) \times 27
 \end{aligned}$$

$$= \frac{32 \times (-27)}{7} = \frac{-864}{7}$$

$$\begin{aligned} \text{d. } & \left(\frac{-1}{5}a^2b\right) \times \left(\frac{-3}{8}b^2c^3\right) \times \left(\frac{16}{9}a^3b^2\right) \\ &= \left(\frac{-1}{5} \times \frac{-3}{8} \times \frac{16}{9}\right) \times (a^{2+3}b^{2+1+2}c^3) \\ &= \frac{2}{15} \times (a^5b^5c^3) \\ &= \frac{2}{15} \times (2)^5 \times \left(\frac{-1}{2}\right)^5 \times (-3)^3 \\ &= \frac{-2}{15} \times 27 = -\frac{18}{5} \end{aligned}$$

3. a. Area = Length $\times$ Breadth

$$= 3x \times 5y^2 = 15xy^2$$

Volume = Length $\times$ Breadth $\times$ Height

$$\begin{aligned} &= 3x \times 5y^2 \times 6xy \\ &= 90 \times x^{1+1} \times y^{2+1} \\ &= 90x^2y^3 \end{aligned}$$

b. Area = Length $\times$ Breadth

$$= 5m^2n \times 3mn$$

$$= 15m^{2+1} \times n^{1+1} = 15m^3n^2$$

Volume = Length $\times$ Breadth $\times$ Height

$$\begin{aligned} &= 5m^2n \times 3mn \times 2n^3 \\ &= 30 \times m^{2+1} \times n^{1+1+3} \\ &= 30m^3n^5 \end{aligned}$$

c. Area = Length $\times$ Breadth

$$= 2q \times 4q^2p$$

$$= 8q^{1+2} \times p = 8q^3p$$

Volume = Length $\times$ Breadth $\times$ Height

$$\begin{aligned} &= 2q \times 4q^2p \times 6p^3 \\ &= 48q^{1+2} \times p^{3+1} = 48q^3p^4 \end{aligned}$$

d. Area = Length $\times$ Breadth

$$= 2l^2m \times 3ln^2$$

$$= 6l^{2+1} \times m^{2+1} = 6l^3m^3$$

$$\text{Volume} = \text{Length} \times \text{Breadth} \times \text{Height}$$

$$= 2l^2m \times 3ln^2 \times 4p^2m$$

$$= 24l^{2+1} \times m^{1+2+1} \times p^2$$

$$= 24l^3m^4p^2$$

4. a. $4x \times (y^2 - 3xy) = 4x \times y^2 - 4x \times 3xy$

$$= 4xy^2 - 12x^{1+1}y$$

$$= 4xy^2 - 12x^2y$$

b. $6m^2n \times (mn - m^2 + 6n^2)$

$$= 6m^2n \times mn - 6m^2n \times m^2 + 6m^2n \times 6n^2$$

$$= 6m^{2+1}n^{1+1} - 6m^{2+2}n + 36m^2n^{1+2}$$

$$= 6m^3n^2 - 6m^4n + 36m^2n^3$$

c. $\frac{5}{7}ab \times (6a^2 - 3ab + 2b^2)$

$$= \frac{5}{7} \times 6 \times a^{2+1} \times b - 3 \times \frac{5}{7} a^{1+1} \times b^{1+1} + 2 \times \frac{5}{7} a \times b^{2+1}$$

$$= \frac{30}{7} \times a^{2+1} \times b - \frac{15}{7} a^{1+1} \times b^{1+1} + \frac{10}{7} a \times b^{2+1}$$

$$= \frac{30}{7} \times a^3b - \frac{15}{7} a^2b^2 + \frac{10}{7} ab^3$$

d. $\frac{-4}{27}xy^2z \times (x^2 - \frac{3}{8}y^2 + 4z)$

$$= \frac{-4}{27} \times x^{2+1} \times y^2 \times z - \frac{4}{27} \times \frac{3}{8} \times x \times y^{2+2} \times z - \frac{4}{27} \times 4 \times x \times y^2 \times z^{1+1}$$

$$= \frac{-4}{27} x^3y^2z + \frac{1}{18} xy^4z + \frac{16}{27} xy^2z$$

5. a. $(2a + b) \times (6b - c)$

$$= 2a(6b - c) + b(6b - c)$$

$$= 12ab - 2ac + 6b^2 - bc$$

b. $(3m^2 + 4n^2) \times (2m - 3n)$

$$= 3m^2(2m - 3n) + 4n^2(2m - 3n)$$

$$= 6m^{2+1} - 9m^2n + 8n^2m - 12n^3$$

$$= 6m^3 - 9m^2n + 8n^2m - 12n^3$$

c. $(2x^2 - 5y^2) \times (x^2 + 4y^2)$

$$= 2x^2(x^2 + 4y^2) - 5y^2(x^2 + 4y^2)$$

$$= 2x^{2+2} + 8x^2y^2 - 5x^2y^2 - 20y^{2+2}$$

$$= 2x^4 + 8x^2y^2 - 5x^2y^2 - 20y^4$$

$$= 2x^4 + 3x^2y^2 - 20y^4$$

d. $(3p^2 + q^2) \times (2p^2 - 4q^2)$

$$= 3p^2(2p^2 - 4q^2) + q^2(2p^2 - 4q^2)$$

$$= 6p^{2+2} - 12q^2p^2 + 2p^2q^2 - 4q^{2+2}$$

$$= 6p^4 - 12q^2p^2 + 2p^2q^2 - 4q^4$$

$$= 6p^4 - 10q^2p^2 - 4q^4$$

6. a. $(4x - y)(3x - 2y + 4)$

$$= 4x(3x - 2y + 4) - y(3x - 2y + 4)$$

$$= 12x^2 - 8xy + 16x - 3xy + 2y^2 - 4y$$

$$= 12x^2 + 2y^2 - 8xy - 3xy + 16x - 4y$$

$$= 12x^2 + 2y^2 - 11xy + 16x - 4y$$

b. $(4a + 3b)(a^2 - 2ab + b^2)$

$$= 4a(a^2 - 2ab + b^2) + 3b(a^2 - 2ab + b^2)$$

$$= 4a^3 - 8a^2b + 4ab^2 + 3a^2b - 6ab^2 + 3b^3$$

$$= 4a^3 + 3b^3 - 5a^2b - 2ab^2$$

c. $(5x - 2)(x^2 - 2xy + 2y^2)$

$$= 5x(x^2 - 2xy + 2y^2) - 2(x^2 - 2xy + 2y^2)$$

$$= 5x^3 - 10x^2y + 10xy^2 - 2x^2 + 4xy - 4y^2$$

$$= 5x^3 - 10x^2y + 10xy^2 - 2x^2 + 4xy - 4y^2$$

d. $(2m - 3n)(m^2 + 4mn + n^2)$

$$= 2m(m^2 + 4mn + n^2) - 3n(m^2 + 4mn + n^2)$$

$$= 2m^3 + 8m^2n + 2mn^2 - 3nm^2 - 12mn^2 - 3n^3$$

$$= 2m^3 + 5m^2n - 10mn^2 - 3n^3$$

7. a.

	4x	-3y
×	4x	+2y
	8xy	-6y ²
16x ²	-12xy	
16x ²	-4xy	-6y ²

b.

	2p ²	+q ²
×	3p ²	-2q ³
	-4p ² q ³	-2q ⁵
		6p ⁴ + 3p ² q ²
	-4p ² q ³	-2q ⁵ + 6p ⁴ + 3p ² q ²

c.

	x^2	$-5x$	$+6$
$\times$	x^2	$+2x$	$+7$
	$7x^2$	$-35x$	$+42$
	$2x^3$	$-10x^2$	$+12x$
	x^4	$-5x^3$	$+6x^2$
	x^4	$-3x^3$	$+3x^2$
		$-23x$	$+42$

d.

	$2a$	$+3b$	$+4c$
$\times$	$3a$	$-2b$	$+5c$
	$10ac$	$+15bc$	$+20c^2$
	$-4ab$	$-6b^2$	$-8bc$
	$6a^2$	$+9ab$	$+12ac$
	$6a^2$	$+5ab$	$-6b^2$
		$+22ac$	$+7bc$
			$+20c^2$

8. a. $\{(a+b)(c-d)\} + \{(c+d)(a-b)\} + 2(ac+bd)$
 $= a(c-d) + b(c-d) + c(a-b) + d(a-b) + 2(ac+bd)$
 $= ac - ad + bc - bd + ca - cb + da - db + 2ac + 2bd$
 $= 2ac - 2bd + 2ac + 2bd$
 $= 2ac + 2ac$
 $= 4ac$
- b. $(3x+4)(2x-5) + (7x-4)(2x+3)$
 $= 3x(2x-5) + 4(2x-5) + 7x(2x+3) - 4(2x+3)$
 $= 6x^2 - 15x + 8x - 20 + 14x^2 + 21x - 8x - 12$
 $= 20x^2 + 6x - 32$
7. a. $(a+b)(2a-3b+c) - (2a-3b)c$
 $= a(2a-3b+c) + b(2a-3b+c) - (2a-3b)c$
 $= 2a^2 - 3ab + ac + 2ab - 3b^2 + bc - 2ac + 3bc$
 $= 2a^2 - 3b^2 - ab - ac + 4bc$
- b. $m^2n(m-n^2) + mn^2(4mn-2m^2) - m^3n(1-2n)$
 $= m^3n - m^2n^3 + 4m^2n^3 - 2m^3n^2 - m^3n + 2m^3n^2$
 $= 3m^2n^3$

SEL-Decision Making

$$9. \quad 5x + 2xy + 1 + 2xy + 2 + 4y + 3x + 4y + 5$$

$$= 8x + 8y + 4xy + 8$$

Hence, the expression of total number of student is

$$8x + 8y + 4xy + 8$$

Critical Thinking Skills

$$\left(\frac{-3}{4} m^2 n + 2mn\right) \times \left(\frac{4}{9} mn - 3mn^2\right)$$

$$= \frac{-3}{4} m^2 n \left(\frac{4}{9} mn - 3mn^2\right) + 2mn \left(\frac{4}{9} mn - 3mn^2\right)$$

$$= \left(\frac{-3}{4} \times \frac{4}{9}\right) m^{2+1} n^{1+1} + \frac{9}{4} m^{2+1} \times n^{2+1} + 2 \times \frac{4}{9} \times m^{1+1}$$

$$\times n^{1+1} - 3 \times 2 \times m^{1+1} \times n^{2+1}$$

$$= \frac{-m^3 n^2}{3} + \frac{9}{4} m^3 n^3 + \frac{8}{9} m^2 n^2 - 6m^2 n^3$$

Now Putting $m = 2, n = -1$

$$= \frac{-1}{3} (2)^3 (-1)^2 + \frac{9}{4} (2)^3 (-1)^3 - 6(2)^3 (-1)^3$$

$$= \frac{-8}{3} - 18 + 48 = \frac{-8}{3} + 30$$

$$= \frac{-8 + 90}{3} = \frac{82}{3}$$

Assessment Time 9.3

1. a. $7x^3y^2z$ by $-14xy$

$$= -\frac{7x^3y^2z}{14xy} = -\frac{7}{14} \times \frac{x^3y^2z}{xy}$$

$$= -\frac{1}{2} \times x^{3-1} \times y^{2-1} \times z$$

$$= -\frac{1}{2} \times x^2 \times y^1 \times z = -\frac{x^2yz}{2}$$

b. $24m^3n^3p$ by $(-8mn^2p)$

$$= \frac{24m^3n^3p}{-8mn^2p} = \frac{24}{-8} \times \frac{m^3n^3p}{mn^2p}$$

$$= -3 \times m^{3-1} \times n^{3-2} \times p^{1-1}$$

$$= -3m^2n$$

$$\begin{aligned}
 \text{c. } & \frac{2}{3} a^3 b^2 \text{ by } \frac{-1}{6} abc^2 \\
 &= \frac{\frac{2}{3} a^3 b^2}{\frac{-1}{6} abc^2} = \frac{\frac{2}{3} \times (-6) \times a^{3-1} \times b^{2-1}}{c^2} \\
 &= \frac{\frac{-2 \times 6}{3} \times a^2 \times b}{c^2} = \frac{-4a^2 b}{c^2}
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } & -72x^2yz^2 \text{ by } 24xyz \\
 &= \frac{-72x^2yz^2}{24xyz} = \frac{-72}{24} \times \frac{x^2yz^2}{xyz} \\
 &= -3 \times x^{2-1} \times y^{1-1} \times z^{2-1} \\
 &= -3 \times x^1 \times y^0 \times z^1 = -3xz
 \end{aligned}$$

$$\begin{aligned}
 2. \text{ a. } & -4p^3 + 8p^2 + 12p + 8 \text{ by } 2p \\
 &= \frac{-4p^3 + 8p^2 + 12p + 8}{2p} \\
 &= \frac{-4p^3}{2p} + \frac{8p^2}{2p} + \frac{12p}{2p} + \frac{8}{2p} \\
 &= -2p^{3-1} + 4p^{2-1} + 6 + \frac{8}{2p} \\
 &= -2p^2 + 4p + 6 + \frac{4}{p}
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } & -5m^3 - 35m^2 + 55m \text{ by } (-5m^2) \\
 &= \frac{-5m^3 - 35m^2 + 55m}{-5m^2} \\
 &= \frac{-5m^3}{-5m^2} - \frac{35m^2}{-5m^2} + \frac{55m}{-5m^2} \\
 &= m^{3-2} + 7m^{2-2} - \frac{11}{m} \\
 &= m + 7 - \frac{11}{m}
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } & 8x^2y^2 - 6x^4y^3 + 10xy^3 \text{ by } 4x^2y^3 \\
 &= \frac{8x^2y^2}{4x^2y^3} - \frac{6x^4y^3}{4x^2y^3} + \frac{10xy^3}{4x^2y^3}
 \end{aligned}$$

$$= \frac{2x^{2-2}}{y} - \frac{6x^{4-2}}{4} + \frac{5}{2x} = \frac{2}{y} - \frac{3x^2}{2} + \frac{5}{2x}$$

d. $-7x^3y^2 + 14xy^3 + 28x^2y$ by $(-35xy^2)$

$$\begin{aligned} &= \frac{-7x^3y^2 + 14xy^3 + 28x^2y}{-35xy^2} \\ &= \frac{-7x^3y^2}{-35xy^2} + \frac{14xy^3}{-35xy^2} + \frac{28x^2y}{-35xy^2} \\ &= \frac{x^2}{5} - \frac{2y}{5} - \frac{4x}{5y} \end{aligned}$$

3. a.
$$\begin{array}{r} 3x-1 \\ 2x+1 \overline{) 6x^2+x-1} \\ \underline{\pm 6x^2 \pm 3x} \\ -2x-1 \\ \underline{\mp 2x \mp 1} \\ 0 \end{array}$$

Hence, Quotient = $3x - 1$, Remainder = 0

b.
$$\begin{array}{r} 4y^2-5 \\ y^2+3 \overline{) 4y^4+7y^2-15} \\ \underline{\pm 4y^4 \pm 12y^2} \\ -5y^2-15 \\ \underline{\mp 5y^2 \mp 15} \\ 0 \end{array}$$

Hence, Quotient = $4y^2 - 5$, Remainder = 0

c.
$$\begin{array}{r} 3x^3-5x+3 \\ 2x^2-6 \overline{) 6x^5-28x^3+6x^2+30x-18} \\ \underline{\pm 6x^5 \mp 18x^3} \\ -10x^3+6x^2+30x \\ \underline{\mp 10x^3} \\ 6x^2+30x \\ \underline{\pm 6x^2} -18 \\ \underline{\pm 6x^2} \mp 18 \\ 0 \end{array}$$

Hence, Quotient = $3x^3 - 5x + 3$, Remainder = 0

$$\begin{array}{r}
 m^3 - m^2 + 3m - 5 \\
 \text{d. } m + 5 \overline{) m^4 + 4m^3 - 2m^2 + 10m - 25} \\
 \underline{\pm m^4 \pm 5m^3} \\
 -m^3 - 2m^2 \\
 \underline{\mp m^3 \mp 5m^2} \\
 3m^2 + 10m \\
 \underline{\pm 3m^2 \pm 15m} \\
 -5m - 25 \\
 \underline{\mp 5m \mp 25} \\
 0
 \end{array}$$

Hence, quotient = $m^3 - m^2 + 3m - 5$, Remainder = 0

$$\begin{array}{r}
 9x - 21 \\
 \text{4. a. } x^2 + 3x - 1 \overline{) 9x^3 + 6x^2 - 4x + 6} \\
 \underline{\pm 9x^3 \pm 27x^2 \mp 9x} \\
 -21x^2 + 5x + 6 \\
 \underline{\mp 21x^2 \mp 63x \pm 21} \\
 68x - 15
 \end{array}$$

Quotient = $9x - 21$, Remainder = $68x - 15$

$$\begin{array}{r}
 y^2 - 2y - 4 \\
 \text{b. } y^2 - y + 6 \overline{) y^4 - 3y^3 + 4y^2 + 6} \\
 \underline{\pm y^4 \mp y^3 \pm 6y^2} \\
 -2y^3 - 2y^2 + 6 \\
 \underline{\mp 2y^3 \pm 2y^2 \mp 12y} \\
 -4y^2 + 6 + 12y \\
 \underline{\mp 4y^2 \mp 24 \pm 4y} \\
 +30 + 8y
 \end{array}$$

Hence, quotient = $y^2 - 2y - 4$, Remainder = $8y + 30$

$$\begin{array}{r}
 \overline{m - 2} \\
 c. \quad m^2 - 12m + 13 \bigg) \\
 \underline{ \pm m^3 \mp 12m^2 \pm 13m} \\
 - 2m^2 + 24m - 26 \\
 \underline{ \pm 2m^2 \pm 24m \mp 26} \\
 0
 \end{array}$$

Hence, quotient = $m - 2$, remainder = 0

$$\begin{array}{r}
 \overline{2p^3 + 2p^2 - p - 1} \\
 d. \quad 3p^2 - p + 1 \bigg) \\
 \underline{ \pm 6p^5 \mp 2p^4 \pm 2p^3} \\
 6p^4 - 5p^3 - 1 \\
 \underline{ \pm 6p^4 \mp 2p^3} \\
 - 3p^3 - 1 - 2p^2 \\
 \underline{ \mp 3p^3} \\
 - 1 - 3p^2 + p \\
 \underline{ \mp 1 \mp 3p^2 \pm p} \\
 0
 \end{array}$$

Hence, Quotient = $2p^3 + 2p^2 - p - 1$, Remainder = 0

$$\begin{array}{r}
 \overline{x^2 - 4x - 2} \\
 5. \quad x^2 - x + 4 \bigg) \\
 \underline{ \pm x^4 \mp x^3 \pm 4x^2} \\
 - 4x^3 + 2x^2 + 5 \\
 \underline{ \mp 4x^3 \pm 4x^2} \\
 - 2x^2 + 5 + 16x \\
 \underline{ \mp 2x^2 \mp 8 \pm 2x} \\
 13 + 4x
 \end{array}$$

No. $(x^4 - 5x^3 + 6x^2 + 5)$ is not exactly divisible by $(x^2 - x + 4)$

Critical Thinking Skills

$$\begin{array}{r}
 y^2 - 2y - 17 \\
 y^2 - y + 2 \overline{) \quad y^4 - 3y^3 - 13y^2 + 12y + 4} \\
 \underline{\pm y^4 \mp y^3 \pm 2y^2} \\
 -2y^3 - 15y^2 + 12y \\
 \underline{\mp 2y^3 \pm 2y^2 \mp 4y} \\
 -17y^2 + 16y + 4 \\
 \underline{\mp 17y^2 \pm 17y - 34} \\
 -y - 30
 \end{array}$$

Hence, $(-y - 30)$ should be subtracted.

Assessment Time 9.4

1. a. $(m + 4)(m + 3)$ $(x + a)(x + b) = x^2 + (a + b)x + ab$
 $= m^2 + (4 + 3)m + 4 \times 3$
 $= m^2 + 7m + 12$
- b. $(m^2 + 4)(m^2 - 6)$
 $= (m^2)^2 + (4 + (-6))m^2 + 4 \times (-6)$
 $= m^4 - 2m^2 - 24$
- c. $\left(y^2 + \frac{3}{11}\right)\left(y^2 - \frac{2}{11}\right)$
 $= (y^2) + \left\{\frac{3}{11} + \left(\frac{-2}{11}\right)\right\}y^2 + \frac{3}{11} \times \left(\frac{-2}{11}\right)$
 $= y^4 + \frac{1}{11}y^2 - \frac{6}{121}$
 $= y^4 + \frac{y^2}{11} - \frac{6}{121}$
- d. $(9x + 4)(9x - 5)$
 $= (9x)^2 + (4 + (-5))9x + 4 \times (-5)$
 $= 81x^2 - 9x - 20$
2. a. $(x + 4y)^2$ $(a + b)^2 = a^2 + b^2 + 2ab$
 $= (x^2) + (4y)^2 + 2 \times x \times 4y$
 $= x^2 + 16y^2 + 8xy$
- b. $(5m - 3n)^2$ $(a - b)^2 = a^2 + b^2 - 2ab$
 $= (5m)^2 + (3n)^2 - 2 \times 5m \times 3n$

$$= 25m^2 + 9n^2 - 30mn$$

$$\text{c. } (6x^2 - 2y^2)^2 \qquad (a - b)^2 = a^2 + b^2 - 2ab$$

$$= (6x^2)^2 + (2y^2)^2 - 2 \times 6x^2 \times 2y^2$$

$$= 36x^4 + 4y^4 - 24x^2y^2$$

$$\text{d. } (0.7x + 0.5y)^2 \qquad (a + b)^2 = a^2 + b^2 + 2ab$$

$$= (0.7x)^2 + (0.5y)^2 + 2 \times 0.7x \times 0.5y$$

$$= 0.49x^2 + 0.25y^2 + 0.7xy$$

$$\text{e. } \left(\frac{2}{5}m + \frac{4}{3}n\right)^2 \qquad (a + b)^2 = a^2 + b^2 + 2ab$$

$$= \left(\frac{2}{5}m\right)^2 + \left(\frac{4}{3}n\right)^2 + 2 \times \frac{2}{5}m \times \frac{4}{3}n$$

$$= \frac{4}{25}m^2 + \frac{16}{9}n^2 + \frac{16}{15}mn$$

$$\text{f. } \left(\frac{mn}{4} - \frac{p}{3}\right)^2$$

$$= \left(\frac{mn}{4}\right)^2 + \left(\frac{p}{3}\right)^2 - 2 \times \frac{mn}{4} \times \frac{p}{3}$$

$$= \frac{m^2n^2}{16} + \frac{p^2}{9} - \frac{2mnp}{12}$$

$$= \frac{m^2n^2}{16} + \frac{p^2}{9} - \frac{mnp}{6}$$

$$3. \text{ a. } (3x + 4y)(3x - 4y) \qquad (a + b)(a - b) = a^2 - b^2$$

$$= (3x)^2 - (4y)^2$$

$$= 9x^2 - 16y^2$$

$$\text{b. } (a^2 + b^2)(a^2 - b^2) \qquad (a + b)(a - b) = a^2 - b^2$$

$$= (a^2)^2 - (b^2)^2$$

$$= a^4 - b^4$$

$$\text{c. } (1.1m - 0.4)(1.1m + 0.4) \qquad (a + b)(a - b) = a^2 - b^2$$

$$= (1.1m)^2 - (0.4)^2$$

$$= 1.21m^2 - 0.16$$

$$\text{d. } (mn^2 + p)(mn^2 - p) \qquad (a + b)(a - b) = a^2 - b^2$$

$$= (mn^2)^2 - p^2$$

$$= m^2n^4 - p^2$$

$$\text{e. } \left(\frac{x}{2} + \frac{2y}{5}\right)\left(\frac{x}{2} - \frac{2y}{5}\right) \qquad (a+b)(a-b) = a^2 - b^2$$

$$= \left(\frac{x}{2}\right)^2 - \left(\frac{2y}{5}\right)^2 = \frac{x^2}{4} - \frac{4y^2}{25}$$

$$\text{f. } \left(\frac{m^2}{4} - \frac{n^2}{3}\right)\left(\frac{m^2}{4} + \frac{n^2}{3}\right) \qquad (a+b)(a-b) = a^2 - b^2$$

$$= \left(\frac{m^2}{4}\right)^2 - \left(\frac{n^2}{3}\right)^2 = \frac{m^4}{16} - \frac{n^4}{9}$$

$$4. \text{ a. } 106 \times 104$$

$$= (100 + 6) \times (100 + 4) \qquad (x^2 + (a+b)x + ab)$$

$$= (100)^2 + (6 + 4) \times 100 + 6 \times 4$$

$$= 10000 + 1000 + 24 = 11024$$

$$\text{b. } 204 \times 196$$

$$= (200 + 4) \times (200 - 4) \qquad \{(a+b)(a-b) = a^2 - b^2\}$$

$$= (200)^2 - (4)^2$$

$$= 40000 - 16 = 39984$$

$$\text{c. } (205)^2 = (200 + 5)^2$$

$$= (200)^2 + (5)^2 + 2 \times (200) \times (5)$$

$$= 40000 + 25 + 2000 = 42025$$

$$\text{d. } (8.9)^2 = (10 - 1.1)^2$$

$$= (10)^2 + (1.1)^2 - 2 \times 10 \times 1.1$$

$$= 100 + 1.21 - 22 = 79.21$$

$$\text{c. } 142^2 - 141^2 \qquad \{a^2 - b^2 = (a+b)(a-b)\}$$

$$= (142 + 141)(142 - 141)$$

$$= 283 \times 1 = 283$$

$$\text{f. } (999)^2 = (1000 - 1)^2$$

$$= (1000)^2 + (1)^2 - 2 \times 1000$$

$$= 1000000 + 1 - 2000$$

$$= 1000001 - 2000 = 998001$$

$$5. \text{ a. } (5m - 3n)^2 + (5m + 3n)^2$$

$$= 25m^2 + 9n^2 - 30mn + 25m^2 + 9n^2 + 30mn$$

$$= 50m^2 + 18n^2$$

- b. $(2x + 5)^2 - (2x - 5)^2$
 $= (4x^2 + 25 + 20x) - (4x^2 + 36 - 20x)$
 $= 4x^2 + 25 + 20x - 4x^2 - 36 + 20x$
 $= 40x$
- c. $(m^2n - 6p)^2 + 24m^2np$
 $= (m^2n)^2 + (6p)^2 - 2 \times mn \times 6p + 24m^2np$
 $= m^4n^2 + 36p^2 - 12m^2np + 24m^2np$
 $= m^4n^2 + 36p^2 + 12m^2np$
- d. $(2.5m - 1.5n)^2 - (1.5m - 2.5n)^2$
 $= (2.5m)^2 + (1.5n)^2 - 2 \times 2.5m \times 1.5n$
 $\quad - \{ (1.5m)^2 + (2.5n)^2 - 2 \times 1.5m \times 2.5n \}$
 $= 6.25m^2 + 2.25n^2 - 7.5mn - (2.25m^2 + 6.25n^2 - 7.5mn)$
 $= 6.25m^2 + 2.25n^2 - 7.5mn - 2.25m^2 - 6.25n^2 + 7.5mn$
 $= 4m^2 - 4n^2$
- e. $\left(\frac{5}{2}mn - p\right)^2 + \left(\frac{5}{2}mn + p\right)^2$
 $= \left(\frac{5}{2}mn\right)^2 + (p)^2 - 2 \times \frac{5}{2}mn \times p$
 $\quad + \left\{ \left(\frac{5}{2}mn\right)^2 + (p)^2 + 2 \times \frac{5}{2} \times mn \times p \right\}$
 $= \frac{25}{4}m^2n^2 + p^2 - 5mnp + \frac{25}{4}m^2n^2 + p^2 + 5mnp$
 $= \frac{50}{4}m^2n^2 + 2p^2$
 $= \frac{25}{2}m^2n^2 + 2p^2$
- f. $(a + b)(a - b) + (b + c)(b - c) + (c + a)(c - a)$
 $= a^2 - b^2 + b^2 - c^2 + c^2 - a^2 = 0$

6. a. $(3x + 7)^2 - 84x = (3x - 7)^2$
 $= (3x)^2 + (7)^2 + 42x - 84x$
 $= (3x)^2 + (7)^2 - 42x$
 $9x^2 + 49 - 42x = 9x^2 + 49 - 42x$
LHS = RHS

$$\begin{aligned}
 \text{b. } (4pq + 3q)^2 - (4pq - 3q)^2 &= 48pq^2 \\
 (4pq)^2 + (3q)^2 + 2 \times (4pq) \times (3q) - \{(4pq)^2 + (3q)^2 \\
 &\quad - 2 \times (4pq) \times (3q)\} = 48pq^2 \\
 16p^2q^2 + 9q^2 + 24pq^2 - 16p^2q^2 - 9q^2 + 24pq^2 &= 48pq^2 \\
 48pq^2 &= 48pq^2 \\
 \text{LHS} &= \text{RHS}
 \end{aligned}$$

$$\begin{aligned}
 7. \text{ a. } 81m^2 + 54mn + 9n^2, \text{ when } m = 1, n = -2 \\
 &= (9m)^2 + 2 \times 3n \times 9m + (3n)^2 \\
 &= (9m + 3n)^2 \\
 &= (9 \times 1 + 3 \times (-2))^2 \\
 &= (9 - 6)^2 = (3)^2 = 9
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } 16x^2 - 48xy + 36y^2, \text{ where } x = 2, y = -3 \\
 &= (4x)^2 - 2 \times 4x \times 6y + (6y)^2 \\
 &= (4x - 6y)^2 \\
 &= (4 \times 2 - 6 \times (-3))^2 \\
 &= (8 + 18)^2 \\
 &= (26)^2 = 676
 \end{aligned}$$

$$\begin{aligned}
 8. \text{ a. } x + \frac{1}{x} &= 6 \\
 \left(x + \frac{1}{x}\right)^2 &= (6)^2 && \text{(On squaring both side)} \\
 x^2 + 2 \times x \times \frac{1}{x} + \frac{1}{x^2} &= 36 \\
 x^2 + \frac{1}{x^2} &= 36 - 2 \\
 x^2 + \frac{1}{x^2} &= 34 \\
 \text{b. } x^2 + \frac{1}{x^2} &= 34 \\
 \left(x^2 + \frac{1}{x^2}\right)^2 &= (34)^2 \\
 x^4 + \frac{1}{x^4} + 2 \times x^2 \times \frac{1}{x^2} &= 1156
 \end{aligned}$$

$$x^4 + \frac{1}{x^4} = 1156 - 2$$

$$x^4 + \frac{1}{x^4} = 1154$$

9. a. $x - \frac{1}{x} = \sqrt{3}$ (on squaring both side)

$$\left(x - \frac{1}{x}\right)^2 = (\sqrt{3})^2 \Rightarrow x^2 + \frac{1}{x^2} - 2 \times x \times \frac{1}{x} = 3$$

$$x^2 + \frac{1}{x^2} = 3 + 2 \Rightarrow x^2 + \frac{1}{x^2} = 5$$

b. $\left(x^2 + \frac{1}{x^2}\right)^2 = (5)^2$ (On squaring both side)

$$x^4 + \frac{1}{x^4} + 2 \times x^2 \times \frac{1}{x^2} = 25$$

$$x^4 + \frac{1}{x^4} + 2 = 25$$

$$x^4 + \frac{1}{x^4} = 25 - 2$$

$$x^4 + \frac{1}{x^4} = 23$$

10. $\left(x^2 + \frac{1}{x^2}\right) = 47$ $\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2 \times x \times \frac{1}{x}$

$$\left(x + \frac{1}{x}\right)^2 = 47 + 2$$

$$\left(x + \frac{1}{x}\right)^2 = 49$$

$$x + \frac{1}{x} = \sqrt{49} = \pm 7$$

Critical Thinking Skills

$$\begin{aligned} & \{(x+y)(x-y)\}(x^2+y^2)(x^4+y^4)(x^8+y^8) \\ &= \{(x^2-y^2)(x^2+y^2)\}(x^4+y^4)(x^8+y^8) \\ &= \{(x^4-y^4)(x^4+y^4)\}(x^8+y^8) \\ &= (x^8-y^8)(x^8+y^8) \\ &= x^{16}-y^{16} \end{aligned}$$

Revision Time

1. a. is a polynomial
2. a. The degree of $7x^2 + 5x + 2$ is 2
 b. The degree of $5x^2y^3 + 7x^3 + 15$ is 5
 c. The degree of $9m^2 + 7n^3 - 3m^4n^5$ is 9
 d. The degree of $51 - 7x$ is 1
3. a. $3y^2z \times (-7x^3yz^2)$
 $= -21x^3y^{2+1} \times z^{2+1} = -21x^3y^3z^3$
 b. $\left(\frac{-1}{24}a^3b^7\right) \times (18ab^2)$
 $= \left(\frac{-1}{27} \times 18\right)(a^{3+1}) \times (b^{7+2})$
 $= \frac{-2}{3}a^4b^9 = \frac{-2a^4b^9}{3}$
 c. $\left(\frac{5}{9}m^3n^2p\right) \times \left(\frac{-18}{25}mn^3p^2\right)$
 $= \left\{\frac{5}{9} \times \left(\frac{-18}{25}\right)\right\} \times (m^{3+1} \times n^{2+3} \times p^{2+1})$
 $= \frac{-2}{5}m^4n^5p^3$
 d. $\left(\frac{-5}{16}a^3b^2c\right) \times \left(\frac{40}{75}c^3ba^2\right)$
 $= \left(\frac{-5}{16} \times \frac{40}{75}\right)(a^{3+2} \times b^{2+1} \times c^{3+1})$
 $= \frac{-1}{6}a^5b^3c^4 = \frac{-a^5b^3c^4}{6}$
4. a. $7x^2 \times (5x + 5y^2 - 3)$
 $= 7 \times 5 \times x^{2+1} + 7x^2 \times 5y^2 - 7x^2 \times 3$
 $= 35x + 35x^2y^2 - 21x^2$
 b. $10a^2b(0.1a - 0.4b^2)$
 $= 0.1 \times 10 \times a \times a^{2+1} - 0.4 \times 10a \times b^{2+1}$
 $= a^3b - 4ab^3$
 c. $\frac{-4}{27}x^2y^3\left(\frac{9}{2}xyz^2 - \frac{3}{4}z^2x\right)$

$$\begin{aligned}
 &= \frac{-4}{27} \times \frac{9}{2} \times x^{2+1} \times y^{3+1} \times z^2 - \frac{3}{4} \times \left(\frac{-4}{27}\right) \times x^{2+1} \times y^3 \times z^2 \\
 &= \frac{-2}{3} x^3 y^4 z^2 + \frac{1}{9} x^3 y^3 z^2
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } &\frac{1}{2} m^2 n \left(5m - \frac{3}{2} mn + \frac{5}{4} n^3 \right) \\
 &= \frac{1}{2} m^2 n \times 5m - \frac{1}{2} m^2 n \times \frac{3}{2} mn + \frac{1}{2} m^2 n \times \frac{5}{4} n^3 \\
 &= \frac{5m^3 n}{2} - \frac{3}{4} m^3 n^2 + \frac{5m^2 n^4}{8}
 \end{aligned}$$

$$\begin{aligned}
 5. \text{ a. } &(2y + 3) \times (7y - 6 + 8x) \\
 &= 2y(7y - 6 + 8x) + 3(7y - 6 + 8x) \\
 &= 14y^2 - 12y + 16xy + 21y - 18 + 24x \\
 &= 14y^2 + 9y + 16xy + 24x - 18
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } &(4x^2 - y^2) \times (3x + 7y^2) \\
 &= 4x^2(3x^2 + 7y^2) - y^2(3x^2 + 7y^2) \\
 &= 12x^4 + 28x^2 y^2 - 3x^2 y^2 - 7y^4 \\
 &= 12x^4 + 25x^2 y^2 - 7y^4
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } &(4a + 3b)(a^2 - 6ab + 2b^2) \\
 &= 4a(a^2 - 6ab + 2b^2) + 3b(a^2 - 6ab + 2b^2) \\
 &= 4a^3 - 24a^2 b + 8ab^2 + 3a^2 b - 18ab^2 + 6b^3 \\
 &= 4a^3 + 6b^3 - 21a^2 b - 10ab^2
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } &(3x - 4y + 5)(2x + 3y + 2) \\
 &= 3x(2x + 3y + 2) - 4y(2x + 3y + 2) + 5(2x + 3y + 2) \\
 &= 6x^2 + 9xy + 6x - 8xy - 12y^2 - 8y + 10x + 15y + 10 \\
 &= 6x^2 - 12y^2 + xy + 16x + 7 + 10
 \end{aligned}$$

$$\begin{aligned}
 6. \text{ a. } &(3x + 4)(2x - 6) + (3x - 5)(2x + 5) \\
 &= 3x(2x - 6) + 4(2x - 6) + 3x(2x + 5) - 5(2x + 5) \\
 &= 6x^2 - 18x + 8x - 24 + 6x^2 + 15x - 10x - 25 \\
 &= 12x^2 - 5x - 49
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } &(x + 3y)(x - 2y) + (y + 4x)(y - 3x) \\
 &= x(x - 2y) + 3y(x - 2y) + y(y - 3x) + 4x(y - 3x) \\
 &= x^2 - 2xy + 3xy - 6y^2 + y^2 - 3xy + 4xy - 12x^2 \\
 &= -11x^2 + 2xy - 5y^2
 \end{aligned}$$

$$7. \text{ a. } \frac{-25m^2n^3p}{10mn^2p^2} = \frac{-25}{10} \times \frac{m^2n^3p}{mn^2p^2}$$

$$= \frac{-5m^{2-1}n^{3-2}}{2p^{2-1}} = \frac{-5mn}{2p}$$

$$\text{b. } \frac{32x^2y^3z - 8xy^4z^2 + 40x^3yz^2}{-16xyz}$$

$$= \frac{32x^2y^3z}{-16xyz} - \frac{8xy^4z^2}{-16xyz} + \frac{40x^3yz^2}{-16xyz}$$

$$= -2x^{2-1}y^{3-1} + \frac{1}{2}x^{1-1}y^{4-1}z^{2-1} - \frac{5}{2}x^{3-1}y^{1-1}z^{2-1}$$

$$= -2xy^2 + \frac{1}{2}y^3z - \frac{5}{2}x^2z$$

$$8. \text{ a. } \begin{array}{r} x^3 + 3x^2 + 4x + 12 \\ x-2 \overline{) x^4 + x^3 - 2x^2 + 4x - 10} \\ \underline{\pm x^4 \mp 2x^3} \\ 3x^3 - 2x^2 \\ \underline{\pm 3x^3 \mp 6x^2} \\ 4x^2 + 4x \\ \underline{\pm 4x^2 \mp 8x} \\ 12x - 10 \\ \underline{\pm 12x \mp 24} \\ 14 \end{array}$$

$$\text{b. } \begin{array}{r} 3m^3 - 5m^2 + 2m + 4 \\ m^2 + m + 1 \overline{) 3m^5 - 2m^4 + m^2 - 2} \\ \underline{\pm 3m^5 \pm 3m^4} \\ 5m^4 - 3m^3 + m^2 \\ \underline{\mp 5m^4 \mp 5m^3 \mp 5m^2} \\ 2m^3 + 6m^2 \\ \underline{\pm 2m^3 \pm 2m^2 \mp 2m} \\ 4m^2 + 2m - 2 \\ \underline{\pm 4m^2 \pm 4m \pm 4} \\ -6m - 6 \end{array}$$

9. a. $(4x - 5)(4x + 3)$

$$= x^2 + (a + b)x + ab$$

$$= (4x)^2 + (-5 + 3)4x + (-5) \times 3$$

$$= 16x^2 - 8x - 15$$

b. $(7mn + 4)(7mn + 3)$

$$= x^2 + (a + b)x + ab$$

$$= (7mn)^2 + (4 + 3)7mn + 4 \times 3$$

$$= 49m^2n^2 + 49mn + 12$$

c. $\left(\frac{2}{3}mn + \frac{1}{7}p\right)\left(\frac{2}{3}mn - \frac{1}{7}p\right) \quad (a + b)(a - b) = a^2 - b^2$

$$= \left(\frac{2}{3}mn\right)^2 - \left(\frac{1}{7}p\right)^2$$

$$= \frac{4}{9}m^2n^2 - \frac{1}{49}p^2$$

d. $(2.5m - 1.5n)(2.5m + 1.5n) \quad (a - b)(a + b) = (a^2 - b^2)$

$$= (2.5m)^2 - (1.5n)^2$$

$$= 6.25m^2 - 2.25n^2$$

10. $(xy - 32)^2 \quad (a - b)^2 = a^2 + b^2 - 2ab$

$$= (xy)^2 + (32)^2 - 2 \times xy \times 32$$

$$= x^2y^2 + 1024 - 64xy$$

$$= x^2y^2 - 64xy + 1024$$

b. $\left(5y + \frac{2}{3}x\right)^2$

$$= (5y)^2 + \left(\frac{2}{3}x\right)^2 + 2 \times 5y \times \frac{2}{3}x$$

$$= 25y^2 + \frac{4}{9}x^2 + \frac{20}{3}xy$$

c. $(0.4mn - 0.3p)^2$

$$= (0.4mn)^2 + (0.3p)^2 - 2 \times 0.4mn \times 0.3p$$

$$= 0.16m^2n^2 + 0.09p^2 - 0.24mnp$$

d. $\left(\frac{2}{5}a + \frac{3}{4}bc\right)^2$

$$= \left(\frac{2}{5}a\right)^2 + \left(\frac{3}{4}bc\right)^2 + 2 \times \frac{2}{5}a \times \frac{3}{4}bc$$

$$= \left(\frac{4}{5}a\right)^2 + \left(\frac{3}{4}bc\right)^2 + 2 \times \frac{2}{5}a \times \frac{3}{4}bc$$

$$= \frac{4a^2}{25} + \frac{9}{16}b^2c^2 + \frac{12}{20}abc$$

$$= \frac{4a^2}{25} + \frac{9}{16}b^2c^2 + \frac{3}{5}abc$$

$$\begin{aligned} 11. \text{ a. } & (mn + np)^2 - 4mn^2p \\ &= (mn)^2 + (np)^2 + 2 \times (mn) \times (np) - 4mn^2p \\ &= m^2n^2 + n^2p^2 + 2mn^2p - 4mn^2p \\ &= m^2n^2 + n^2p^2 - 2mn^2p \\ &= (mn - np)^2 \end{aligned}$$

$$\begin{aligned} \text{b. } & (9x - 5y)^2 + 180xy \\ &= (9x)^2 + (5y)^2 - 2 \times 9x \times 5y + 180xy \\ &= 81x^2 + 25y^2 - 90xy + 180xy \\ &= 81x^2 + 25y^2 + 90xy \\ &= (9x + 5y)^2 \end{aligned}$$

$$\begin{aligned} 12. \text{ a. } & (102)^2 = (100 + 2)^2 \\ &= (100)^2 + (2)^2 + 2 \times 100 \times 2 \\ &= 10000 + 4 + 400 = 10404 \end{aligned}$$

$$\begin{aligned} \text{b. } & 78 \times 82 = (80 - 2)(80 + 2) \\ &= (80)^2 - (2)^2 \\ &= 6400 - 4 = 6396 \end{aligned}$$

$$\begin{aligned} \text{c. } & (5.2)^2 = (5 + 0.2)^2 \\ &= (5)^2 + (0.2)^2 + 2 \times 5 \times 0.2 \\ &= 25 + 0.04 + 2 = 27.04 \end{aligned}$$

$$\begin{aligned} \text{d. } & (12.1)^2 - (7.9)^2 & (a)^2 - (b)^2 = (a + b)(a - b) \\ &= (12.1 + 7.9)(12.1 - 7.9) \\ &= 20 \times 4.2 = 84 \end{aligned}$$

$$13. \text{ a. } \frac{4.7 \times 4.7 + 2 \times 4.7 \times 3.3 + 3.3 \times 3.3}{4.7 \times 4.7 - 3.3 \times 3.3}$$

$$\begin{aligned}
 &= \frac{(4.7)^2 \times 2 \times (4.7) \times (3.3) + (3.3)^2}{(4.7)^2 - (3.3)^2} \\
 &= \frac{(4.7 + 3.3)^2}{(4.7 + 3.3)(4.7 - 3.3)} \\
 &= \frac{(4.7 + 3.3)}{(4.7 - 3.3)} = \frac{8.0}{1.4} = \frac{80}{14} = \frac{40}{7}
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } &\frac{6.7 \times 6.7 - 4.3 \times 4.3}{6.7 - 4.3} \\
 &= \frac{(6.7)^2 - (4.3)^2}{6.7 - 4.3} \\
 &= \frac{(6.7 + 4.3)(6.7 - 4.3)}{(6.7 - 4.3)} = (6.7 + 4.3) = 11
 \end{aligned}$$

$$\begin{aligned}
 14. \quad \left(x - \frac{1}{x}\right) &= x^2 + \frac{1}{x^2} - 2 \times x \times \frac{1}{x} \\
 &= \left(x - \frac{1}{x}\right)^2 = 38 - 2 = \left(x - \frac{1}{x}\right)^2 = 36
 \end{aligned}$$

$$x - \frac{1}{x} = \sqrt{36} = \pm 6$$

$$\begin{aligned}
 15. \quad \left(x - \frac{1}{x}\right) &= x^2 + \frac{1}{x^2} - 2 \\
 &= \left(x + \frac{1}{x}\right)^2 - 4 = 8^2 - 4 \\
 &= 64 - 4 = 60
 \end{aligned}$$

$$\begin{aligned}
 \therefore x - \frac{1}{x} &= \pm \sqrt{60} \\
 &= \pm 2\sqrt{15}
 \end{aligned}$$

Mental Zone

- | | |
|-------------------|-------------------------|
| 1. Monomial | 2. Trinomial |
| 3. 4 | 4. 5 |
| 5. $-15x^2y^3z$ | 6. $\frac{-2}{3}m^5n^2$ |
| 7. $9x^2 - 25y^2$ | 8. 18000 |

Multiple Choice Questions

- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (b) | 2. (c) | 3. (a) | 4. (b) | 5. (c) |
| 6. (b) | 7. (d) | 8. (a) | 9. (c) | 10. (b) |

CHAPTER-10: MENSURATION

1. Total area of plot = Length $\times$ Breadth

$$= 50 \text{ m} \times 50 \text{ m} = 2500 \text{ m}^2$$

$$\text{Total area of the house} = 40 \text{ m} \times 35 \text{ m}$$

$$= 1400 \text{ m}^2$$

$$\text{Area of garden} = (2500 - 1400) = 1100 \text{ m}^2$$

$$\text{Hence, the cost of developing garden} = ₹ (1100 \times 105)$$

$$= ₹ 1,15,500$$

Hence, the cost of developing garden is ₹ 1,15,500

2. Area of quadrilateral = $\frac{1}{2} \times 28 \times (8.4 + 4.6)$

$$= 14 \times 18.0 = 252 \text{ cm}^2$$

3. Area of rhombus = $\frac{1}{2} \times d_1 \times d_2$

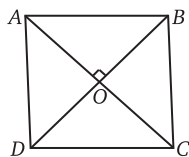
$$= \frac{1}{2} \times 24 \times 18$$

$$= 12 \times 18 = 216 \text{ cm}^2$$

4. Let $ABCD$ be a rhombus, $AB = 15 \text{ cm}$, $AC = 18 \text{ cm}$

$$\begin{aligned} \text{So, } OA &= \frac{1}{2} \times AC \\ &= \frac{1}{2} \times 18 = 9 \text{ cm} \end{aligned}$$

$$AB = 15 \text{ cm}$$



Now, in right angle $\triangle OAB$, by Pythagoras theorem

$$(AO)^2 = OA^2 + OB^2$$

$$(15)^2 = (9)^2 + (OB)^2$$

$$225 = 81 + (OB)^2$$

$$225 - 81 = (OB)^2$$

$$144 = (OB)^2$$

$$OB = \sqrt{12} \text{ cm}$$

$$BD = 2 \times OB$$

$$= 2 \times 12 = 24 \text{ cm}$$

$$\text{So, area of rhombus} = \frac{1}{2} \times d_1 \times d_2$$

$$= \frac{1}{2} \times 18 \times 24$$

$$= 12 \times 18 = 216 \text{ cm}^2$$

5. Let the other parallel side be x .

$$\begin{aligned} \text{Area of a trapezium} &= \frac{1}{2} \times (\text{sum of parallel sides}) \\ &\quad \times \text{Perpendicular distance between them} \end{aligned}$$

$$480 = \frac{1}{2} \times (44 + x) \times 12$$

$$\frac{480}{6} = 44 + x$$

$$80 = 44 + x$$

$$x = 80 - 44 = 36$$

The other parallel side is 36 m.

6. Let one parallel side be x cm, then other parallel side will be $(x + 8)$ cm.

$$\begin{aligned} \text{Area of trapezium} &= 720 \text{ cm}^2 \\ &= \frac{1}{2} \times (x + 8 + x) \times 18 = 720 \\ &= (2x + 8) \times 9 = 720 \end{aligned}$$

$$2x + 8 = \frac{720}{9}$$

$$2x + 8 = 80 - 8$$

$$2x = 72$$

$$x = \frac{72}{2} = 36 \text{ m}$$

$$x + 8 = 36 + 8 = 44 \text{ m}$$

7. Let one parallel side be x .

The other parallel side be $2x$.

$$\text{Area of trapezium} = 360 \text{ m}^2$$

$$\frac{1}{2} (x + 2x) \times 12 = 360$$

$$3x \times 6 = 360$$

$$3x = \frac{360}{6} = 60$$

$$3x = 60 \Rightarrow x = \frac{60}{3} = 20 \text{ m}$$

$$2x = 2 \times 20 = 40 \text{ cm}$$

8. Let $PQRS$ is a trapezium in which $PQ \parallel RS$

Let $PQ = 30$ cm, then $SR = 20$ cm

and $PS = QR = 13$ cm

Now draw $QN \perp RS$

So, $PQMS$ is a parallelogram

and $QM = PS = 13$ cm

$$SM = PQ = 30 \text{ cm}$$

So, $MR = SR - SM = 30 - 20 = 10$ cm

Now in by Pythagoras theorem,

$$(QM)^2 = (QN)^2 + (MN)^2$$

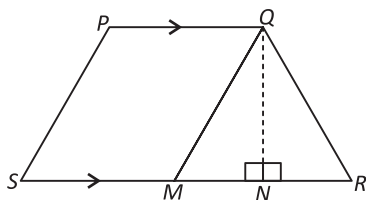
$$(13)^2 = (QN)^2 + (5)^2$$

$$QN^2 = 169 - 25 = 144$$

$$QN = \sqrt{144} = 12 \text{ cm}$$

$$\begin{aligned} \text{Area of trapezium} &= \frac{1}{2} \times (30 + 20) \times 12 \\ &= \frac{1}{2} \times 50 \times 12 \\ &= 25 \times 12 = 300 \text{ cm}^2 \end{aligned}$$

Hence, the area of trapezium is 300 cm^2 .



$$\begin{aligned} 9. \text{ Area of trapezium} &= \frac{1}{2} \times (\text{sum of parallel side}) \\ &\quad \times (\text{Perpendicular distance}) \\ &= \frac{1}{2} \times (30 + 20) \times 20 \\ &= \frac{1}{2} \times 50 \times 20 = 500 \text{ cm}^2 \end{aligned}$$

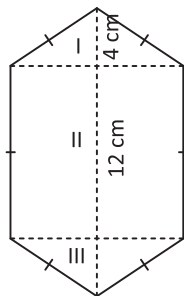
SEL-Behaviour

Area of part I = Area of part III

$$= \frac{1}{2} \times 12 \times 4 = 24 \text{ cm}^2$$

Area of part III = $12 \times 12 = 144 \text{ cm}^2$

$$\begin{aligned} \text{So, Area of cake} &= 2 \times 24 + 144 \\ &= 192 \text{ cm}^2 \end{aligned}$$



Critical Thinking Skills

Area of outer dimensions = $30 \text{ cm} \times 24 \text{ cm} = 720 \text{ cm}^2$

Area of inner dimensions = $18 \text{ cm} \times 16 \text{ cm}$

Area of width = Area of other dimensions

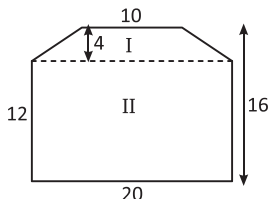
– Area of inner dimension

$$= 720 - 288 = 432 \text{ cm}^2$$

Assessment Time 10.2

1. a. Area of part I trapezium = $\frac{1}{2} (10 + 20) \times 4 = 60 \text{ cm}^2$

Area of part II = $20 \times 12 = 24 \text{ cm}^2$



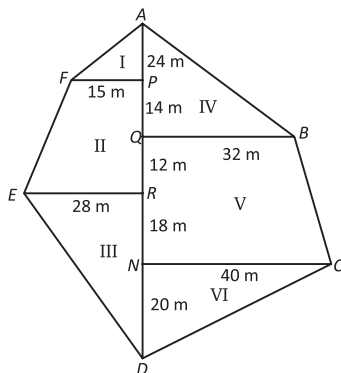
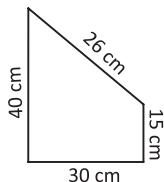
Total area of the parallelogram = $60 + 24 = 84 \text{ cm}^2$

b. Area of trapezium = $\frac{1}{2} (40 + 15) \times 30$

$$= 55 \times 15 = 825 \text{ cm}^2$$

2. a. Area of part I = Area of $\triangle APF$

$$= \frac{1}{2} \times 15 \times 24 = 180 \text{ m}^2$$



Area of part II = $\frac{1}{2} \times (15 + 28) \times 26 = 559 \text{ m}^2$

Area of part III = $\frac{1}{2} \times 28 \times 38 = 532 \text{ m}^2$

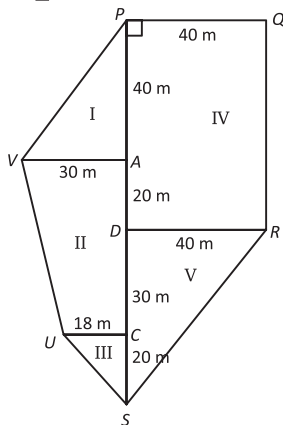
Area of part IV = $\frac{1}{2} \times 32 \times 24 = 384 \text{ m}^2$

Area of part V = $\frac{1}{2} (32 + 40) \times 30 = 1080 \text{ m}^2$

$$\text{Area of part VI} = \frac{1}{2} \times 40 \times 20 = 400 \text{ m}^2$$

$$\begin{aligned} \text{Total are} &= 180 + 559 + 532 + 384 + 1080 + 400 \\ &= 3135 \text{ m}^2 \end{aligned}$$

b. Area of part I = $\frac{1}{2} \times 40 \times 30 = 600 \text{ m}^2$



$$\text{Area of part II} = \frac{1}{2} \times (30 + 18) \times 50 = 1200 \text{ m}^2$$

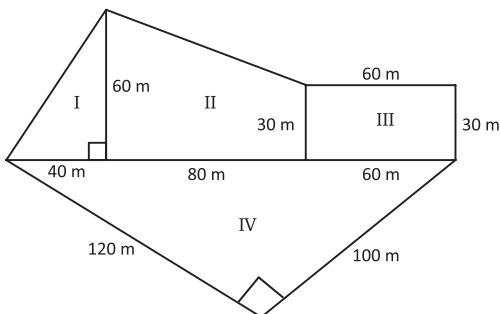
$$\text{Area of part III} = \frac{1}{2} \times 18 \times 20 = 180 \text{ m}^2$$

$$\text{Area of part IV} = 40 \times 60 = 2400 \text{ m}^2$$

$$\text{Area of part V} = \frac{1}{2} \times 40 \times 50 = 1000 \text{ m}^2$$

$$\begin{aligned} \text{Total area of field} &= 600 + 1200 + 180 + 2400 + 1000 \\ &= 5380 \text{ m}^2 \end{aligned}$$

3. Area of part I = $\frac{1}{2} \times 40 \times 60 = 1200 \text{ m}^2$



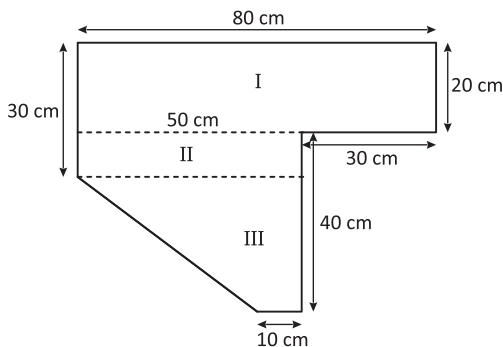
$$\text{Area of part II} = \frac{1}{2}(60+30) \times 80 = 3600 \text{ m}^2$$

$$\text{Area of part III} = 60 \times 30 = 1800 \text{ m}^2$$

$$\text{Area of part IV} = \frac{1}{2} \times 120 \times 100 = 6000 \text{ m}^2$$

$$\begin{aligned} \text{Total area} &= 1200 + 3600 + 1800 + 6000 \\ &= 12600 \text{ m}^2 \end{aligned}$$

4. $\text{Area of part I} = 80 \times 20 = 1600 \text{ cm}^2$



$$\text{Area of part II} = 50 \times 10 = 500 \text{ cm}^2$$

$$\text{Area of part III} = \frac{1}{2} \times (50 + 10) \times 30 = 900 \text{ cm}^2$$

$$\text{Total area} = 1600 + 500 + 900 = 3000 \text{ cm}^2$$

Assessment Time 10.3

1. Length of the room (l) = 10 m

Breadth of the room (b) = 8 m

Height of the room (h) = 6 m

$$\begin{aligned} \text{Lateral surface area of room} &= 2 \times h \times (l + b) \\ &= 2 \times 6 (10 + 8) \\ &= 12 \times 18 = 216 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Total surface area of room} &= 2(lb + bh + hl) \\ &= 2(10 \times 8 + 8 \times 6 + 6 \times 10) \\ &= 2(80 + 48 + 60) \\ &= 2(140 + 48) \\ &= 2 \times 188 = 376 \text{ m}^2 \end{aligned}$$

$$\begin{aligned}
 2. \text{ Total surface area of cube} &= 6 \times (\text{side})^2 \\
 &= 6 \times (12)^2 \\
 &= 6 \times 144 = 864 \text{ cm}^2
 \end{aligned}$$

$$3. \text{ Length of the box } (l) = 32 \text{ cm}$$

$$\text{Breadth of the box } (b) = 28 \text{ cm}$$

$$\text{Height of the box } (h) = 20 \text{ cm}$$

$$\begin{aligned}
 \text{Total surface area of box} &= 2(lb + bh + hl) \\
 &= 2(32 \times 28 + 28 \times 20 + 20 \times 32) \\
 &= 2(896 + 560 + 640) \\
 &= 2 \times 2096 = 4192 \text{ cm}^2
 \end{aligned}$$

Cost of wooden box if cost of wood used for it is ₹ 25.50 per sq. cm.

$$\begin{aligned}
 &= ₹ (4192 \times 25.50) \\
 &= ₹ 106896
 \end{aligned}$$

Hence, the cost of wood is ₹ 1,06,896

$$\begin{aligned}
 4. \text{ Area of tank} &= 2h + (l + b) + l \times b \\
 &= 2 \times 4 \times (10 + 8) + 10 \times 8 \\
 &= 8 \times 18 + 80 \\
 &= 144 + 80 = 224
 \end{aligned}$$

$$\begin{aligned}
 \text{Cost of iron sheet at the rate of ₹ 50 per sq meter} &= 224 \times 50 \\
 &= ₹ 11,200
 \end{aligned}$$

$$5. \text{ Let the length, breadth and height be } 4x, 2x \text{ and } x.$$

$$\text{Total surface area} = 2800 \text{ m}^2$$

$$2800 = 2(4x \times 2x + 2x \times x + x \times 4x)$$

$$2800 = 16x^2 + 4x^2 + 8x^2$$

$$2800 = 28x^2$$

$$\frac{2800}{28} = x^2$$

$$100 = x^2$$

$$x = \sqrt{100} = 10 \text{ m}$$

$$4x = 4 \times 10 = 40 \text{ m}, \quad 2x = 2 \times 10 = 20 \text{ m}$$

$$x = 10 \text{ m}$$

6. Length (l) = 10m, breadth (b) = 8 m and height (h) = 5 m

$$\begin{aligned}\text{Area of four walls and coiline} &= 2 \times h \times (l + b) + l \times b \\ &= 2 \times 5 \times (10 + 8) + 10 \times 8 \\ &= 10 \times 18 + 80 = 180 + 80 \\ &= 260 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{Cost of washing it at the rate of ₹ 45 per m}^2 \\ &= 260 \times 45 = ₹ 11,700\end{aligned}$$

7. Length (l) = 22.5 cm, breadth (b) = 10 cm
and height (h) = 7.5 cm

$$\begin{aligned}\text{Area of brick} &= 2(lb + bh + hl) \\ &= 2(22.5 \times 10 + 10 \times 7.5 + 7.5 \times 22.5) \\ &= 2(225 + 75 + 168.75) \\ &= 2 \times 46 \times 75 = 957.50\end{aligned}$$

$$\text{Number of brick} = \frac{9.375 \times 100 \times 100}{937.50} = 100$$

8. Length (l) = 30 m, breadth (b) = 20 m, height (h) = 3 m

$$\begin{aligned}\text{Area of swimming pool} &= 2h \times (l + b) + l \times b \\ &= 2 \times 3 \times (30 + 20) + 30 \times 20 \\ &= 6 \times 50 + 600 \\ &= 300 + 600 = 900 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{Cost of cementing its floor and walls at the rate of ₹ 48 per m}^2 \\ &= 900 \times 48 = ₹ 43,200\end{aligned}$$

9. Length (l) = 10 cm, breadth (b) = 8 m, height (h) = 4 m

$$\begin{aligned}\text{Length of the longest pole} &= \text{Length of the diagonal of room} \\ &= \sqrt{l^2 + b^2 + h^2} \\ &= \sqrt{10^2 + 8^2 + 4^2} \\ &= \sqrt{180} = 6\sqrt{5} \\ &= 6 \times 2.26 = 13.42\end{aligned}$$

Hence, 13.42 m long pole can be placed in the room along diagonally.

SEL-Helping

10. Area of tarpaulin = $2h(l + b) + l \times b$
 $= 2 \times 3(10 + 8) + 10 \times 8$

$$= 6 \times 18 + 80$$

$$= 108 + 80 = 188 \text{ m}^2$$

$$\text{Area of 10 shelters} = 188 \times 10 = 1880 \text{ m}^2$$

$$\text{Width of tarpaulin} = 80 \text{ cm} = 0.80 \text{ m}$$

$$\text{Length of tarpaulin} = \frac{1880}{0.80} = 2350 \text{ m}$$

Critical Thinking Skills

$$\text{Total cost of paper} = ₹ 4500, \text{ Rate} = ₹ 25$$

$$\text{Area of four walls} = \frac{4500}{25}$$

$$2(l + b) \times h = 180 \text{ m}$$

$$40 \times h = 180$$

$$h = \frac{180}{40} = 4.5 \text{ m}$$

Assessment Time 10.4

1. Total surface of cube = $6 \times (\text{side})^2$

$$600 = 6 \times (\text{side})^2$$

$$\frac{600}{6} = (\text{side})^2 \Rightarrow 100 = (\text{side})^2$$

$$\text{Side} = \sqrt{100} = 10 \text{ cm}$$

$$\text{Volume of cube} = (\text{side})^3$$

$$= (10)^3 = 1000 \text{ cm}^3$$

2. Volume of cube = 512 cm^3

$$a^3 = (512)^3 \text{ cm}^3$$

$$a = 8 \text{ cm}$$

$$\text{Total surface area of cube} = 6 \times (\text{side})^2$$

$$= 6 \times (8)^2$$

$$= 4 \times 64$$

$$= 256 \text{ cm}^2$$

3. Length (l) = 8, breadth (b) = 6, height (h) = 2

$$\text{Volume of cuboid} = l \times b \times h$$

$$= 8 \times 6 \times 2 = 96 \text{ cm}^3$$

$$1 \text{ L} = 1000 \text{ cm}^3 = 96000 \text{ L}$$

4. Capacity of the tank = 480 kL

$$1 \text{ kL} = 1 \text{ m}^3$$

$$480 \text{ kL} = 480 \times 1 \text{ m}^3 = 480 \text{ m}^3$$

$$\text{Length of the tank } (l) = 12 \text{ m}$$

$$\text{Breadth of the tank } (b) = 5 \text{ m}$$

$$\text{Volume of the tank} = 480 \text{ m}^3$$

$$l \times b \times h = 480 \text{ m}^3$$

$$12 \times 5 \times h = 480 \text{ m}^3$$

$$h = \frac{480}{12 \times 5} = 8 \text{ m}$$

Hence, the depth of the tank is 8 m.

5. Volume of three metal cubes = $5^3 + 4^3 + 3^3$
 $= 125 + 64 + 27 = 216$

Let side of new cube so formed be x cm.

$$\therefore x^3 = 216$$

$$x = \sqrt[3]{216} = 6 \text{ cm}$$

6. Number of cubical blocks = $\frac{12 \times 12 \times 12}{6 \times 3 \times 0.90}$
 $= 106.67 = 106$

7. a. Capacity of the box = Internal volume of box
 $= 60 \times 50 \times 40$
 $= 1,20,000 \text{ cm}^3$

b. External volume = $62 \times 52 \times 41$
 $= 1,32,184 \text{ cm}^3$

$$\text{Volume of wood used} = 1,32,184 - 1,20,000$$

$$= 12,184 \text{ cm}^3$$

$$\text{Weight of the empty box} = (12184 \times 25) \text{ g}$$

$$= 304600 \text{ g}$$

$$= 304.600 \text{ kg}$$

8. Let rise of water level be x cm.

Volume of cube = volume of water displaced by cube

$$10^3 = 25 \times 20 \times x$$

$$x = \frac{1000}{25 \times 20} = 2 \text{ cm}$$

9. a. Length cube = 5 cm

$$\text{New cuboid} = 5 \times 4 = 20 \text{ cm}$$

$$\text{New breadth of cuboid} = 5 \text{ cm}$$

$$\text{New height of cuboid} = 5 \text{ cm}$$

Ratio of volume of new solid to original cube

$$= \frac{20 \times 5 \times 5}{5 \times 5 \times 5} = 4 : 1$$

$$\begin{aligned} \text{b. Ratio of surface area} &= \frac{2(20 \times 5 + 5 \times 5 + 5 \times 20)}{6 \times 5^2} \\ &= \frac{2(100 + 25 + 100)}{150} \\ &= \frac{2 \times 225}{150} = 3 : 1 \end{aligned}$$

$$10. \text{Volume of one tank} = 2 \times 1.5 \times 1 = 3 \text{ m}^3$$

$$\text{Volume of 4 tanks} = 3 \times 4 = 12 \text{ m}^3$$

$$\therefore 1 \text{ m}^3 = 1000 \text{ L}$$

$$\therefore 12 \text{ m}^3 = 12000 \text{ L}$$

Assessment Time 10.5

1. Here, $r = 14 \text{ cm}$, $h = 20 \text{ cm}$

$$\begin{aligned} \therefore \text{Volume of cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times 14^2 \times 20 \\ &= 12320 \text{ cm}^3 \\ \text{Curved surface area} &= 2 \pi r h \\ &= 2 \times \frac{22}{7} \times 14 \times 20 \\ &= 1760 \text{ cm}^2 \end{aligned}$$

2. Here, $\text{CSA} = 3300 \text{ cm}^2$, $2 \pi r = 110 \text{ cm}$

$$2 \pi r = 110 = 2 \times \frac{22}{7} \times r = 110$$

$$r = \frac{110 \times 7}{44} = 17.5 \text{ cm}$$

$$2 \pi r h = 3300$$

$$h = \frac{3300}{110} = 30 \text{ cm}$$

$$\begin{aligned}\text{Volume of cylinder} &= \pi r^2 h \\ &= \frac{22}{7} \times (17.5)^2 \times 30 \\ &= 28,875 \text{ cm}^3\end{aligned}$$

3. Here, volume = 474.32 cm^3 , $h = 77 \text{ cm}$

$$\begin{aligned}\text{Volume} &= 474.32 \text{ cm}^3 \\ \Rightarrow \pi r^2 h &= 474.32 \\ \Rightarrow \frac{22}{7} \times r^2 \times 77 &= 474.32 \\ \Rightarrow r^2 &= \frac{474.32}{22 \times 11} \\ \Rightarrow r &= \sqrt{1.96} = 1.4 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{So, total surface area} &= 2\pi r(h + r) \\ &= 2 \times \frac{22}{7} \times 1.4(77 + 1.4) \\ &= 689.92 \text{ cm}^2\end{aligned}$$

4. Here, $r = 88 \text{ cm}$, $h = 2.4 \text{ m}$

$$\begin{aligned}\text{Total surface area of the closed tank} &= 2\pi r(h + r) \\ &= 2 \times \frac{22}{7} \times \frac{88}{100}(2.4 + 0.88) \\ &= 18.14 \text{ m}^2\end{aligned}$$

$$\text{Cost of tank} = ₹ (18.14 \times 350) = ₹ 6350$$

6. Here, diameter = $84 \text{ cm} = 0.84 \text{ m}$

$$\text{Length } (h) = 1.8 \text{ m}$$

$$\begin{aligned}\text{CSA of road roller} &= 2\pi r h \\ &= 2 \times \frac{22}{7} \times \frac{0.84}{2} \times 1.8 \\ &= 4.752 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{So, area of the road} &= 4.752 \times 800 \\ &= 3801.6 \text{ m}^2 \text{ or } 3802 \text{ m}^2\end{aligned}$$

7. Here, $L = 44 \text{ cm}$, $b = 16 \text{ cm}$

$$\begin{aligned}\therefore 2\pi r &= 44 \\ r &= \frac{44 \times 7}{2 \times 22} = 7 \text{ cm}\end{aligned}$$

$$\text{and } h = 16 \text{ cm}$$

$$\therefore \text{Volume of the cylinder} = \pi r^2 h$$

$$\begin{aligned}
 &= \frac{22}{7} \times 7^2 \times 16 \\
 &= 2464 \text{ cm}^2
 \end{aligned}$$

8. Let level of water rises be x cm.

$\therefore$ Volume of water in rectangular vessel = volume of water in cylindrical vessel

$$\begin{aligned}
 \Rightarrow 48 \times 36 \times 24 &= \pi r^2 h \\
 &= \frac{22}{7} \times (10.5)^2 \times x \\
 \Rightarrow x &= \frac{48 \times 36 \times 24 \times 7}{22 \times 10.5 \times 10.5} \\
 &= 120 \text{ cm or } 1.20 \text{ m}
 \end{aligned}$$

9. Let length of wire be x cm.

Volume of cylindrical wire = volume of solid cylindrical

$$\begin{aligned}
 \Rightarrow \pi r^2 x &= 7^2 \times 15 \\
 \Rightarrow \left(\frac{1}{10}\right) \times x &= 49 \times 15 \times 100 \\
 &= 73500 \text{ cm} = 735 \text{ m}
 \end{aligned}$$

SDG

10. Volume of green dustbin = $30 \times 25 \times 36$
 $= 27000 \text{ cm}^3$

$$\begin{aligned}
 \text{Volume of blue dustbin} &= \pi r^2 h \\
 &= \frac{22}{7} \times 14^2 \times 36 \\
 &= 22,176 \text{ cm}^3
 \end{aligned}$$

Revision Time

1. Total surface area of coin = $2(lb + bh + hl)$
 $= 2(48 \times 36 + 36 \times 24 + 24 \times 48)$
 $= 2(1728 + 864 + 1152)$
 $= 7488 \text{ cm}^2$
 $\therefore$ Cost of wood = ₹ (7488×25.50)
 $= ₹ 1,90,944$

2. Let edge of cube be x .

$$\text{Surface area of cube} = 150 \text{ cm}^2$$

$$\Rightarrow 6x^2 = 150$$

$$\Rightarrow x^2 = \frac{150}{6} = 25$$

$$\Rightarrow x = \sqrt{25} = 5 \text{ cm}$$

$$\begin{aligned}\therefore \text{Volume of cube} &= x^3 \\ &= 5^3 = 125 \text{ cm}^3\end{aligned}$$

3. Area of four walls $= 2h(l + b)$
 $= 2 \times 4(10 + 8)$
 $= 8 \times 18 = 144 \text{ m}^2$

$$\text{Area of ceiling} = 10 \times 8 = 80 \text{ m}^2$$

$$\text{Total area of four walls and ceiling} = 144 + 80 = 224 \text{ m}^2$$

$$\begin{aligned}\therefore \text{Cost of whitewashing} &= ₹ (224 \times 150) \\ &= ₹ 33,600\end{aligned}$$

4. Here, Diameter of container $= 14 \text{ cm}$, Radius $= 7 \text{ cm}$
Height of label $= 18 - 4 = 14 \text{ cm}$

$$\begin{aligned}\therefore \text{Area of the label} &= 2\pi rh \\ &= 2 \times \frac{22}{7} \times 7 \times 14 \\ &= 616 \text{ m}^2\end{aligned}$$

5. Ratio of radius to height $= 2 : 3$

Let radius be $2x$ and height be $3x$.

$$\text{Volume of cylinder} = 1617 \text{ cm}^3$$

$$\Rightarrow \pi r^2 h = 1617$$

$$\Rightarrow \frac{22}{7} \times (2x)^2 \times 3x = 1617$$

$$\Rightarrow x^3 = \frac{1617 \times 7}{22 \times 12} = 42.875$$

$$\Rightarrow x^3 = (3.5)^3$$

$$\Rightarrow x = 3.5$$

$$\therefore \text{Radius} = 2 \times 3.5 = 7 \text{ cm}$$

$$\text{and height} = 3 \times 3.5 = 10.5 \text{ cm}$$

$$\therefore \text{Total surface area} = 2\pi r(h + r)$$

$$\begin{aligned}
 &= 2 \times \frac{22}{7} \times 7 (10.5 + 7) \\
 &= 44 \times 17.5 = 770 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 6. \text{ Volume of air} &= l \times b \times h \\
 &= 10 \times 8 \times 4 = 320 \text{ m}^3
 \end{aligned}$$

$$\begin{aligned}
 7. \text{ Volume of rain water} &= \text{Area} \times \text{height} \\
 &= 10 \times 10000 \times \frac{10}{100} \text{ m}^3 \\
 &= 10000 \text{ m}^3
 \end{aligned}$$

$$\begin{aligned}
 \text{Since,} \quad 1 \text{ m}^3 &= 1 \text{ kL} \\
 \therefore 10000 \text{ m}^3 &= 10,000 \text{ kL}
 \end{aligned}$$

$$\begin{aligned}
 8. \text{ Number of wooden crate} &= \frac{\text{Volume of godown}}{\text{Volume of one crate}} \\
 &= \frac{50 \times 40 \times 18}{1.5 \times 0.90 \times 0.60} \\
 &= 44,444.44 = 44,444
 \end{aligned}$$

$$\begin{aligned}
 9. \text{ Number of cubical block} &= \frac{400 \times 400 \times 400}{4 \times 4 \times 4} \\
 &= 10,00,000
 \end{aligned}$$

$$\begin{aligned}
 10. \text{ Volume of pit} &= 10 \times 8 \times 4 \\
 &= 320 \text{ m}^3
 \end{aligned}$$

$$\begin{aligned}
 \text{Area of remaining field} &= 80 \times 65 - 10 \times 8 \\
 &= 5200 - 80 = 5120 \text{ m}^2
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{ Rise in level} &= \frac{320}{5120} \\
 &= 0.0625 \text{ m} = 6.25 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 11. \text{ Here, } r &= \frac{1.8}{2} = 0.9 \text{ cm}, \quad R = 0.9 + 2 = 2.9 \text{ cm} \\
 h &= 20 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total surface area} &= 2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2) \\
 &= 2\pi h(R + r) + 2\pi(R^2 - r^2) \\
 &= 2 \times \frac{22}{7} \times 20(2.9 + 0.9) \\
 &\quad + 2 \times \frac{22}{7} [(2.9)^2 - (0.9)^2]
 \end{aligned}$$

$$= 477.71 + 47.77$$

$$= 525.48 \text{ cm}^2$$

12. Given, $r = 18 \text{ cm}$, $R = 22 \text{ cm}$

Let radius of new cylinder be x and height be h .

$\therefore$ Volume of new cylinder = volume of hollow cylinder

$$\Rightarrow \pi x^2 h = \pi h (22^2 - 18^2)$$

$$\Rightarrow x^2 = 160$$

$$\Rightarrow x = \sqrt{160} = 12.65 \text{ cm}$$

13. Let each edge of cube be x .

a. Surface area = $6x^2$, New edge = $2x$

$\therefore$ New surface area = $6(2x)^2$

$$= 24x^2$$

$$\text{So, their ratio} = \frac{24x^2}{6x^2} = 4$$

So, surface area will be four times.

b. New volume = $(2x)^3 = 8x^3$

$$\text{So, their ratio} = \frac{8x^3}{x^3} = \frac{8}{1}$$

So, volume will be 8 times.

14. Given, $L = 40 \text{ cm}$, $B = 33 \text{ cm}$

$$\therefore 2\pi r = 33$$

$$\Rightarrow 2 \times \frac{22}{7} r = 33 \Rightarrow r = \frac{33 \times 7}{44}$$

$$\Rightarrow r = 5.25 \text{ cm}$$

and $h = 40 \text{ cm}$

So, volume of cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times (5.25)^2 \times 40 = 3465 \text{ cm}^3$$

15. a. Area of shaded region = $\frac{1}{2} \times 6 \times 8$

$$= 24 \text{ cm}^2$$

$$[\therefore h = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8 \text{ cm}]$$

b. Area of shaded region = $12 \times 12 - \frac{1}{2} \times 12 \times 12$

$$= 144 - 72 = 72 \text{ cm}^2$$

16. Total surface area of cylindrical vessel = $2(2\pi rh + \pi r^2)$

$$= 2\left(2 \times \frac{22}{7} \times 12 \times 21 + \frac{22}{7} \times 12^2\right)$$

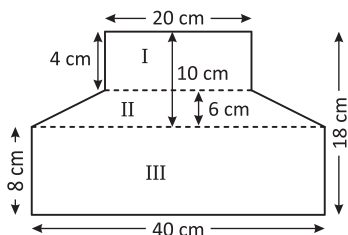
$$= 2(1584 + 452.57)$$

$$= 2 \times 2036.57 \text{ cm}^2$$

$$= 4073.14 \text{ cm}^2$$

$$\therefore \text{Cost of plating} = 4073.14 \times \frac{7.33}{100} = ₹ 298.46$$

17. Area of part I = $20 \times 4 = 80 \text{ cm}^2$

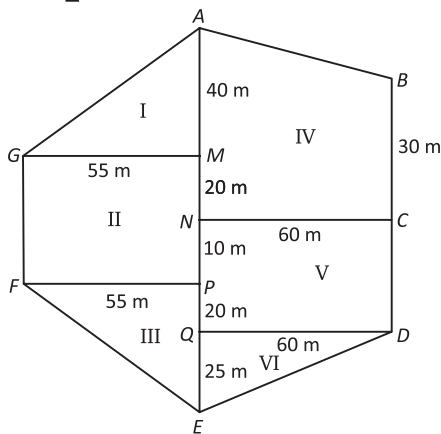


$$\text{Area of part II} = \frac{1}{2} \times (20 + 40) \times 6 \text{ cm} = 180 \text{ cm}^2$$

$$\text{Area of part III} = 40 \times 8 = 320 \text{ cm}^2$$

$$\text{Total area} = 80 + 180 + 320 = 580 \text{ cm}^2$$

18. Area of part I = $\frac{1}{2} \times 55 \times 40 = 1100 \text{ m}^2$



$$\text{Area of part II} = 55 \times 30 = 1650 \text{ m}^2$$

$$\text{Area of part III} = \frac{1}{2} \times 55 \times 45 = 1237.50 \text{ m}^2$$

$$\text{Area of part IV} = \frac{1}{2} \times (30 + 60) \times 60 = 2700 \text{ m}^2$$

$$\text{Area of part V} = 60 \times 30 = 1800 \text{ m}^2$$

$$\text{Area of part VI} = \frac{1}{2} \times 60 \times 25 = 750 \text{ m}^2$$

$$\begin{aligned} \text{Total area} &= 1100 + 1650 + 1237.50 + 2700 + 1800 + 750 \\ &= 9237.50 \text{ m}^2 \end{aligned}$$

Mental Zone

1. Without

2. Volume

3. Total surface area of a cube $= 4^3 = 64 \text{ cm}^3$

4. Volume of tank $= 3 \times 2 \times 1.5 = 9 \text{ m}^3 = 9000 \text{ L}$

5. Volume of a cube $= 216 \text{ cm}^3$

$$\Rightarrow \text{side}^3 = 6^3$$

$$\Rightarrow \text{side} = 6 \text{ cm}$$

$$\begin{aligned} \therefore \text{Total surface area} &= 6(\text{side})^2 \\ &= 6 \times 6^2 = 216 \text{ cm}^3 \end{aligned}$$

6. Surface area of cube $= 486 \text{ cm}^2$

$$6(\text{side})^2 = 486$$

$$(\text{side})^2 = 81 = 9^2$$

$$(\text{side}) = 9 \text{ cm}$$

7. Volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 7^2 \times 7 = 1078 \text{ cm}^3$$

8. Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$$= \frac{1}{2} \times 28 \times 20 = 280 \text{ cm}^2$$

9. Area of triangle $= 120 \text{ cm}^2$

$$\Rightarrow \frac{1}{2} \times \text{base} \times \text{altitude} = 120$$

$$\Rightarrow \frac{1}{2} \times 24 \times \text{altitude} = 120$$

$$\Rightarrow \text{altitude} = \frac{120}{12} = 10 \text{ cm}$$

$$\begin{aligned}
 10. \text{ Area of parallelogram} &= \text{Base} \times \text{altitude} \\
 &= 8 \times 10 = 80 \text{ cm}^2
 \end{aligned}$$

Multiple Choice Questions

1. (b)

$$\text{Area of triangle} = \frac{1}{2} \times 10 \times 5 = 25 \text{ cm}^2$$

2. (b)

$$\text{Area of trapezium} = 36 \text{ cm}^2$$

$$\Rightarrow \frac{1}{2}(10 + x) \times 4 = 36$$

$$\Rightarrow 10 + x = 18$$

$$\Rightarrow x = 18 - 10 = 8 \text{ cm}$$

3. (b)

4. (a)

5. (b)

$$\text{Volume of a cube} = (4a)^3 = 64a^3 \text{ unit}^3$$

6. (a)

$$\text{Total surface area of cylinder} = 2\pi r(h + r)$$

$$= 2 \times \frac{22}{7} \times 14(20 + 14)$$

$$= 88 \times 34 = 2992 \text{ cm}^2$$

7. (a)

$$\text{Volume of a cylinder} = 660 \text{ cm}^3$$

$$\Rightarrow \pi r^2 h = 660$$

$$\frac{22}{7} \times 52 \times h = 660$$

$$\Rightarrow h = \frac{660 \times 7}{22 \times 52} = 8.4 \text{ cm}$$

8. (d)

$$\text{CSA of a cylinder} = 264 \text{ m}^2$$

$$\text{Volume of a cylinder} = 924 \text{ m}^3$$

$$\Rightarrow \frac{2\pi r h}{\pi r^2 h} = \frac{264}{924}$$

$$\Rightarrow \frac{2}{r} = \frac{264}{924}$$

$$\Rightarrow r = \frac{924 \times 2}{264} = 7 \text{ m}$$

CHAPTER-11 : EXPONENTS (POWER)

Assessment Time

1. a. $(-6)^8$

Hence, -6 is the base and 8 is the exponents.

b. $\left(\frac{3}{7}\right)^7$

Hence, $\frac{3}{7}$ is the base and 7 is the exponents.

c. $\left(\frac{-8}{9}\right)^6$

Hence, $\frac{-8}{9}$ is the base and 6 is the exponents.

d. $\left(\frac{-13}{23}\right)^5$

Hence, $\frac{-13}{23}$ is the base and 5 is the exponents.

2. a. $(-4) \times (-4) \times (-4) \times (-4) = (-4)^4$

b. $7 \times 7 \times 7 \times 7 \times 7 \dots m \text{ times} = 7^m$

c. $\left(\frac{-11}{8}\right) \times \left(\frac{-11}{8}\right) \times \left(\frac{-11}{8}\right) \times \left(\frac{-11}{8}\right) = \left(\frac{-11}{8}\right)^4$

d. $\left(\frac{-5}{9}\right) \times \left(\frac{-5}{9}\right) \times \left(\frac{-5}{9}\right) \times \dots n \text{ times} = \left(\frac{-5}{9}\right)^n$

3. a. $\frac{27}{125} = \frac{3 \times 3 \times 3}{5 \times 5 \times 5} = \left(\frac{3}{5}\right)^3$

b. $\frac{-64}{343} = \frac{(-4) \times (-4) \times (-4)}{7 \times 7 \times 7} = \left(\frac{-4}{7}\right)^3$

c. $\frac{-32}{243} = \frac{-2 \times -2 \times -2 \times -2 \times -2}{3 \times 3 \times 3 \times 3 \times 3} = \left(\frac{-2}{3}\right)^5$

d. $\frac{-81}{625} = \frac{(-3) \times (-3) \times (-3) \times (-3)}{5 \times 5 \times 5 \times 5} = \left(\frac{-3}{5}\right)^4$

4. a. $\left(\frac{2}{5}\right)^4 \times \left(\frac{2}{5}\right)^6 \times \left(\frac{2}{5}\right)^3 = \left(\frac{2}{5}\right)^{4+6+3} = \left(\frac{2}{5}\right)^{13}$

b. $\left(\frac{-6}{7}\right)^4 \times \left(\frac{-6}{7}\right)^8 \times \left(\frac{-6}{7}\right)^5 = \left(\frac{-6}{7}\right)^{4+8+5} = \left(\frac{-6}{7}\right)^{17}$

c. $\left(\frac{5}{8}\right)^7 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^{7-4} = \left(\frac{5}{8}\right)^3$

d. $\left(\frac{-3}{7}\right)^{13} \div \left(\frac{-3}{7}\right)^8 = \left(\frac{-3}{7}\right)^{13-8} = \left(\frac{-3}{7}\right)^5$

5. a. $(6^4)^3 = 6^{4 \times 3} = 6^{12}$

b. $\left[\left(\frac{-8}{9}\right)^3\right]^4 = \left(\frac{-8}{9}\right)^{3 \times 4} = \left(\frac{-8}{9}\right)^{12}$

c. $\left[\left(\frac{3}{2}\right)^4\right]^0 = \left(\frac{3}{2}\right)^0 = 1$

d. $\left[\left(\frac{-5}{7}\right)^0\right]^4 = \left(\frac{-5}{7}\right)^{0 \times 4} = 1$

6. a. $\left[\left(\frac{1}{2}\right)^4 - \left(\frac{1}{2}\right)^3\right] \times 4^2$
 $= \left(\frac{1}{2 \times 2 \times 2 \times 2} - \frac{1}{2 \times 2 \times 2}\right) \times 16$
 $= \left(\frac{1}{16} - \frac{1}{8}\right) \times 16$
 $= \left(\frac{1-2}{16}\right) \times 16 = -1$

b. $(4^2 - 3^2) \times \frac{1}{49} = (4 \times 4 - 3 \times 3) \times \frac{1}{49}$
 $= (16 - 9) \times \frac{1}{49}$
 $= \frac{7}{49} = \frac{1}{7}$

7. a. $\frac{3^4 \times x^5 \times y^2}{3^2 \times x^2 y^4} = 3^{4-2} \times x^{5-2} \times y^{2-4}$
 $= 3^2 \times x^3 \times y^{-2} = \frac{9x^3}{y^2}$

b. $\frac{5^3 \times a^4 \times b^6 \times c^2}{5^5 \times a^2 \times b^2 \times c^5} = 5^{3-5} \times a^{4-2} \times b^{6-2} \times c^{2-5}$
 $= 5^{-2} \times a^2 \times b^4 \times c^{-3}$
 $= \frac{a^2 \times b^4}{5^2 \times c^3}$

8. a. $5^m \div 5^2 = 125$

$5^m \div 5^2 = 5^3$

$m - 2 = 3$

(on comparing the exponent)

$m = 3 + 2 = 5$

b. $2^{2m+4} = 2^{2(2m-3)}$

$$2m + 4 = 2(2m - 3) \quad (\text{on comparing the exponent})$$

$$2m + 4 = 4m - 6$$

$$4 + 6 = 4m - 2m$$

$$10 = 2m$$

$$m = \frac{10}{2} = 5$$

Assessment Time 11.2

1. a. $x^m \times x^{-n} = x^{m-n}$
 b. $(x^{-6})^3 = x^{-18}$
 c. $a^5 \div a^{-3} = a^{5-(-3)} = a^{5+3} = a^8$
 d. $a^{-6} \div a^{-5} = a^{-6-(-5)} = a^{-6+5} = a^{-1}$
2. a. $6^3 \times 6^{-5} = 6^{3-5}$

$$= 6^{-2} = \frac{1}{6^2}$$

 b. $9^{-3} \times 9^{-6} \times 9^{-5} = 9^{-3-6-5}$

$$= 9^{-9-5}$$

$$= 9^{-14} = \frac{1}{9^{14}}$$

 c. $\left(\frac{5}{4}\right)^{-3} \times \left(\frac{5}{4}\right)^6 \times \left(\frac{5}{4}\right)^{-2} = \left(\frac{5}{4}\right)^{-3+6-2}$

$$= \left(\frac{5}{4}\right)^{6-5} = \frac{5}{4}$$

 d. $\left(\frac{-6}{11}\right)^{-4} \times \left(\frac{-6}{11}\right)^{-2} = \left(\frac{-6}{11}\right)^{-4-2}$

$$= \left(\frac{-6}{11}\right)^{-6} = \left(\frac{-11}{6}\right)^6$$
3. a. $10^{-6} \div 10^{-4} = 10^{-6-(-4)}$

$$= 10^{-6+4} = 10^{-2}$$

$$= \frac{1}{10^2}$$

 b. $\left(\frac{7}{2}\right)^{-3} \div \left(\frac{7}{2}\right)^{-5} = \left(\frac{7}{2}\right)^{-3-(-5)}$

$$= \left(\frac{7}{2}\right)^{-3+5} = \left(\frac{7}{2}\right)^2$$

$$\begin{aligned} \text{c. } \left(\frac{-3}{5}\right)^{-4} \div \left(\frac{-3}{5}\right)^{-4} &= \left(\frac{-3}{5}\right)^{-4-(-4)} \\ &= \left(\frac{-3}{5}\right)^0 = 1 \end{aligned}$$

$$\begin{aligned} \text{d. } \left(\frac{-6}{7}\right)^5 \div \left(\frac{-7}{6}\right)^3 &= \left(\frac{-6}{7}\right)^5 \div \left(\frac{-6}{7}\right)^{-3} \\ &= \left(\frac{-6}{7}\right)^{5-(-3)} = \left(\frac{-6}{7}\right)^{5+3} = \left(\frac{-6}{7}\right)^8 \end{aligned}$$

$$4. \text{ a. } (3)^{-9} \times 3^0 \div 5^{-1} = \frac{1}{3^9} \div \frac{1}{5} = \frac{5}{3^9} = \frac{5}{19,683}$$

$$\begin{aligned} \text{b. } (-4)^{-2} \times (5)^{-3} \times 5^4 &= \frac{1}{(-4)^2} \times \frac{1}{(5)^3} \times 5^4 \\ &= \frac{5 \times 5 \times 5 \times 5}{(-4) \times (-4) \times 5 \times 5 \times 5 \times 5} \\ &= \frac{5}{16} \end{aligned}$$

$$\begin{aligned} \text{c. } 3^{-2} \times \left(\frac{5}{9}\right)^0 \times 4^2 &= \frac{1}{3 \times 3} \times 4^2 \\ &= \frac{1}{9} \times 16 = \frac{16}{9} \end{aligned}$$

$$\begin{aligned} \text{d. } \left[\left(\frac{-2}{7}\right)^0 + \left(\frac{3}{7}\right)^0\right] \div 7^0 &= [1 + 1] \div 1 \\ &= 2 \div 1 = 2 \end{aligned}$$

$$\begin{aligned} 5. \text{ a. } (4^{-1} + 5^{-1}) \times 2^2 &= \left(\frac{1}{4} + \frac{1}{5}\right) \times 4 \\ &= \frac{5+4}{20} \times 4 = \frac{9 \times 4}{20} = \frac{9}{5} \end{aligned}$$

$$\begin{aligned} \text{b. } (3^{-1} + 5^{-1} + 10^{-1})^{-1} &= \left(\frac{1}{3} + \frac{1}{5} + \frac{1}{10}\right)^{-1} \\ &= \left(\frac{10+6+3}{30}\right)^{-1} \\ &= \left(\frac{19}{30}\right)^{-1} = \frac{30}{19} \end{aligned}$$

$$\begin{aligned} \text{c. } \left\{\left(\frac{1}{3}\right)^{-2} - \left(\frac{1}{2}\right)^{-2}\right\} \div \left(\frac{1}{4}\right)^{-2} &= [(3)^2 - (2)^2] \div (4)^2 \\ &= (9 - 4) \div (4)^2 \\ &= 5 \div 16 = \frac{5}{16} \end{aligned}$$

$$\begin{aligned}
 \text{d. } \left[\left(\frac{-5}{7} \right)^{-1} \times \left(\frac{10}{21} \right)^{-1} \right] \div \left(\frac{4}{14} \right)^{-1} &= \left(\frac{-7}{5} \times \frac{21}{10} \right) \div \frac{14}{4} \\
 &= \frac{-147}{50} \div \frac{14}{4} \\
 &= \frac{-144}{50} \times \frac{4}{14} \\
 &= \frac{-21}{25} \times \frac{2}{2} = \frac{-21}{25}
 \end{aligned}$$

$$6. \text{ a. } (169)^{\frac{3}{2}} = (13)^{2 \times \frac{3}{2}} = (13)^3 = 13 \times 13 \times 13 = 2197$$

$$\begin{aligned}
 \text{b. } (729)^{\frac{-5}{6}} &= 3^{6 \times \frac{-5}{6}} = 3^{(-5)} \\
 &= \frac{1}{3^5} \frac{1}{3 \times 3 \times 3 \times 3 \times 3} = \frac{1}{243}
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } \left(\frac{125}{343} \right) &= \left(\frac{5}{7} \right)^{3 \times \frac{-2}{3}} = \left(\frac{5}{7} \right)^{-2} \\
 &= \left(\frac{7}{5} \right)^2 = \frac{49}{25}
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } \left(\frac{32}{729} \right)^{\frac{-2}{5}} &= \left(\frac{2}{3} \right)^{5 \times \frac{-2}{5}} = \left(\frac{2}{3} \right)^{-2} \\
 &= \left(\frac{3}{2} \right)^2 = \left(\frac{9}{4} \right)
 \end{aligned}$$

$$7. \text{ a. } 5^{m-3} = 1$$

$$m - 3 = 0$$

$$m = 3$$

On comparing the exponent

$$\text{b. } (-4)^4 \times (-4)^{2m-1} = (-4)^{3m}$$

$$(-4)^{4+2m-1} = (-4)^{3m}$$

$$(-4)^{3+2m} = (-4)^{3m}$$

$$3 + 2m = 3m$$

On comparing the exponent

$$3 = 3m - 2m$$

$$m = 3$$

$$\text{c. } 6^m \div 6^{-4} = 6^3$$

$$6^{m+4} = 6^3$$

$$m + 4 = 3$$

On comparing the exponent

$$m = 3 - 4 = -1$$

$$m = -1$$

$$\text{d. } \left(\frac{-6}{7}\right)^2 \times \left(\frac{-6}{7}\right)^{2m-1} = \left(\frac{-6}{7}\right)^{-2}$$

$$\left(\frac{-6}{7}\right)^{2+2m-1} = \left(\frac{-6}{7}\right)^{-2}$$

$$\left(\frac{-6}{7}\right)^{2m+1} = \left(\frac{-6}{7}\right)^{-2}$$

$$2m + 1 = 2$$

On comparing the exponent

$$2m = 2 - 1 = 1$$

$$m = \frac{1}{2}$$

SEL-Social Behaviour

$$\text{Dengali} = 64 = 2^6$$

$$\text{Marathis} = 256 = 2^8$$

$$\text{Total people} = 64 + 256 = 320$$

$$\begin{aligned} \text{Total handshakes} &= \frac{n(n-1)}{2} \\ &= \frac{320(320-1)}{2} = 50880 \end{aligned}$$

Critical Thinking Skills

$$\frac{a}{b} = \left(\frac{5}{2}\right)^{-2} \div \left(\frac{3}{4}\right)^0$$

$$\frac{a}{b} = \left(\frac{5}{2}\right)^{-2} \div 1$$

$$\frac{a}{b} = \left(\frac{2}{5}\right)^2$$

$$\frac{a}{b} = \frac{4}{25}$$

$$\left(\frac{a}{b}\right)^{-3} = \left(\frac{4}{25}\right)^{-3} = \left(\frac{25}{4}\right)^3 = \frac{15625}{64}$$

Assessment Time 11.3

$$1. \text{ a. } \sqrt{32} = (32)^{\frac{1}{2}}$$

$$\text{b. } \sqrt[3]{71} = (71)^{\frac{1}{3}}$$

$$\text{c. } \sqrt[5]{\frac{8}{13}} = \left(\frac{8}{13}\right)^{\frac{1}{5}}$$

$$\text{d. } \sqrt[7]{\frac{9}{17}} = \left(\frac{9}{17}\right)^{\frac{1}{7}}$$

2. a. $\sqrt[7]{3}$ b. $\sqrt[5]{15}$ c. $\sqrt[7]{\left(\frac{1}{4}\right)^3}$ d. $\sqrt[6]{\left(\frac{3}{11}\right)}$

3. $4^{\frac{1}{3}} \times (4)^{3 \times \frac{1}{2}} \times 4^{\frac{2}{3}} = 4^{\frac{1}{3}} \times (4)^{\frac{3}{2}} \times 4^{\frac{2}{3}}$
 $= 4^{\left(\frac{1}{3} + \frac{3}{2} + \frac{2}{3}\right)} = 4^{\left(\frac{2+9+4}{6}\right)}$
 $= 4^{\left(\frac{15}{6}\right)} = 4^{\left(\frac{5}{2}\right)}$

b. $(125)^{\frac{-2}{3}} \times (64)^{\frac{5}{3}} = 5^{3 \times \frac{-2}{3}} \times 4^{3 \times \frac{5}{3}}$
 $= (5)^{-2} \times (4)^5$
 $= \frac{1}{(5)^2} \times (4)^5 = \frac{1024}{25}$

c. $(27)^{\frac{2}{3}} \times (27)^{\frac{1}{3}} \times (27)^{\frac{-4}{3}} = (27)^{\frac{2}{3} + \frac{1}{3} - \frac{4}{3}}$
 $= (27)^{\frac{-1}{3}} = 3^{(3 \times \frac{-1}{3})}$
 $= 3^{-1} = \frac{1}{3}$

d. $(216)^{\frac{-1}{3}} \times (216)^{\frac{2}{3}} \times (216)^{\frac{-4}{3}}$
 $= (216)^{\frac{-1}{3} + \frac{2}{3} - \frac{4}{3}} = (216)^{\frac{-3}{3}}$
 $= (6^3)^{\frac{-3}{3}} = (216)^{-1} = \frac{1}{216}$

4. a. $(5^2 + 12^2)^{\frac{3}{2}} = (25 + 144)^2$
 $= (169)^{\frac{3}{2}} = (13)^{2 \times \frac{3}{2}}$
 $= (13)^3 = 2197$

b. $(1^3 + 2^3 + 3^3)^{\frac{-3}{2}} = (1 + 8 + 27)^{\frac{-3}{2}}$
 $= (36)^{\frac{-3}{2}} = (6)^{2 \times \frac{-3}{2}}$
 $= (6)^{-3} = \frac{1}{216}$

c. $(10^2 - 8^2)^{\frac{1}{2}} = (100 - 64)^{\frac{1}{2}}$
 $= (36)^{\frac{1}{2}} = 6^{2 \times \frac{1}{2}} = 6$

d. $(17^2 - 8^2)^{\frac{1}{2}} = (289 - 64)^{\frac{1}{2}}$
 $= (225)^{\frac{1}{2}} = (15)^{2 \times \frac{1}{2}} = 15$

$$\begin{aligned}
 5. \quad a. \quad (0.008)^{\frac{-2}{3}} &= (0.2^3)^{\frac{-2}{3}} \\
 &= (0.2)^{3 \times \frac{-2}{3}} = (0.2)^{-2} \\
 &= (0.04)^{-1} = \frac{1}{0.04}
 \end{aligned}$$

$$\begin{aligned}
 b. \quad (0.125)^{\frac{-2}{3}} &= (0.5^3)^{\frac{-2}{3}} \\
 &= (0.5)^{3 \times \frac{-2}{3}} = (0.5)^{-2} \\
 &= (0.25)^{-1} = \frac{1}{0.25}
 \end{aligned}$$

$$\begin{aligned}
 c. \quad (0.00064)^{\frac{-2}{3}} &= (0.4^3)^{\frac{-2}{3}} \\
 &= (0.4)^{3 \times \frac{-2}{3}} = (0.4)^{-2} \\
 &= (0.16)^{-1} = \frac{1}{0.16}
 \end{aligned}$$

$$\begin{aligned}
 d. \quad (0.01024)^{\frac{3}{5}} &= \{(0.4)^5\}^{\frac{3}{5}} \\
 &= (0.4)^3 = 0.064
 \end{aligned}$$

$$\begin{aligned}
 6. \quad a. \quad \sqrt{\frac{49}{64}} \times \sqrt[3]{\frac{343}{512}} &= \left(\frac{49}{64}\right)^{\frac{1}{2}} \times \left(\frac{343}{512}\right)^{\frac{1}{3}} \\
 &= \left[\left(\frac{7}{8}\right)^2\right]^{\frac{1}{2}} \times \left[\left(\frac{7}{8}\right)^3\right]^{\frac{1}{3}} \\
 &= \frac{7}{8} \times \frac{7}{8} = \frac{49}{64}
 \end{aligned}$$

$$\begin{aligned}
 b. \quad \sqrt[5]{\frac{243}{3125}} \times \sqrt[3]{\frac{125}{27}} &= \left[\left(\frac{3}{5}\right)^5\right]^{\frac{1}{5}} \times \left[\left(\frac{5}{3}\right)^3\right]^{\frac{1}{3}} \\
 &= \frac{3}{5} \times \frac{5}{3} = 1
 \end{aligned}$$

$$\begin{aligned}
 c. \quad \sqrt[4]{\frac{81}{256}} \times \sqrt[5]{\frac{32}{243}} &= \left[\left(\frac{3}{4}\right)^4\right]^{\frac{1}{4}} \times \left[\left(\frac{2}{3}\right)^5\right]^{\frac{1}{5}} \\
 &= \left(\frac{3}{4}\right)^{4 \times \frac{1}{4}} \times \left(\frac{2}{3}\right)^{5 \times \frac{1}{5}} \\
 &= \frac{3}{4} \times \frac{2}{3} = \frac{1}{2}
 \end{aligned}$$

$$d. \quad \sqrt[5]{\frac{16}{625}} \times \sqrt[5]{\frac{2}{5}} = \sqrt[5]{\frac{16}{625} \times \frac{2}{5}}$$

$$= \left[\left(\frac{2}{5} \right)^5 \right]^{\frac{1}{5}} = \frac{2}{5}$$

$$\begin{aligned} 7. \quad \text{a.} \quad 4x^{\frac{-2}{5}} \times 5x^{\frac{-3}{10}} &= 5 \times 4 \times x^{\frac{-2}{5} + \frac{-3}{10}} \\ &= 20x^{\frac{-4-3}{10}} = 20x^{\frac{-7}{10}} = \frac{10}{x^{\frac{7}{10}}} \end{aligned}$$

$$\begin{aligned} \text{b.} \quad (y^{-3})^4 \times (x^{\frac{-3}{5}})^{10} &= y^{-12} \times x^{\frac{-3}{5} \times 10} \\ &= y^{-12} \times x^{-6} = x^{-6} y^{-12} \\ &= \frac{1}{x^6 y^{12}} \end{aligned}$$

$$\begin{aligned} \text{c.} \quad \left[\sqrt[3]{\left(\frac{a}{b} \right)^9} \right]^{-15} &= \left[\left(\frac{a}{b} \right)^{\frac{1}{3} \times 9} \right]^{-15} \\ &= \left[\left(\frac{a}{b} \right)^3 \right]^{-15} = \left(\frac{a}{b} \right)^{-45} = \left(\frac{b}{a} \right)^{45} \end{aligned}$$

$$\begin{aligned} \text{d.} \quad \left[\sqrt[4]{\left(\frac{m}{n} \right)^{-16}} \right]^{\frac{1}{4}} &= \left[\left(\frac{m}{n} \right)^{\frac{1}{4} \times (-16)} \right]^{\frac{1}{4}} \\ &= \left(\frac{m}{n} \right)^{-4 \times \frac{1}{4}} = \left(\frac{m}{n} \right)^{-1} = \frac{n}{m} \end{aligned}$$

$$\begin{aligned} 8. \quad \text{a.} \quad \frac{3^{-4} \times 5^{-2} \times 27^{\frac{2}{3}}}{6^3 \times (125)^{\frac{1}{3}} \times (49)^{\frac{-1}{2}}} &= \frac{3^{-4} \times 5^{-2} \times 3^{3 \times \frac{2}{3}}}{6^3 \times (5^3)^{\frac{1}{3}} \times (7^2)^{\frac{-1}{2}}} \\ &= \frac{3^{-4} \times 5^{-2} \times 3^2}{6^3 \times (5^3)^{\frac{1}{3}} \times (7^2)^{\frac{-1}{2}}} \\ &= \frac{3^{-4} \times 5^{-2} \times 3^{3 \times \frac{2}{3}}}{6^3 \times 5 \times 7^{-1}} \\ &= \frac{3^{-4} \times 5^{-2} \times 3^2}{6^3 \times 5 \times 7^{-1}} \\ &= \frac{7 \times 3^{-4+2} \times 5^{-2-1}}{2^3 \times 3^3} \\ &= \frac{7 \times 3^{-2-3} \times 5^{-3}}{2^3} \end{aligned}$$

$$= \frac{7 \times 3^{-5} \times 5^{-3}}{2^3}$$

$$= \frac{7}{2^3 \times 3^5 \times 5^3}$$

$$\begin{aligned} \text{b. } \frac{(2^2)^{-2} \times 5^{-3} \times 4^{3 \times \frac{2}{3}}}{5^{3 \times \left(\frac{-2}{3}\right)} \times (10^3)^{\frac{2}{3}} \times 3^2} &= \frac{2^{-4} \times 5^{-3} \times 16}{5^{-2} \times 10^2 \times 3^2} \\ &= \frac{2^{-4} \times 5^{-3} \times 2^4}{5^{-2} \times 2^2 \times 5^2 \times 3^2} \\ &= \frac{2^{-4+4} \times 5^{-3-(-2)-2}}{2^2 \times 3^2} \\ &= \frac{1}{5^3 \times 2^2 \times 3^2} = \frac{1}{125 \times 4 \times 9} \\ &= \frac{1}{4500} \end{aligned}$$

$$\begin{aligned} \text{c. } (x^{-15}y^{10})^{\frac{1}{5}} \div (x^{14}y^{-7})^{\frac{1}{7}} &= x^{-15 \times \frac{1}{5}} y^{10 \times \frac{1}{5}} \div x^{14 \times \frac{1}{7}} y^{-7 \times \frac{1}{7}} \\ &= x^{-3} y^2 \div xy^{-1} \\ &= \frac{x^{-3} y^2}{x^2 y^{-1}} = x^{-3-2} y^{2-(-1)} \\ &= x^{-5} y^3 = \frac{y^3}{x^5} \end{aligned}$$

$$\begin{aligned} \text{d. } \sqrt[3]{x^{-6}y^9} \div \sqrt[5]{x^{-5}y^{20}} &= (x^{-6}y^9)^{\frac{1}{3}} \div (x^{-5}y^{20})^{\frac{1}{5}} \\ &= x^{-6 \times \frac{1}{3}} y^{9 \times \frac{1}{3}} \div x^{-5 \times \frac{1}{5}} y^{20 \times \frac{1}{5}} \\ &= x^{-2} y^3 \div x^{-1} y^4 \\ &= \frac{x^{-2} y^3}{x^{-1} y^4} = x^{-2-(-1)} y^{3-4} \\ &= x^{-2+1} y^{-1} \\ &= x^{-1} y^{-1} = \frac{1}{xy} \end{aligned}$$

Assessment Time 11.4

1. a. 67500000
 $67500000 = 6.75 \times 10^7$
 Decimal point is shifting by 7 place from right to left.
- b. $816000000.0 = 8.16 \times 10^8$
 Decimal point is shifting by 8 place from right to left.
- c. $0.0000673 = 6.73 \times 10^{-5}$
 Decimal point is shifting by 5 place from left to right.
- d. $0.0000000896 = 8.96 \times 10^{-8}$
 Decimal point is shifting by 8 place from left to right.
2. a. $2.76 \times 10^6 = 2760000$
- b. $3.59 \times 10^8 = 359000000$
- c. $5.6 \times 10^{-5} = 0.000056$
- d. $4.76 \times 10^{-7} = 0.000000476$
3. a. The speed of the light is 3.0×10^8 m/s
- b. 1 nanometre is equal to 1.0×10^{-9} m
- c. The size of plant cell is 1.275×10^{-5} m
- d. Diameter of the sun is 1.4×10^9 m

Critical Thinking Skills

Thickness of 8 books = $8 \times 25 = 200$ mm

Thickness of 10 paper = $10 \times 0.012 = 0.12$ mm

So, total thickness of stock = $200 + 0.12$
 $= 200.12$ mm

Revision Time

1. a. $6^3 = 6 \times 6 \times 6 = 216$
- b. $5^{-3} = \frac{1}{5^3} = \frac{1}{5 \times 5 \times 5} = \frac{1}{125}$
- c. $\left(\frac{3}{4}\right)^{-2} = \left(\frac{4}{3}\right)^2 = \frac{4 \times 4}{3 \times 3} = \frac{16}{9}$
- d. $\left(\frac{2}{7}\right)^{-3} = \left(\frac{7}{2}\right)^3 = \frac{7 \times 7 \times 7}{2 \times 2 \times 2} = \frac{343}{8}$
2. a. $(\sqrt{7})^0 + 5^0 = 1 + 1 = 2$

$$\text{b. } 6^0 - 5^0 = 1 - 1 = 0$$

$$\begin{aligned} \text{c. } (8^0 + 3^0) + (7^0 - 3^0) &= (1 + 1) + (1 - 1) \\ &= 2 + 0 = 2 \end{aligned}$$

$$\text{d. } \left(\frac{5}{6}\right)^0 + \left(\frac{3}{4}\right)^0 - \left(\frac{6}{7}\right)^0 = 1 + 1 - 1 = 2 - 1 = 1$$

$$3. \text{ a. } 32^{\frac{-2}{5}} = 2^{5 \times \frac{-2}{5}} = 2^{-2} = \frac{1}{2^2} = \frac{1}{4}$$

$$\begin{aligned} \text{b. } \left(\frac{125}{343}\right)^{\frac{-2}{3}} &= \left[\left(\frac{5}{7}\right)^3\right]^{\frac{-2}{3}} = \left(\frac{5}{7}\right)^{3 \times \frac{-2}{3}} \\ &= \left(\frac{5}{7}\right)^{-2} = \left(\frac{7}{5}\right)^2 = \frac{49}{25} \end{aligned}$$

$$\text{c. } \left(\frac{81}{2401}\right)^{\frac{-1}{4}} = \left\{\left(\frac{3}{4}\right)^4\right\}^{\frac{-1}{4}} = \left(\frac{3}{4}\right)^{-1} = \frac{7}{3}$$

$$\begin{aligned} \text{d. } \left(\frac{16}{625}\right)^{\frac{-3}{4}} &= \left[\left(\frac{2}{5}\right)^4\right]^{\frac{-3}{4}} = \left(\frac{2}{5}\right)^{4 \times \frac{-3}{4}} \\ &= \left(\frac{2}{5}\right)^{-3} = \left(\frac{5}{2}\right)^3 = \frac{125}{8} \end{aligned}$$

$$\begin{aligned} 4. \text{ a. } \left(\frac{3}{4}\right)^2 \times \left(\frac{3}{4}\right)^{-6} \times \left(\frac{3}{4}\right)^{-4} &= \left(\frac{3}{4}\right)^{2-6-7} = \left(\frac{3}{4}\right)^{2-10} \\ &= \left(\frac{3}{4}\right)^{-8} = \left(\frac{4}{3}\right)^8 \end{aligned}$$

$$\begin{aligned} \text{b. } (3^{-7} \times 3^{-8}) \div 3^{-20} &= (3^{-7-8}) \div 3^{-20} \\ &= 3^{-15} \div 3^{-20} = \frac{3^{-15}}{3^{-20}} \\ &= 3^{-15 - (-20)} = 3^{-15+20} = 3^5 \end{aligned}$$

$$\begin{aligned} \text{c. } \left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} + \left(\frac{-1}{6}\right)^{-2} &= (2)^2 + (4)^2 + (-6)^2 \\ &= 4 + 16 + 36 = 56 \end{aligned}$$

$$5. \text{ a. } \left[\left(\frac{3}{25}\right)^{-6}\right]^0 = \left(\frac{3}{25}\right)^{-6 \times 0} = 1$$

$$\text{b. } \left[\left(\frac{4}{15}\right)^{-2}\right]^3 = \left(\frac{4}{15}\right)^{-6} = \left(\frac{15}{4}\right)^6$$

$$\text{c. } \left[\left(\frac{-5}{19}\right)^3\right]^0 = \left(\frac{-5}{19}\right)^0 = 1$$

$$6. \text{ a. } (\sqrt{2})^{2m} = (2)^{\frac{1}{2} \times 2m} = 2^7$$

$$2^m = 2^7$$

$$m = 7$$

On comparing the exponent, we get

$$\text{b. } \left(\frac{-3}{7}\right)^{3m+4} \times \left(\frac{-3}{7}\right)^{-6} = \left(\frac{-3}{7}\right)^{-2}$$

$$\left(\frac{-3}{7}\right)^{3m+4-6} = \left(\frac{-3}{7}\right)^{-2}$$

$$3m - 2 = -2$$

On comparing the exponent, we get

$$3m = 0$$

$$m = 0$$

$$7. \text{ a. } \sqrt[3]{\frac{27}{343}} \times \sqrt[5]{\frac{16807}{243}} = \left(\frac{3}{7}\right)^{3 \times \frac{1}{3}} \times \left(\frac{7}{3}\right)^{5 \times \frac{1}{5}}$$

$$= \frac{3}{7} \times \frac{7}{3} = 1$$

$$\text{b. } \left[\sqrt[4]{\left(\frac{x}{y}\right)^{\frac{-1}{2}}} \right]^{\frac{-2}{3}} = \left[\left(\frac{x}{7}\right)^{\frac{1}{4} \times \frac{-1}{2} \times \frac{-2}{3}} \right]$$

$$= \left(\frac{x}{y}\right)^{\frac{1}{12}}$$

$$8. \text{ a. } \frac{4^{-3} \times 5^{-2} \times (4^3)^{\frac{2}{3}}}{(5^{-3})^{\frac{-4}{3}} \times (10^4)^{\frac{3}{4}} \times 3^3} = \frac{4^{-3} \times 5^{-2} \times 4^2}{5^{-4} \times 10^3 \times 3^3}$$

$$= \frac{4^{-3} \times 5^{-2} \times 4^2}{5^{-4} \times 2^3 \times 5^3 \times 3^3}$$

$$= \frac{4^{-1} \times 5^{-2-(-4)-3}}{2^3 \times 3^3}$$

$$= \frac{1}{5 \times 5 \times 2^3 \times 3^3}$$

$$= \frac{1}{2^2 \times 5 \times 2^3 \times 3^3}$$

$$= \frac{1}{2^5 \times 5 \times 3^3}$$

$$= \frac{1}{27 \times 5 \times 32} = \frac{1}{4320}$$

$$\begin{aligned}
 \text{b. } & \sqrt[5]{a^{10}b^{-15}} \times \sqrt[3]{a^{-6}b^9} \\
 &= a^{10 \times \frac{1}{5}} b^{-15 \times \frac{1}{5}} \times a^{-6 \times \frac{1}{3}} b^{9 \times \frac{1}{3}} \\
 &= a^2 b^{-3} \times a^{-2} \times b^3 \\
 &= a^{2-2} \times b^{-3+3} \\
 &= a^0 \times b^0 = 1 \times 1 = 1
 \end{aligned}$$

9. 1.673×10^{-15}

10. 0.000632

Mental Zone

- | | | | |
|-------------|--------------------------|-------------------|---------------------------------|
| 1. -3 | 2. 2 | 3. $\frac{7}{12}$ | 4. $\left(\frac{7}{2}\right)^3$ |
| 5. 648 | 6. 1 | 7. 1 | 8. 13 |
| 9. 0.000632 | 10. 6.7×10^{-5} | | |

Multiple Choice Questions

- | | | | |
|--------|--------|--------|--------|
| 1. (b) | 2. (d) | 3. (b) | 4. (a) |
| 5. (a) | 6. (c) | 7. (c) | |

CHAPTER-12 : DIRECT AND INDIRECT (INVERSE) PROPORTION

Assessment Time 12.1

1. Since, it is a direct variation

$$\begin{aligned}
 \text{So, } & \frac{6}{10} = \frac{30}{p} \\
 & p = \frac{30 \times 10}{6} = 50
 \end{aligned}$$

$$\begin{aligned}
 \text{So, } & \frac{30}{50} = \frac{m}{70} \\
 & m = \frac{70 \times 30}{50} = \frac{210}{5} = 42
 \end{aligned}$$

$$\begin{aligned}
 \text{So, } & \frac{42}{70} = \frac{78}{n} \\
 & n = \frac{78 \times 70}{42} = 13 \times 10 = 130
 \end{aligned}$$

x	6	30	42	78
y	10	50	70	130

2. Hence, the quantity of sugar is increasing.

So, cost will also be increased. So, it is a direct variation.

Quantity of sugar	7 kg	18 kg
Cost (in ₹)	210	x

$$\text{So, } \frac{7}{210} = \frac{18}{x}$$

$$x = \frac{18 \times 210}{7} = 18 \times 30 = 540$$

The cost of 18 kg sugar is ₹ 540.

3. Here, the minute is decreasing. So, the words will also decrease.
So, it is a direct variation.

Words	720	x
Minutes	12	9

$$\text{So, } \frac{720}{12} = \frac{x}{9}$$

$$x = \frac{720 \times 9}{12} = 60 \times 9 = 540$$

Hence, the 540 words will be typed in 9 minutes.

4. Since, it is a direct variation. So, according to the question.

Distance	472	x
Petrol	32	45

$$\text{So, } \frac{472}{32} = \frac{x}{45}$$

$$x = \frac{472 \times 45}{32} = 663.75 \text{ km}$$

Hence, 663.75 km will be covered in 45 L of petrol.

5. Since, it is a direct variation. So, according to the question.

Wheat	9	x
Price	166.50	259

$$\text{So, } \frac{9}{166.50} = \frac{x}{259}$$

$$x = \frac{9 \times 259}{166.50}$$

$$= \frac{9 \times 259 \times 100}{16650} = 14 \text{ kg}$$

6. Since, it is a direct variation. So, according to the situation.

Length	22.5	y
Weight	78.75	112

$$\frac{225}{78.75} = \frac{y}{112}$$

$$y = \frac{22.5 \times 112.5}{78.75}$$

$$= \frac{225 \times 112 \times 10}{7875} = 32 \text{ m}$$

Hence, the length of the rod is 32 m.

7. Distance = Speed $\times$ Time

$$90 \text{ km} = 60 \text{ km/hr} \times \text{Time}$$

$$\Rightarrow \text{Time} = \frac{90}{60} = \frac{3}{2} = 1\frac{1}{2} \text{ hours}$$

Hence, it takes $1\frac{1}{2}$ hours to cover 90 km distance.

- 8.

Height of the pole	15.40	18.60
Length of the shadow	10.60	y

$$\frac{15.40}{10.60} = \frac{18.60}{y}$$

$$y = \frac{18.60 \times 10.6}{15.40} = 12.80 \text{ m}$$

- 9.

Workers	20	x
Day	10	5
Length	8 mm	8 km

Since, it is indirect proportion,

$$20 \times 10 = x \times 5$$

$$\therefore x = \frac{20 \times 10}{5} = 40$$

40 workers

Critical Thinking Skills

10.

Actual Distance	2	x
Map Distance	1	6.5

It is direct variation

$$\frac{2}{1} = \frac{x}{6.5}$$

$$\therefore x = 6.5 \times 2 = 13 \text{ km}$$

Assessment Time 12.2

1.

Number of horse	18	x
Number of days	30	36

Since, it is an inverse variation

$$18 \times 30 = x \times 36$$

$$x = \frac{18 \times 30}{36} = 15$$

Hence, 15 horses can graze the same field.

2. According to the given condition, it is an inverse proportion

Number of men	20	x
Number of days	12	8

$$20 \times 12 = x \times 8$$

$$x = \frac{20 \times 12}{8} = 30$$

Hence, 30 men are required.

3.

Number of men	32	24
Number of days	18	x

Since it is an inverse variation

$$32 \times 18 = 24 \times x$$

$$x = \frac{32 \times 18}{24} = 24$$

Hence, 24 days are required.

4. According to the given condition, it is an inverse proportion

Speed	56	x
Hours	7	5

$$56 \times 7 = x \times 5$$

$$x = \frac{56 \times 7}{5} = 78.4$$

Hence, the speed of the car is 78.4 km/hr to cover the same distance in 5 hours.

5.

Number of sweets	24	20
Number of boxes	30	x

According to given condition, it is an inverse proportion

$$24 \times 30 = 20 \times x$$

$$x = \frac{24 \times 30}{20} = 36$$

Hence, 36 boxes are required.

6.

Number of soldiers	120	150
Number of days	50	x

According to the given condition it is an inverse proportion

$$120 \times 50 = 150 \times x$$

$$x = \frac{120 \times 50}{150} = 40$$

Hence, 40 days are required.

7.

Number of victims	320	400
Number of days	8	x

According to the given condition, it is an inverse proportion

$$320 \times 8 = 400 \times x$$

$$x = \frac{320 \times 8}{400} = 6.4$$

Hence, 6.4 days are required.

SEL-Sharing

No. of children	2	5
Chocolates	5	x

Inverse proportion

$$2 \times 5 = 5 \times x$$

$$\therefore x = \frac{10}{5} = 2$$

Critical Thinking Skills

Workers	60	x
Days	28	15

Inverse variation

$$60 \times 28 = x \times 15$$

$$\therefore x = \frac{60 \times 28}{15} = 112$$

$$\text{More workers needed} = 112 - 60 = 52$$

Revision Time

1.

x	28	x	224	z
y	7	35	y	84

According to the condition, it is an direct variation

$$\text{So, } \frac{28}{7} = \frac{x}{35} \quad x = \frac{35 \times 28}{7} = 5 \times 28 = 140$$

$$\text{So, } \frac{140}{35} = \frac{224}{y} \quad y = \frac{224 \times 35}{140} = 56$$

$$\text{So, } \frac{224}{56} = \frac{z}{84} \quad z = \frac{224 \times 84}{56} = 336$$

x	28	140	224	336
y	7	35	56	84

2.

x	10	x	20	z
y	4	5	y	8

According to the condition, it is in a direct variation.

$$\text{So, } 10 \times 4 = x \times 5 \quad x = \frac{4 \times 10}{5} = 8$$

$$\text{So, } x \times 5 = 20 \times y \quad 8 \times 5 = 20 \times y$$

$$y = \frac{40}{20} = 2$$

$$\text{So, } 20 \times 2 = z \times 8 \quad 20 \times 2 = z \times 8$$

$$40 = z \times 8$$

$$z = \frac{40}{8} = 5$$

x	10	8	20	5
7	4	5	2	8

3. According to the condition, it is a direct proportion.

Number of soap	10	18
Cost of soap	84	x

$$\frac{10}{84} = \frac{18}{x}$$

$$x = \frac{84 \times 18}{10} = 151.20$$

Hence, the cost of 18 soap bars is ₹ 151.20

- 4.

Number of pumps	25	45
Number of hours	18	x

According to the condition it is a indirect variation

$$25 \times 18 = 45 \times x$$

$$x = \frac{25 \times 18}{45} = 10$$

Hence, 10 hours are required for 45 pumps to do the same work.

5. Speed = 40 km/hr, Time = 32 minutes = $\frac{32}{60}$ hours

Distance = speed $\times$ time

$$= 40 \times \frac{32}{60} = 21.33 \text{ km}$$

6. According to the given condition, it is a direct proportion.

Thickness	3.5	x
Sheet of paper	400	150

$$\frac{3.5}{400} = \frac{x}{150}$$

$$x = \frac{3.5 \times 150}{400} = \frac{35 \times 150}{4000} = 1.3125 \text{ cm}$$

Hence, the thickness of 150 sheets is 1.3125 cm.

7.

Number of men	18	x
Number of days	48	36

Since, it is an inverse proportion

$$18 \times 48 = x \times 36$$

$$x = \frac{18 \times 48}{36} = 24$$

Hence, 24 men can dig the same canal in 36 days.

8. $1 : 20,00,000 = 8 : x$

$$\frac{1}{20,00,000} = \frac{8}{x}$$

$$\Rightarrow x = 20,00,000 \times 8$$

$$\Rightarrow = 1,60,00,000 \text{ cm}$$

$$\text{or } \frac{1,60,00,000}{1,00,000} = 160 \text{ km}$$

9.

Number of persons	300	400
Number of days	12	x

According to condition, it is an inverse proportion.

$$300 \times 12 = 400 \times x$$

$$x = \frac{300 \times 12}{400} = 9$$

Hence, the stock will last long for 9 days.

10.

Number of machines	14	x
Number of days	63	49

According to the condition, it is an inverse proportion

$$14 \times 63 = x \times 49$$

$$x = \frac{14 \times 63}{49} = 18$$

$$\text{More machines} = 18 - 14 = 4$$

Hence, 4 man machines are required to produce same number of chair.

Mental Zone

1. Increase

2. Increases

3. $\frac{x}{y} = \text{Constant}$

4. $xy = \text{constant}$ 5. 5

Case Study

1. $360 \times 3.5 = 72 \times x$
 $\therefore x = \frac{360 \times 3.5}{72} = 17.5 \text{ years}$
2. No

Multiple Choice Questions (MCQs)

1. (b) 2. (c) 3. (a) 4. (b) 5. (c)

CHAPTER 13: FACTORISATION

Assessment Time 13.1

1. a. Factor of $14pq = 2 \times 7 \times p \times q$
 Factor of $-21p^2q^2r = -1 \times 3 \times 7 \times p \times p \times q \times q \times r$
 Common factors are 7, p and q
 So, the greatest common factors of given terms is $7pq$.
- b. Factors of $15p^2q^2 = 3 \times 5 \times p \times p \times q \times q$
 Factors of $-20p^2q = -2 \times 2 \times 5 \times p \times p \times q$
 Factors of $25q^2r^2 = 5 \times 5 \times q \times q \times r \times r$
 Common factors are $5q$.
- c. Factors of $11m^2n^2 = 11 \times m \times m \times n \times n$
 Factors of $22n^2p^2 = 2 \times 11 \times n \times n \times p \times p$
 Factors of $-33mnp = -3 \times 11 \times m \times n \times p$
 Common factors are 11, m , n and p
 So, the greatest common factors of given terms is $11mnp$.
- d. Factors of $3x^2y^2 = 3 \times x \times x \times y \times y$
 Factors of $10y^3x^2z = 2 \times 5 \times y \times y \times y \times x \times x \times z$
 Factor of $-15x^2z^3 = -3 \times 5 \times x \times x \times z \times z \times z$
 Common factors are x, x
 The greatest common factor is x^2 .
2. a. $24a^3b + 15b^2a$
 $14a^3b = 2 \times 2 \times 2 \times 3 \times a \times a \times a \times b$
 $15b^2a = 3 \times 5 \times b \times b \times a$
 Common factor are 3, b and a

So, the greatest common factor of given terms is $3ab$.

$$\text{Now, } 24a^3b + 15b^2a = 3ab(8a^2 + 5b)$$

b. $63ab^3c - 99a^2c^2b$

$$63ab^3c = 3 \times 3 \times 7 \times a \times b \times b \times b \times c$$

$$99a^2c^2b = 3 \times 3 \times 11 \times a \times a \times c \times c \times b$$

Common factors are 3, 3, a , b , c

So, the greatest common factor of given terms is $9abc$.

$$\text{Now, } 63ab^3c - 99a^2c^2b = 9abc(7b^2 - 11ac)$$

c. $8x^2 - 72xy + 18x^2y^2$

$$8x^2 = 2 \times 2 \times 2 \times x \times x$$

$$72xy = 2 \times 2 \times 2 \times 3 \times 3 \times x \times y$$

$$18x^2y^2 = 2 \times 3 \times x \times x \times y \times y$$

Common factors are 2, x

So, the greatest common factor of given term is $2x$.

$$8x^2 - 72xy + 18(xy)^2 = 2x(4x - 36y + 9xy^2)$$

d. $-10ab^3 + 40b^2 + 25a^2b^2$

$$10ab^3 = 2 \times 5 \times a \times b \times b \times b$$

$$40b^2 = 2 \times 2 \times 2 \times 5 \times b \times b$$

$$25a^2b^2 = 5 \times 5 \times a \times a \times b \times b$$

Common factor are 5, b

So, the greatest common factor of given terms is $5b$.

$$\text{Now, } -10a^3b + 40b^2 + 25a^2b^2 = 5b(-2a^3 + 8b + 5a^2b)$$

e. $15 = 3 \times 5$

$$25t^3 = 5 \times 5 \times t \times t \times t$$

$$30t^2 = 2 \times 3 \times 5 \times t \times t$$

Common factors are 5,

So, the greatest common factor of given terms is 5.

$$-15 + 25t^3 - 30t^2 = 5(-3 + 5t^3 - 6t^2)$$

f. $m^3np - 6mn^2 + 30m^2n^2$

$$m^3np = m \times m \times m \times n \times p$$

$$6mn^2 = 6 \times m \times n \times n$$

$$30m^2n^2 = 2 \times 3 \times 5 \times m \times m \times n \times n$$

Common factor are m and n

So, the greatest common factor of given terms is mn .

$$m^3np - 6mn^2 + 30m^2n^2 = mn(m^2p - 6n + 30mn)$$

$$\begin{aligned} 3. \quad a. \quad 18pq + 9q + 5 + 10p &= 9q(2p + 1) + 5(1 + 2p) \\ &= (2p + 1)(9q + 5) \end{aligned}$$

$$\begin{aligned} b. \quad m^2 - mn + mp - np &= m(m - n) + p(m - n) \\ &= (m - n)(m + p) \end{aligned}$$

$$\begin{aligned} c. \quad ar^2 - br^2 + 7a - 7b &= r^2(a - b) + (a - b) \\ &= (r^2 + 7)(a - b) \end{aligned}$$

$$\begin{aligned} d. \quad x(x + y) + 8x + 8y &= x(x + y) + 8(x + y) \\ &= (x + y)(x + 8) \end{aligned}$$

$$\begin{aligned} 4. \quad a. \quad 25x^2 + 30 + 9 &= (5x)^2 + 2 \times 5x \times 3 + (3)^2 \\ &= (5x + 3)^2 \\ &= (5x + 3)(5x + 3) \end{aligned}$$

$$\begin{aligned} b. \quad p^2 - 10p + 25 &= (p)^2 - 2 \times 5 \times p + (5)^2 \\ &= (p - 5)^2 = (p - 5)(p - 5) \end{aligned}$$

$$\begin{aligned} c. \quad 64 - 16y + y^2 &= (8)^2 - 2 \times 8 \times y + (y)^2 \\ &= (8 - y)^2 \end{aligned}$$

$$\begin{aligned} d. \quad 2m^2 + 12m + 18 &= 2(m^2 + 2 \times 3m + 3^2) \\ &= 2(m + 3)^2 \\ &= 2(m + 3)(m + 3) \end{aligned}$$

$$\begin{aligned} e. \quad 49m^4 - 112m^2n^2 + 64n^4 \\ &= (7m^2)^2 - 2 \times 7m^2 \times 8n^2 + (8n^2)^2 \\ &= (7m^2 - 8n^2)^2 \\ &= (7m^2 - 8n^2)(7m^2 - 8n^2) \end{aligned}$$

$$\begin{aligned} f. \quad 16a^2 + 40a + 25 &= (4a)^2 + 2 \times 4a \times 5 + (5)^2 \\ &= (4a + 5)^2 \\ &= (4a + 5)(4a + 5) \end{aligned}$$

$$\begin{aligned} 5. \quad a. \quad x^2 - 4y^2 &= x^2 - (2y)^2 \quad [\because a^2 - b^2 = (a + b)(a - b)] \\ &= (x + 2y)(x - 2y) \end{aligned}$$

$$\begin{aligned}
 \text{b. } 16x^5 - 144x^3 &= 16x^3(x^2 - 9) \\
 &= 16x^3\{(x)^2 - (3)^2\} & [\because a^2 - b^2 = (a + b)(a - b)] \\
 &= 16x^3(x + 3)(x - 3)
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } 0.09x^2 - 0.49y^2 &= (0.3x)^2 - (0.7y)^2 \\
 &= (0.3x + 0.7y)(0.3x - 0.7y)
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } (l + m)^2 - (l - m)^2 & & [\because a^2 - b^2 = (a + b)(a - b)] \\
 &= (l + m + l - m)(l + m - l + m) \\
 &= (2l)(2m) = 4lm
 \end{aligned}$$

$$\begin{aligned}
 \text{e. } y^2 - \frac{49}{25} &= (y)^2 - \left(\frac{7}{5}\right)^2 & [\because a^2 - b^2 = (a + b)(a - b)] \\
 &= \left(y + \frac{7}{5}\right)\left(y - \frac{7}{5}\right)
 \end{aligned}$$

$$\begin{aligned}
 \text{f. } 36 - a^2 - b^2 - 2ab \\
 &= 36 - (a^2 + b^2 + 2ab) \\
 &= (6)^2 - (a + b)^2 & [\because a^2 - b^2 = (a + b)(a - b)] \\
 &= (6 + a + b)(6 - a - b)
 \end{aligned}$$

$$\begin{aligned}
 6. \text{ a. } (x + y)^2 - 4xy &= x^2 + y^2 + 2xy - 4xy \\
 &= x^2 + y^2 - xy \\
 &= (x - y)^2
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } (ax + by)^2 - (bx + ay)^2 \\
 &= a^2x^2 + b^2y^2 + 2axby - (b^2x^2 + a^2y^2 + 2axby) \\
 &= a^2x^2 + b^2y^2 + 2axby - b^2x^2 - a^2y^2 - 2axby \\
 &= (a^2x^2 - b^2x^2) + (b^2y^2 - a^2y^2) \\
 &= x^2(a^2 - b^2) - y^2(a^2 - b^2) \\
 &= (a^2 - b^2)(x^2 - y^2)
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } (x - 2)^4 - x^4 \\
 &= \{(x - 2)^2\}^2 - (x^2)^2 \\
 &= \{(x - 2)^2 + x^2\}\{(x - 2)^2 - x^2\} \\
 &= (x^2 + 4 - 4x + x^2)(x - 2 - x)(x - 2 + x) \\
 &= (2x^2 - 4x + 4)(-2)(2x - 2) \\
 &= -8(x^2 - 2x + 2)(x - 1)
 \end{aligned}$$

$$d. (m - 2n)^2 + 8mn = m^2 + (2n)^2 - 4mn + 8mn$$

$$= m^2 + (2n)^2 + 4mn$$

$$= (m + 2n)^2$$

$$e. (a^2 - b^2)^2 + 4a^2b^2 = a^4 + b^4 - 2a^2b^2 + 4a^2b^2$$

$$= a^4 + b^4 + 2a^2b^2 = (a^2 + b^2)^2$$

$$f. m^4 - 256 = (m^2)^2 - 16^2$$

$$= (m^2 + 16)(m^2 - 16)$$

$$= (m^2 + 16)(m^2 - 4^2)$$

$$= (m^2 + 16)(m + 4)(m - 4)$$

Assessment Time 13.2

$$1. x^2 + 6x + 5 = x^2 + 5x + x + 5$$

$$= x(x + 5) + 1(x + 5)$$

$$= (x + 5)(x + 1)$$

$$2. x^2 + 8x + 15$$

$$= x^2 + 3x + 5x + 15$$

$$= x(x + 3) + 5(x + 3)$$

$$= (x + 3)(x + 5)$$

$$3. x^2 - 6x - 7 = x^2 - 7x + x - 7$$

$$= x(x - 7) + 1(x - 7)$$

$$= (x - 7)(x + 1)$$

$$4. x^2 - 21x + 68$$

$$= x^2 - 17x - 4x + 68$$

$$= x(x - 17) - 4(x - 17)$$

$$= (x - 17)(x - 4)$$

$$5. x^2 - 2x - 24$$

$$= x^2 - 6x + 4x - 24$$

$$= x(x - 6) + 4(x - 6)$$

$$= (x - 6)(x + 4)$$

$$6. x^2 - 29x + 204$$

$$= x^2 - 12x - 17x + 204$$

$$= x(x - 12) - 17(x - 12)$$

$$= (x - 12)(x - 17)$$

$$7. 48 + 22m - m^2$$

$$= 48 + 24m - 2m - m^2$$

$$= 24(2 + m) - m(2 + m)$$

$$= (2 + m)(24 - m)$$

$$8. y^2 + 23y - 108$$

$$= y^2 + 27y - 4y - 108$$

$$= y(y + 27) - 4(y + 27)$$

$$= (y + 27)(y - 4)$$

$$9. x^2 + 19x - 150$$

$$= x^2 + 25x - 6x - 150$$

$$= x(x + 25) - 6(x + 25)$$

$$= (x + 25)(x - 6)$$

10. $p^2 - 25p + 84$

$$\begin{aligned} &= p^2 - 21p - 4p + 84 \\ &= p(p - 21) - 4(p - 21) \\ &= (p - 21)(p - 4) \end{aligned}$$

12. $x^2 - 8x - 65$

$$\begin{aligned} &= x^2 - 13x + 5x - 65 \\ &= x(x - 13) + 5(x - 13) \\ &= (x - 13)(x + 5) \end{aligned}$$

14. $y^2 - 10y + 21$

$$\begin{aligned} &= y^2 - 3y - 7y + 21 \\ &= y(y - 3) - 7(y - 3) \\ &= (y - 3)(y - 7) \end{aligned}$$

16. $3y^2 - 10y + 8$

$$\begin{aligned} &= 3y^2 - 4y - 6y + 8 \\ &= y(3y - 4) - 2(3y - 4) \\ &= (y - 2)(3y - 4) \end{aligned}$$

18. $3m^2 - 4m - 4$

$$\begin{aligned} &= 3m^2 - 6m + 2m - 4 \\ &= 3m(m - 2) + 2(m - 2) \\ &= (3m + 2)(m - 2) \end{aligned}$$

20. $4x^2 + 24x + 20$

$$\begin{aligned} &= 4x^2 + 20x + 4x + 20 \\ &= 4x(x + 5) + 4(x + 5) \\ &= (4x + 4)(x + 5) \\ &= 4(x + 1)(x + 5) \end{aligned}$$

22. $40x^2 + x - 6$

$$\begin{aligned} &= 40x^2 + 16x - 15x - 6 \\ &= 8x(5x + 2) - 3(5x + 2) \\ &= (8x - 3)(5x + 2) \end{aligned}$$

11. $-5x^2 - x + 4$

$$\begin{aligned} &= -5x^2 - 5x + 4x + 4 \\ &= -5x(x + 1) + 4(x + 1) \\ &= (x + 1)(-5x + 4) \end{aligned}$$

13. $a^2 + a - 56$

$$\begin{aligned} &= a^2 + 8a - 7a - 56 \\ &= a(a + 8) - 7(a + 8) \\ &= (a + 8)(a - 7) \end{aligned}$$

15. $6m^2 + 7m - 3$

$$\begin{aligned} &= 6m^2 + 9m - 2m - 3 \\ &= 3m(2m + 3) - 1(2m + 3) \\ &= (3m - 1)(2m + 3) \end{aligned}$$

17. $2y^2 + y - 45$

$$\begin{aligned} &= 2y^2 + 10y - 9y - 45 \\ &= 2y(y + 5) - 9(y + 5) \\ &= (2y - 9)(y + 5) \end{aligned}$$

19. $3x^2 - 19x + 30$

$$\begin{aligned} &= 3x^2 - 10x - 9x + 30 \\ &= x(3x - 10) - 3(3x - 10) \\ &= (x - 3)(3x - 10) \\ &= (x - 3)(3x - 10) \end{aligned}$$

21. $-27c^2 - 9c + 6$

$$\begin{aligned} &= -27c^2 - 18c + 9c + 6 \\ &= -9c(3c + 2) + 3(3c + 2) \\ &= (-9c + 3)(3c + 2) \\ &= -3(1 - 3c)(3c + 2) \end{aligned}$$

23. $2x^3 + 10x^2 - 28x$

$$\begin{aligned} &= 2x(x^2 + 5x - 14) \\ &= 2x(x^2 + 7x - 2x - 14) \\ &= 2x\{x(x + 7) - 2(x + 7)\} \\ &= 2x(x + 7)(x - 2) \end{aligned}$$

$$\begin{aligned}
 24. \quad & y^4 - 5y^2 - 36 \\
 &= y^4 - 9y^2 + 4y^2 - 36 \\
 &= y^2(y^2 - 9) + 4(y^2 - 9) \\
 &= (y^2 + 4)(y^2 - 9) \\
 &= (y^2 + 4)(y + 3)(y - 3)
 \end{aligned}$$

Assessment Time 13.3

- $5pq(4p^2 - 9q^2)$ by $10p(2p + 3q)$
 $5pq(4p^2 - 9q^2) = 5pq\{(2p)^2 - (3q)^2\}$ [$a^2 - b^2 = (a + b)(a - b)$]
 $= 5pq(2p + 3q)(2p - 3q)$
 Now, $\frac{5pq(2p + 3q)(2p - 3q)}{10p(2p + 3q)}$
 $= \frac{q(2p + 3q)(2p - 3q)}{2(2p + 3q)} = \frac{q(2p - 3q)}{2}$
- $(m^2 - 14m - 32)$ by $(m - 16)$
 $m^2 - 14m - 32 = m^2 - 16m + 2m - 32$
 $= m(m - 16) + 2(m - 16)$
 $= (m - 16)(m + 2)$
 Now, $\frac{(m + 2)(m - 16)}{(m - 16)} = (m + 2)$
- $4xy(9x^2 - 16y^2)$ by $14xy(3x + 4y)$
 $4xy(9x^2 - 16y^2) = 4xy\{(3x)^2 - (4y)^2\}$
 $= 4xy(3x + 4y)(3x - 4y)$
 Now, $\frac{4xy(3x + 4y)(3x - 4y)}{14xy(3x + 4y)} = \frac{2}{7}(3x - 4y)$
- $39m^2(50m^2 - 98)$ by $52m(5m - 7)$
 $39m^2(50m^2 - 98) = 39m^2 \times 2(25m^2 - 49)$
 $= 78m^2\{(5m)^2 - (7)^2\}$
 $= 78m^2(5m + 7)(5m - 7)$
 Now, $\frac{78m^2(5m + 7)(5m - 7)}{52m(5m - 7)} = \frac{3}{2}m(5m + 7)$
- $28(50m^2 - 200n^2)$ by $14(m - 2n)$
 $28(50m^2 - 200n^2) = 28 \times 50(m^2 - 4n^2)$
 $= 1400\{(m)^2 - (2n)^2\}$

$$= 1400(m + 2n)(m - 2n)$$

$$\text{Now, } \frac{1400(m + 2n)(m - 2n)}{14(m - 2n)} = 100(m + 2n)$$

6. $48(2x^4 - 36x^2 + 16^2)$ by $4(x + 3)^2$

$$\begin{aligned} 48(2x^4 - 36x^2 + 16^2) &= 48 \times 2(x^4 - 18x^2 + 81) \\ &= 96(x^4 - 9x^2 - 9x^2 + 81) \\ &= 96\{x^2(x^2 - 9) - 9(x^2 + 9)\} \\ &= 96(x^2 - 9)(x^2 - 9) \\ &= 96\{(x)^2 - (3)^2\}\{(x)^2 - (3)^2\} \\ &= 96\{(x + 3)(x - 3)\}\{(x + 3)(x - 3)\} \\ &= 96(x + 3)(x - 3)(x + 3)(x - 3) \end{aligned}$$

$$\text{Now, } \frac{96(x + 3)(x - 3)(x + 3)(x - 3)}{4(x + 3)^2} = 24(x - 3)^2$$

7. $(5p^2 - 25p + 20)$ by $(p - 4)$

$$\begin{aligned} 5p^2 - 25p + 20 &= 5(p^2 - 5p + 4) \\ &= 5(p^2 - 4p - p + 4) \\ &= 5\{p(p - 4) - 1(p - 4)\} \\ &= 5(p - 4)(p - 1) \end{aligned}$$

$$\text{Now, } \frac{5p(p - 4)(p - 1)}{(p - 4)} = 5p(p - 1)$$

8. $y^4 - 10y^3 + 21y^2 = y^4 - 7y^3 - 3y^3 + 21y^2$

$$\begin{aligned} &= y^3(y - 7) - 3y^2(y^3 - 7) \\ &= (y - 7)(y^3 - 3y^2) \\ &= (y - 7)y^2(y - 3) \\ &= y^2(y - 7)(y - 3) \end{aligned}$$

$$\text{Now, } \frac{y^2(3 - y)(y - 7)}{(3 - y)} = y^2(y - 7)$$

9. $4y(3y^2 - 4y - 4)$ by $8(3y + 2)$

$$\begin{aligned} 4y(3y^2 - 4y - 4) &= 4y(3y^2 - 6y + 2y - 4) \\ &= 4y\{3y(y - 2) + 2(y - 2)\} \\ &= 4y(y - 2)(3y + 2) \end{aligned}$$

$$\text{Now, } \frac{4y(y - 2)(3y + 2)}{8(3y + 2)} = \frac{y}{2}(y - 2)$$

10. $15p(p + q) - 7q(p + q)$ by $(15p - 7q)$
 $15p(p + q) - 7q(p + q) = (p + q)(15p - 7pq)$
 Now, $\frac{(p + q)(15p - 7pq)}{(15p - 7q)} = (p + q)$

Critical Thinking Skills

$$\begin{aligned} & \frac{(x^2 - 11x - 80)(x + 8)(x + 5)}{(x - 16)(x^2 + 5x - 24)} \\ &= \frac{(x^2 - 16x + 5x - 80)(x + 8)(x + 5)}{(x - 16)(x^2 + 8x - 3x - 24)} \\ &= \frac{x(x - 16) + 5(x - 16)(x + 8)(x + 5)}{(x - 16)\{x(x + 8) - 3(x + 8)\}} \\ &= \frac{(x - 16)(x + 5)(x + 8)(x + 5)}{(x - 16)(x + 8)(x - 3)} = \frac{(x + 5)^2}{(x - 3)} \end{aligned}$$

Revision Time

1. a. $3x^2y^3 = 3 \times x \times x \times y \times y \times y$
 $15xy^2 = 3 \times 5 \times x \times y \times y$
 Common factors are 3, x, y, y
 The greatest common factor of given term is $3xy^2$.
 b. Factors of $-9m^2np^2 = -3 \times 3 \times m \times m \times n \times p \times p$
 Factors of $12mnp^3 = 2 \times 2 \times 3 \times m \times n \times p \times p \times p$
 Common factors are 3, m, n, p, p
 So, the greatest common factor of given terms are $3mnp^2$.
 c. $15p^2q^2r, -25pqr^3$
 Factors of $15p^2q^2r = 3 \times 5 \times p \times p \times q \times q \times r$
 Factors of $25pqr^3 = 5 \times 5 \times p \times q \times r \times r \times r$
 So, the greatest common factor of given terms are $5pqr$.
2. a. $44x^2y^3z - 66xyz^2$
 $= 22xyz(2xy^2 - 3z)$
 $= 22xyz(2xy^2 - 3z)$
 b. $-10a^3b + 15ab^2 + 25a^2b^2$
 $= 5ab(-2a^2 + 3b + 5ab)$
 c. $-25 + 15t^2 - 30t^3$
 $= 5(-5 + 3t^2 - 6t^3)$

3. a. $6mn - n^2 + 12mp - 2np$
 $= n(6m - n) + 2p(6m - n)$
 $= (n + 2p)(6m - n)$
- b. $2ax^2 + 2a - 36x^2 - 36$
 $= 2a(x^2 + 1) - 36(x^2 + 1)$
 $= (2a - 36)(x^2 + 1)$
4. a. $36m^2 + 60mn + 25n^2$
 $= (6m)^2 + 2 \times 6m \times 5n + (5n)^2$
 $= (6m + 5n)^2$
 $= (6m + 5n)(6m + 5n)$
- b. $64 - 16x + x^2 = x^2 - 16x + 64$
 $= x^2 - 8x - 8x + 64$
 $= x(x - 8) - 8(x - 64)$
 $= (x - 8)(x - 8) = (x - 8)^2$
- c. $\frac{4}{9}x^2 - \frac{4}{15}xy + \frac{1}{25}y^2$
 $= \left(\frac{2}{3}x\right)^2 - 2 \times \frac{2}{3}x \times \frac{1}{5}y + \left(\frac{1}{5}y\right)^2$
 $= \left(\frac{2}{3}x - \frac{1}{5}y\right)^2$
- d. $\frac{25}{64}m^2n^2 + \frac{5}{16}mnp + \frac{1}{16}p^2$
 $= \left(\frac{5}{8}mn\right)^2 + 2 \times \frac{5}{8} \times \frac{1}{4}p + \left(\frac{1}{4}p\right)^2$
 $= \left(\frac{5}{8}mn + \frac{p}{4}\right)^2$
5. a. $4m^2 - 64 = 4(m^2 - 16)$
 $= 4\{(m)^2 - (4)^2\}$
 $= 4(m + 4)(m - 4)$
- b. $x^4 - 625 = (x^2)^2 - (25)^2$
 $= (x^2 + 25)(x^2 - 25)$
 $= (x^2 + 25)\{(x)^2 - (5)^2\}$
 $= (x^2 + 25)(x + 5)(x - 5)$

c. $25a^2 + 10ac + c^2 - 49b^2$

$$= (5a)^2 + 2 \times 5a \times c + (c)^2 - (7b)^2$$

$$= (5a + c)^2 - (7b)^2$$

$$= (5a + c + 7b)(5a + c - 7b)$$

d. $(x - y)^4 - z^4$

$$= \{(x - y)^2\}^2 - (z^2)^2$$

$$= \{(x - y)^2 + z^2\}\{(x - y)^2 - z^2\}$$

$$= \{(x - y)^2 + z^2\}(x - y + z)(x - y - z)$$

$$= \{(x - y)^2 + z^2\}(x - y + z)(x - y - z)$$

6. a. $x^2 - 10x + 21$

$$= x^2 - 3x - 7x + 21$$

$$= x(x - 3) - 7(x - 3)$$

$$= (x - 7)(x - 3)$$

b. $-3m^2 + 12m + 15$

$$= -3(m^2 - 4m - 5)$$

$$= -3(m^2 - 5m + m - 5)$$

$$= -3\{m(m - 5) + 1(m - 5)\}$$

$$= -3(m + 1)(m - 5)$$

c. $x^2 - 11x - 102$

$$= x^2 - 17x + 6x - 102$$

$$= x(x - 17) + 6(x - 17)$$

$$= (x + 6)(x - 17)$$

d. $y^2 + 29y + 204$

$$= y^2 + 17y + 12y + 204$$

$$= y(y + 17) + 12(y + 17)$$

$$= (y + 12)(y + 17)$$

7. a. $4y^2 + 24y + 20$

$$= 4(y^2 + 6y + 5)$$

$$= 4(y^2 + 5y + y + 5)$$

$$= 4\{y(y + 5) + 1(y + 5)\}$$

$$= 4(y + 1)(y + 5)$$

b. $2m^2 + 4mn - 15n^2$

$$= 2m^2 + 10mn - 3mn - 15n^2$$

$$= 2m(m + 5n) - 3n(m - 5n)$$

$$= (2m - 3n)(m - 5n)$$

c. $13x^2 + 19x + 6$

$$= 13x^2 + 13x + 6x + 6$$

$$= 13x(x + 1) + 6(x + 1)$$

$$= (13x + 6)(x + 1)$$

d. $6y^6 - 21y^4 - 12y^2$

$$= 6y^6 - 24y^4 + 3y^4 - 12y^2$$

$$= 6y^4(y^2 - 4) + 3y^2(y^2 - 4)$$

$$= (6y^4 + 3y^2)(y^2 - 4)$$

$$= 3y^2(2y^2 + 1)(y - 2)(y + 2)$$

8. a. $(x^2 + 6x + 5)$ by $(x + 5)$

$$x^2 + 7x + 5 = x^2 + 5x + x + 5$$

$$= x(x + 5) + 1(x + 5)$$

$$= (x + 1)(x + 5)$$

$$\text{Now, } \frac{(x + 1)(x + 5)}{(x + 5)} = (x + 1)$$

b. $(15y^2 - 26y + 8)$ by $(3y - 4)$

$$\begin{aligned} 15y^2 - 26y + 8 &= 15y^2 - 20y - 6y + 8 \\ &= 5y(3y - 4) - 2(3y - 4) \\ &= (5y - 2)(3y - 4) \end{aligned}$$

$$\text{Now, } \frac{(5y - 2)(3y - 4)}{(3y - 4)} = (5y - 2)$$

9. a. $5x^2 + 15x^3y$ by $(-20x)$

$$\begin{aligned} &= \frac{5x^2(1 + 3xy)}{-20x} = \frac{x(1 + 3xy)}{-4} \\ &= -\frac{x(1 + 3xy)}{4} \end{aligned}$$

b. $39mnp + 52n^2p$ by $13mn$

$$\begin{aligned} &= 39mnp + 52n^2p \\ &= 13np(3m + 4n) \\ &= \frac{13np(3m + 4n)}{13mn} = \frac{13p(3m + 4n)}{13m} \\ &= \frac{p(3m + 4n)}{m} = 3p + \frac{4np}{m} \end{aligned}$$

10. a. $44(5x^2 - 20x - 84 + 2xy)$

$$\begin{aligned} &= 44\{5x(x - 4) + 2y(x - 4)\} \\ &= 44(x - 4)(5x + 2y) \end{aligned}$$

$$\text{Now, } \frac{44(x - 4)(5x + 2y)}{(5x + 2y)} = 44(x - 4)$$

b. $72(m^4 - 32m^2 + 256)$ by $18(m - 4)^2$

$$\begin{aligned} &= 72(m^4 - 16m^2 - 16m^2 + 256) \\ &= 72\{m^2(m^2 - 16) - 16(m^2 - 16)\} \\ &= 72\{(m^2 - 16)(m^2 - 16)\} \\ &= 72[\{(m)^2 - (4)^2\} \{(m)^2 - (4)^2\}] \\ &= 72(m + 4)(m - 4)(m + 4)(m - 4) \end{aligned}$$

$$\text{Now, } \frac{72(m + 4)(m - 4)(m + 4)(m - 4)}{18(m - 4)^2}$$

$$= 4(m + 2)^2$$

Mental Zone

- | | |
|-----------------------|---|
| 1. $6(x^2 + 3)$ | 2. $(y - x)(2p - q)$ |
| 3. $3x(x + 5)(x - 5)$ | 4. $\left(x - \frac{y}{10}\right)\left(x + \frac{y}{10}\right)$ |
| 5. $(y - 8)(y + 5)$ | |

Multiple Choice Questions

1. (c) 2. (c) 3. (c) 4. (d) 5. (d)

CHAPTER-14: INTRODUCTION TO GRAPH

Assessment Time 14.1

- | | | |
|---|-----------------------------|------------|
| 1. $(-, -)$ | 2. y-axis | 3. 0 |
| 4. on x-axis | 5. Do yourself | 6. 8 units |
| 7. $(a, 0), (-a, 0)$ | | |
| 8. (x) IV (ii) I (iii) II (iv) III | | |
| 9. $(8, 0), (0, 6)$ | | |
| 10. On x-axis – C, F, G | On y-axis – A, D, E | |
| 11. (i) $A(-2, 3), B(0, 3)$ | (ii) $LM = 3 + 4 = 7$ units | |

12.

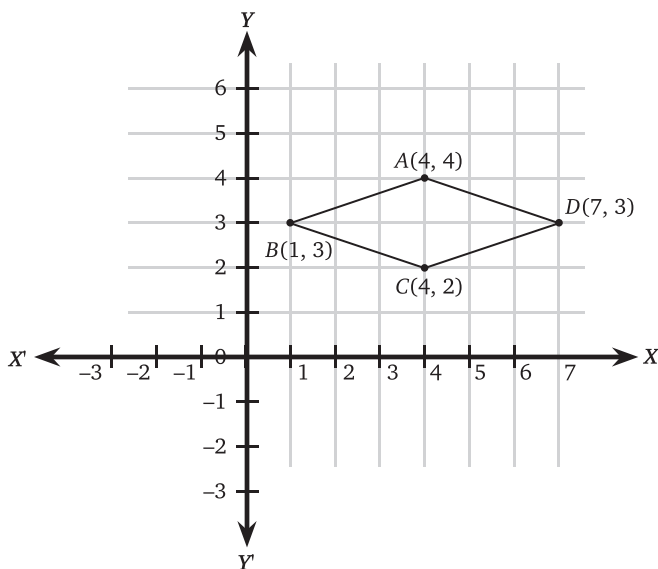
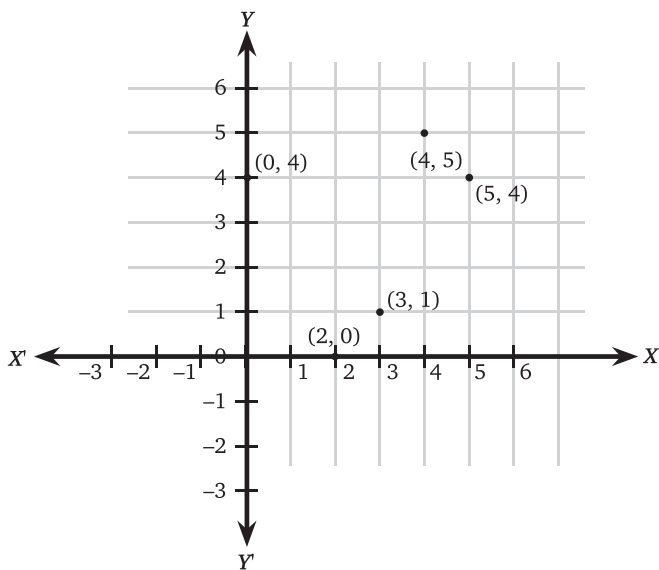
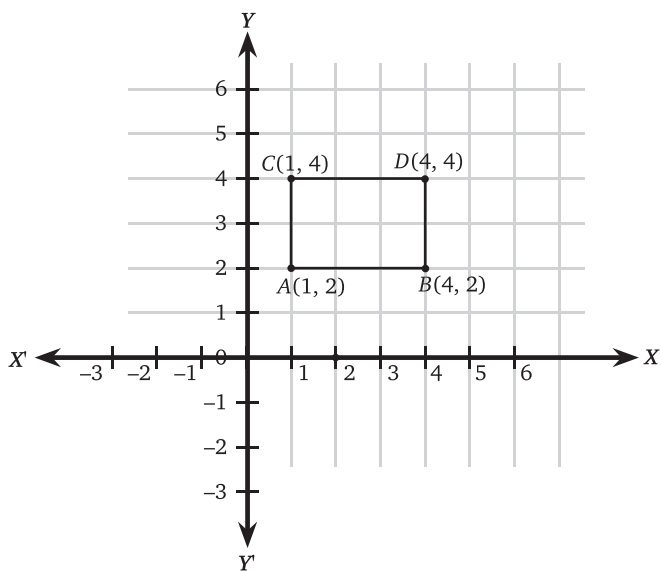


Figure ABCD is a rhombus

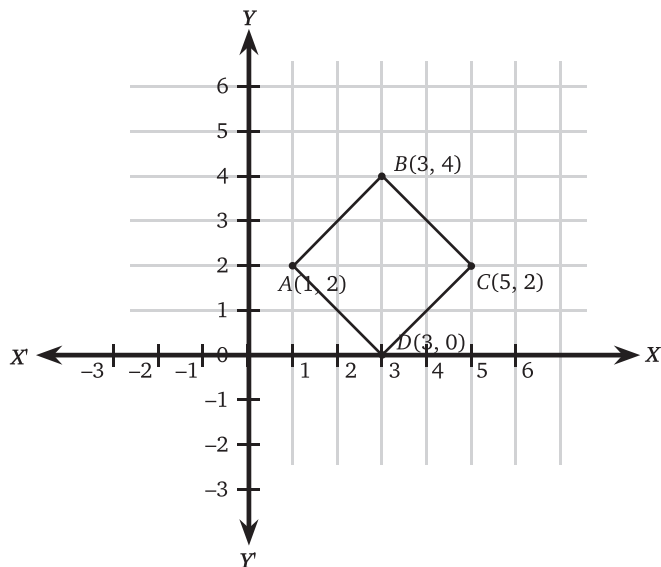
13.



14. Coordinator of D are (4, 4)



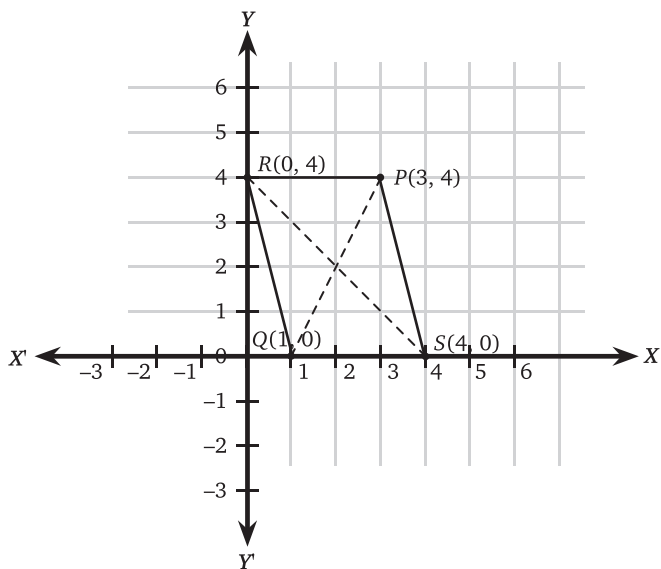
15.



Coordinator of D are $(3, 0)$

$AB = CD$, Yes equal

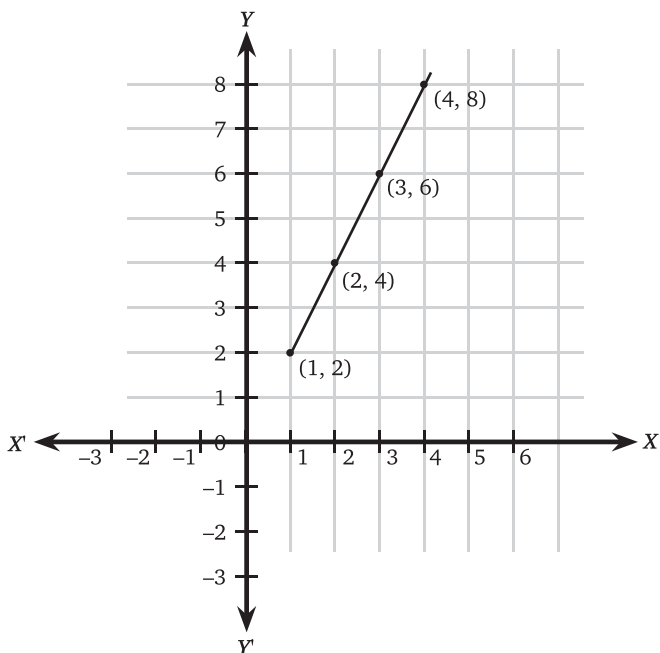
16.



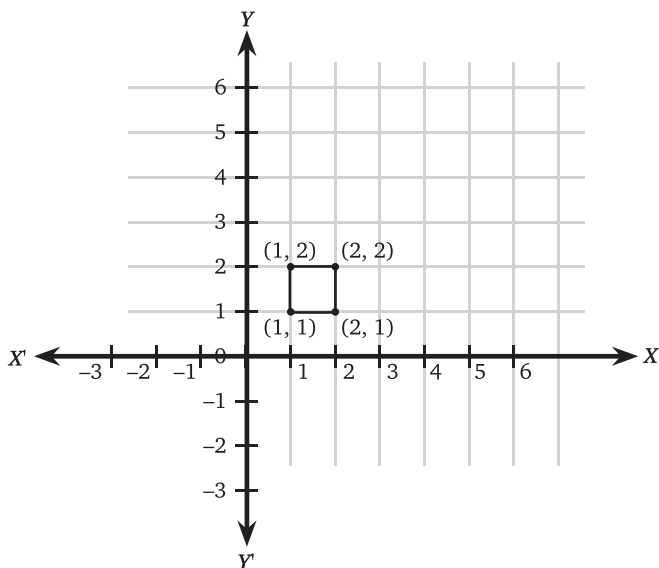
Coordinator of intersection of PQ and RS are $O(2, 2)$

17. $A(4, 7)$, $B(7, 4)$, $C(4, 1)$, $D(1, 4)$, $E(3, 5)$, $F(5, 5)$, $G(5, 3)$,
 $H(3, 3)$, $I(4, 5)$, $J(5, 4)$, $K(4, 3)$, $L(3, 4)$

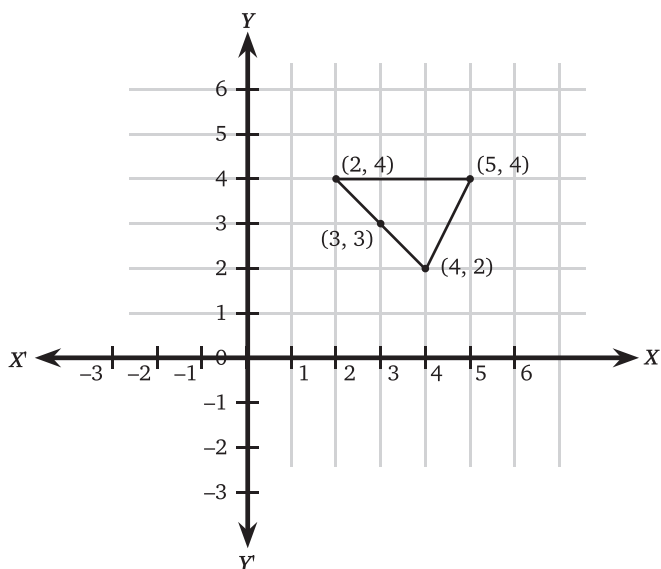
18. a. Yes, Straight line



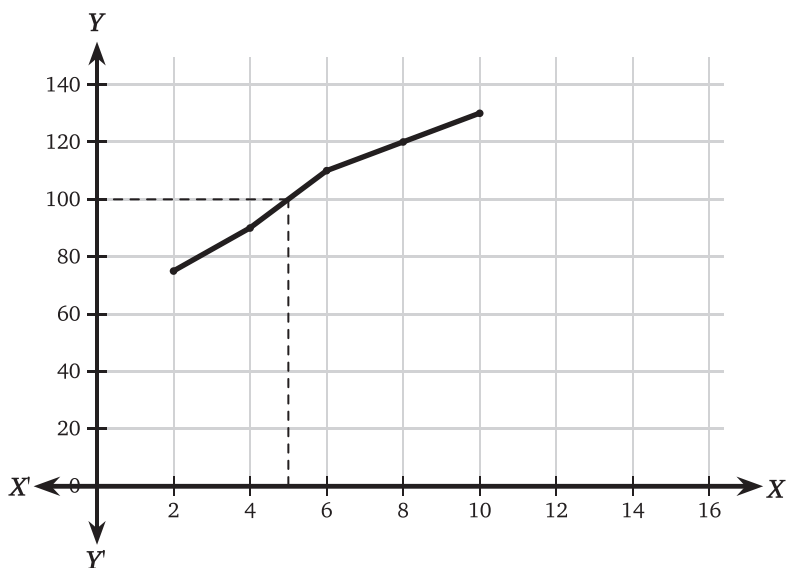
b. Square



c. Triangle



19. a. at 5 parks, 110 cm

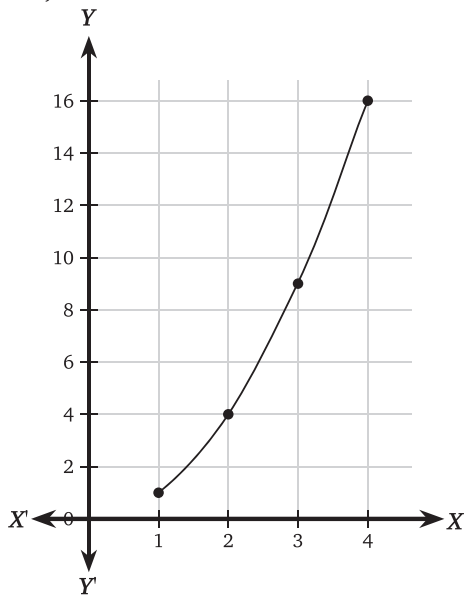


b. Difference = $130 - 110 = 20$

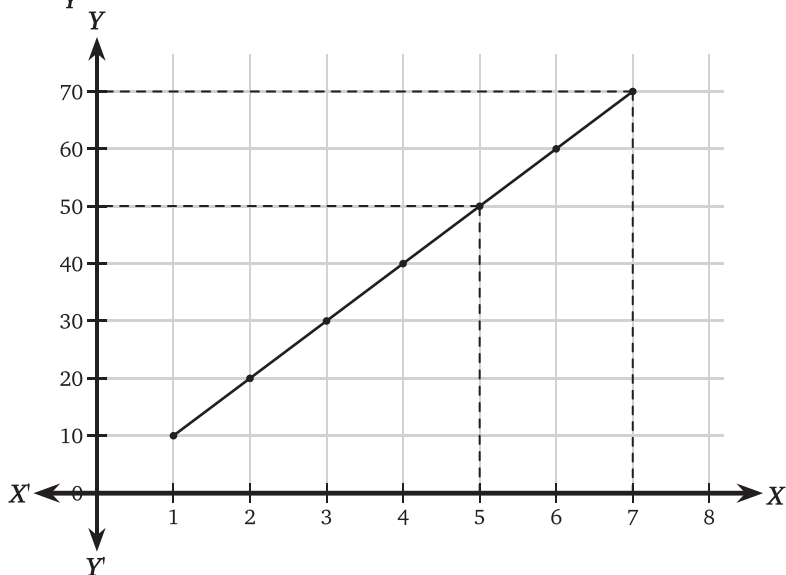
c. Between 4 and 6

Assessment Time 14.2

1. No, it is not linear



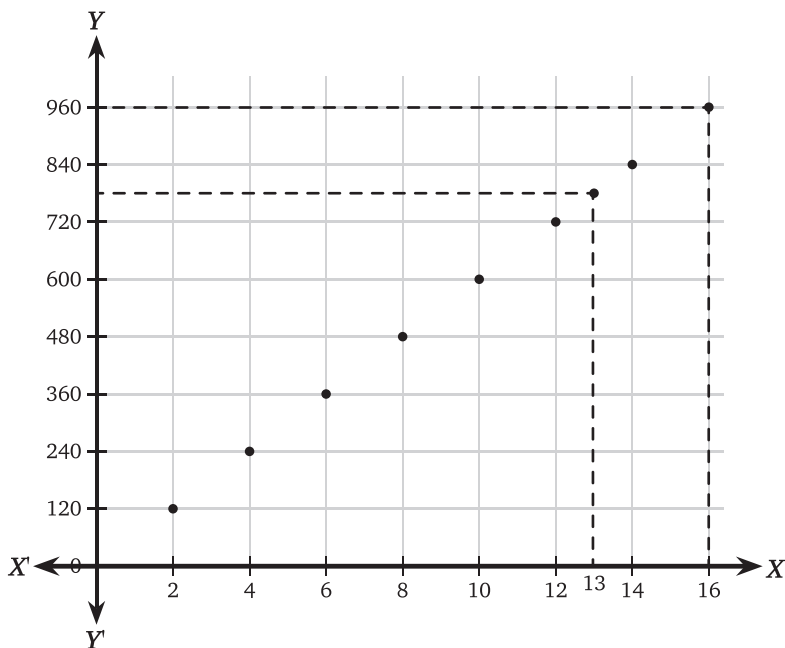
2.



a. Cost of 7 notebooks is ₹ 70

b. 5 notebooks

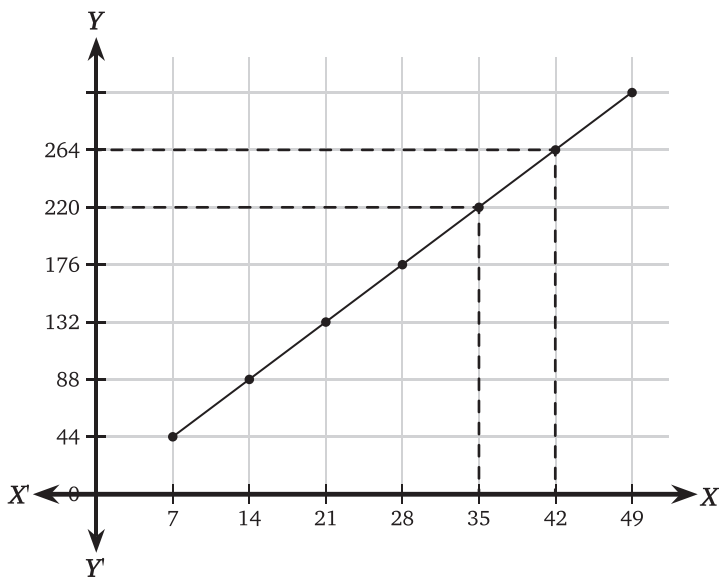
3.



Cost of 13 kg apples = ₹ 780 Cost of 16 kg apples = ₹ 960

4. a. Uniform motion b. rest
c. non uniform motion

5.

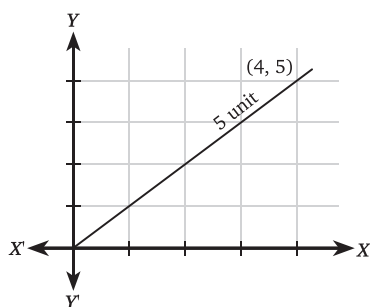


R (cm)	7	14	21	28
C (cm)	44	88	132	176

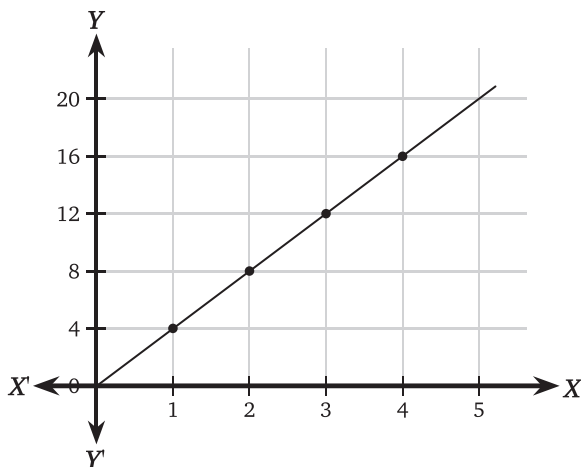
- a. $C = 264$ cm
 - b. $R = 35$ cm
6. a. Distance in 2 hrs = 80 km b. 5 hrs
- c. 2 hrs d. 120 km
- e. 6 hrs

Revision Time

1. 0
2. IInd
3. 7 units
4. $(0, -8)$
5. 5 units



6. Yes, it is linear



7. 8. 9. Do yourself
10. a. 60°C b. 68°F
11. a. Subject wise marks in test I and II.
- b. Maths c. English and Hindi
- d. No e. 6

12. a. M temperature in a week

2. Sunday

3. Wednesday

4. Friday

13. (a) B

(b) Saturday

(c) Saturday

(d) Wednesday

(e) Monday and Tuesday

Mental MCQs

1. (0, 0)

2. y-axis

3. x-axis

4. coordinate

5. x

6. x-axis

7. 2 units

8. 0

9. 4

10. abscissa

Multiple Choice Questions

1. (b)

2. (c)

3. (a)

4. (d)

5. (b)

6. (b)

7. (c)

8. (d)

9. (d)

10. (d)

Model Test Paper-I

1. a. $\frac{-6}{11}, \frac{-17}{33}, \frac{-9}{22}, \frac{-3}{1}$

LCM of 11, 33, 22 and 1 is 66

$$\frac{-6}{11} \times \frac{6}{6} = \frac{-36}{66}$$

$$\frac{-17}{33} \times \frac{2}{2} = \frac{-34}{66}$$

$$\frac{-9}{22} \times \frac{3}{3} = \frac{-27}{66}$$

$$\frac{-3}{1} \times \frac{66}{66} = \frac{-198}{66}$$

$$\text{Since, } \frac{-27}{66} > \frac{-34}{66} > \frac{-36}{66} > \frac{-198}{66}$$

$$\text{Hence, descending order is } \frac{-9}{22}, \frac{-17}{33}, \frac{-6}{11} \text{ and } -3$$

b. $\frac{-7}{10}, \frac{-3}{8}, \frac{9}{-20}, \frac{-13}{15}$

On converting $\frac{9}{-20}$ into standard form we get

$$\frac{9}{-20} \times \frac{(-1)}{(-1)} = \frac{-9}{20}$$

LCM of 10, 8, 20 and 15 is 120

$$\frac{-7}{10} \times \frac{12}{12} = \frac{-84}{120}$$

$$\frac{-3}{8} \times \frac{15}{15} = \frac{-45}{120}$$

$$\frac{-9}{20} \times \frac{6}{6} = \frac{-54}{120}$$

$$\frac{-13}{15} \times \frac{8}{8} = \frac{-104}{120}$$

$$\text{Since, } \frac{-45}{120} > \frac{-54}{120} > \frac{-84}{120} > \frac{-104}{120}$$

$$\text{So, } \frac{-3}{8} > \frac{-9}{20} > \frac{-7}{10} > \frac{-13}{15}$$

$$\text{Hence, descending order is } \frac{-3}{8}, \frac{-9}{20}, \frac{-7}{10} \text{ and } \frac{-13}{15}$$

c. $\frac{-3}{5}, \frac{-13}{15}, \frac{-7}{10}, \frac{17}{-25}$ LCM of 5, 15, 10 and 25 is 150

$$\frac{-3}{5} \times \frac{30}{30} = \frac{-90}{150}$$

$$\frac{-13}{15} \times \frac{10}{10} = \frac{-130}{150}$$

$$\frac{-7}{10} \times \frac{15}{15} = \frac{-105}{150}$$

$$\frac{-17}{25} \times \frac{6}{6} = \frac{-102}{150}$$

$$\text{Since, } \frac{-90}{150} > \frac{-17}{25} > \frac{-7}{10} > \frac{-13}{15}$$

$$\text{So, } \frac{-3}{5} > \frac{-102}{150} > \frac{-105}{150} > \frac{-130}{150}$$

$$\text{Hence, the descending order is } \frac{-3}{5}, \frac{-17}{25}, \frac{-7}{10} \text{ and } \frac{-13}{15}$$

d. $\frac{-10}{11}, \frac{-11}{22}, \frac{-21}{33}, \frac{-18}{44}$

LCM of 11, 22, 33 and 44 is 132

$$\frac{-10}{11} \times \frac{12}{12} = \frac{-120}{132}$$

$$\frac{-11}{22} \times \frac{6}{6} = \frac{-66}{132}$$

$$\frac{-21}{33} \times \frac{4}{4} = \frac{-84}{132}$$

$$\frac{-18}{44} \times \frac{3}{3} = \frac{-54}{132}$$

$$\text{Since, } \frac{-54}{132} > \frac{-66}{132} > \frac{-84}{132} > \frac{-120}{132}$$

$$\text{Hence, descending order is } \frac{-18}{44}, \frac{-11}{22}, \frac{-21}{33} \text{ and } \frac{-10}{11}$$

2. a. $3x + 4 = 2x - 18$

$$3x - 2x = -18 - 4$$

$$x = -22$$

Verification

$$3x - 22 + 4 = 2 \times -22 - 18$$

$$-66 + 4 = -44 - 18$$

$$-62 = -62$$

$$\text{LHS} = \text{RHS}$$

$$\begin{aligned}
 \text{b. } 2y + \frac{5}{3} &= \frac{24}{5} - 3y \\
 \frac{6y + 5}{3} &= \frac{24 - 15y}{5} \\
 5(6y + 5) &= 3(24 - 15y) \\
 30y + 25 &= 72 - 25 \\
 75y &= 47 \\
 y &= \frac{47}{75}
 \end{aligned}$$

Verification

$$\begin{aligned}
 2 \times \frac{47}{75} + \frac{5}{3} &= \frac{24}{5} - \frac{3 \times 47}{75} \\
 \frac{94}{75} + \frac{5}{3} &= \frac{24}{5} - \frac{141}{75} \\
 \frac{94 + 5 \times 25}{75} &= \frac{24 \times 15 - 141}{75} \\
 &= \frac{94 + 125}{75} \\
 &= \frac{360 - 141}{75} \\
 \frac{219}{75} &= \frac{219}{75} \\
 \text{LHS} &= \text{RHS}
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } 2m &= 5m - \frac{7}{4} \quad \Rightarrow \quad \frac{7}{4} = 5m - 2m \\
 \Rightarrow \frac{7}{4} &= 3m \quad \Rightarrow \quad m = \frac{7}{3 \times 4} = \frac{7}{12}
 \end{aligned}$$

Verification:

$$\begin{aligned}
 2 \times \frac{7}{12} &= 5 \times \frac{7}{12} - \frac{7}{4} \\
 &= \frac{14}{12} = \frac{35}{12} - \frac{7}{4} \\
 \Rightarrow \frac{14}{12} &= \frac{35 - 7 \times 3}{12} \\
 \Rightarrow \frac{14}{12} &= \frac{35 - 21}{12} \quad \Rightarrow \quad \frac{14}{12} = \frac{14}{12} \\
 \text{LHS} &= \text{RHS}
 \end{aligned}$$

$$\begin{aligned} \text{d. } \frac{x}{2} - \frac{1}{5} &= \frac{x}{4} + \frac{3}{10} &\Rightarrow \frac{x}{2} - \frac{x}{4} &= \frac{3}{10} + \frac{1}{5} \\ \frac{2x-x}{4} &= \frac{3+2}{10} \\ \frac{x}{4} &= \frac{5}{10} &\Rightarrow \frac{x}{4} &= \frac{1}{2} &\Rightarrow x &= \frac{4}{2} = 2 \end{aligned}$$

Verification:

$$\begin{aligned} \frac{x}{2} - \frac{1}{5} &= \frac{x}{4} + \frac{3}{10} &\Rightarrow \frac{2}{2} - \frac{1}{5} &= \frac{2}{4} + \frac{3}{10} \\ 1 - \frac{1}{5} &= \frac{1}{2} + \frac{3}{10} &\Rightarrow \frac{5-1}{5} &= \frac{5+3}{10} \\ \frac{4}{5} &= \frac{8}{10} &\Rightarrow \frac{4}{5} &= \frac{4}{5} \end{aligned}$$

LHS = RHS

$$\begin{aligned} \text{e. } \frac{6x+1}{3} + 2 &= \frac{x-3}{4} \\ \frac{6x+1+6}{3} &= \frac{x-3}{4} \\ \frac{6x+7}{3} &= \frac{x-3}{4} \\ 4(6x+7) &= 3(x-3) \\ 24x+28 &= 3x-9 \\ 24x-3x &= -9-28 \\ 21x &= -37 \\ x &= \frac{-37}{21} \end{aligned}$$

Verification:

$$\begin{aligned} \frac{6x+1}{3} + 2 &= \frac{x-3}{4} \\ \frac{6x+7}{3} &= \frac{x-3}{4} \\ 24x+28 &= 3x-9 \\ 24 \times \left(\frac{-37}{21} \right) + 28 &= 3 \times \left(\frac{-37}{21} \right) - 9 \\ 8 \times \frac{-37}{7} + 28 &= \frac{-37}{7} - 9 \\ \frac{-296}{7} + 28 &= \frac{-37-63}{7} \\ \frac{-296+196}{7} &= \frac{-100}{7} \\ \frac{-100}{7} &= \frac{-100}{7} \\ \text{LHS} &= \text{RHS} \end{aligned}$$

f. $3(t - 4) = 5(2t + 1)$

$$3t - 12 = 10t + 5$$

$$3t - 10t = 5 + 12$$

$$-7t = 17$$

$$t = \frac{-17}{7}$$

Verification:

$$3(t - 4) = 5(2t + 1)$$

$$3t - 12 = 10t + 5$$

$$3 \times \frac{-17}{7} - 12 = 10 \times \frac{-17}{7} + 5$$

$$\frac{-51}{7} - 12 = \frac{-170}{7} + 5$$

$$\frac{-51 - 84}{7} = \frac{-170 - 35}{7}$$

$$-51 - 84 = -170 + 35$$

$$-135 = -135$$

$$\text{LHS} = \text{RHS}$$

3. a. Sum of all angles of quadrilateral = 360°

$$x + 110^\circ + 70^\circ + 100^\circ = 360^\circ$$

$$x + 280^\circ = 360^\circ$$

$$x = 360^\circ - 280^\circ = 80^\circ$$

b. $y + 80^\circ = 180^\circ$ (Linear pair)

$$y = 180^\circ - 80^\circ = 100^\circ$$

$z + 70^\circ = 180^\circ$ (Linear pair)

$$z = 180^\circ - 70^\circ = 110^\circ$$

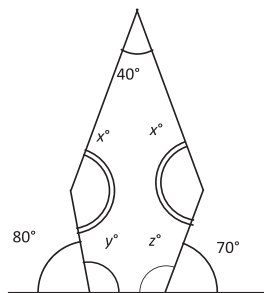
This is a pentagon

$$\therefore 40^\circ + x^\circ + x^\circ + y + z = 540^\circ$$

$$40 + 2x + 100^\circ + 110^\circ = 540^\circ$$

$$2x = 540^\circ - 250^\circ = 290^\circ$$

$$x = \frac{290^\circ}{2} = 145^\circ$$



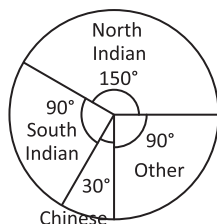
4. Total people = $50 + 30 + 10 + 30 = 120$

$$\text{Central angle for North Indian} = \left(\frac{50}{120} \times 360 \right)^\circ = 150^\circ$$

$$\text{Central angle for South Indian} = \left(\frac{30}{120} \times 360 \right)^\circ = 90^\circ$$

$$\text{Central angle for chinese} = \left(\frac{10}{120} \times 360 \right)^\circ = 30^\circ$$

$$\text{Central angle for others} = \left(\frac{30}{120} \times 360 \right)^\circ = 90^\circ$$



5. a. 5776

$$\begin{array}{r} 76 \\ 7 \overline{) 5776} \\ +7 -49 \\ \hline 146 876 \\ +6 -876 \\ \hline 0 \end{array}$$

Hence, $\sqrt{5776} = 76$

c. 49284

$$\begin{array}{r} 222 \\ 2 \overline{) 049284} \\ +2 -04 \\ \hline 42 092 \\ +2 -84 \\ \hline 442 884 \\ +2 -884 \\ \hline 0 \end{array}$$

Hence, $\sqrt{49284} = 222$

b. 7921

$$\begin{array}{r} 89 \\ 8 \overline{) 7921} \\ +8 -64 \\ \hline 169 1521 \\ +9 -1521 \\ \hline 0 \end{array}$$

Hence, $\sqrt{7921} = 89$

d. 290521

$$\begin{array}{r} 539 \\ 5 \overline{) 290521} \\ +5 -25 \\ \hline 103 405 \\ +3 -309 \\ \hline 1069 9621 \\ +9 -9621 \\ \hline 0 \end{array}$$

Hence, $\sqrt{290521} = 539$

6. a. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 =$ Sum of first 8 odd numbers

$$= 8^2 = 8 \times 8 = 64$$

b. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 =$ Sum of first 10 odd numbers.

$$10^2 = 10 \times 10 = 100$$

c. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 =$ Sum of first 11 odd numbers.

$$11^2 = 11 \times 11 = 121$$

- d. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 = \text{Sum of first 13 odd numbers.}$

$$13^2 = 13 \times 13 = 169$$

7. a.

$$\begin{array}{r|l} & 26.7 \\ \hline 2 & \overline{07\ 12.89} \\ +2 & -4 \\ \hline 46 & 3\ 12 \\ +6 & -2\ 76 \\ \hline 527 & 36\ 89 \\ +7 & -36\ 89 \\ \hline & 0 \end{array}$$

$$\begin{array}{r|l} & 2.9 \\ \hline 2 & \overline{08.41} \\ +2 & -4 \\ \hline 49 & 4\ 41 \\ +9 & -4\ 41 \\ \hline & 0 \end{array}$$

$$\begin{aligned} \therefore & \frac{\sqrt{712.89} + \sqrt{8.41}}{\sqrt{712.89} - \sqrt{8.41}} \\ &= \frac{26.7 + 2.9}{26.7 - 2.9} = \frac{29.6}{23.8} \\ &= \frac{296}{238} = \frac{148}{119} \end{aligned}$$

b.

$$\begin{array}{r|l} & 24.6 \\ \hline 2 & \overline{06\ 05.16} \\ +2 & -4 \\ \hline 44 & 2\ 05 \\ +4 & -1\ 76 \\ \hline 486 & 29\ 16 \\ +6 & -29\ 16 \\ \hline & 0 \end{array}$$

$$\begin{array}{r|l} & 4.6 \\ \hline 4 & \overline{21.16} \\ +4 & -16 \\ \hline 86 & 5\ 16 \\ +6 & -5\ 16 \\ \hline & 0 \end{array}$$

$$\begin{aligned} \therefore & \frac{\sqrt{605.16} - \sqrt{21.16}}{\sqrt{605.16} + \sqrt{21.16}} = \frac{24.6 - 4.6}{24.6 + 4.6} \\ &= \frac{20}{29.2} = \frac{200}{292} = \frac{50}{73} \end{aligned}$$

8. a. 2744

$$2744 = \overline{2 \times 2 \times 2} \times \overline{7 \times 7 \times 7}$$

Every factor is in the group of 3. So 2744 is a perfect cube.

$$\begin{array}{r|l} 2 & 2744 \\ \hline 2 & 1372 \\ \hline 2 & 686 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

b. 15360

2	15360		2	120
2	7680		2	60
2	3840		2	30
2	1920		3	15
2	960		5	5
2	480			1
2	240			

$$15360 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times 2 \times 3 \times 5$$

Every number is not in group of three.

So, 15360 is not a perfect cube.

c. 32768

2	32768		2	256		
2	16384		2	128		
2	8192		2	64		
2	4096		2	32		
2	2048		2	16		
2	1024		2	8		
2	512					

$$32768 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2}$$

Every number is in the group of three.

So, 32768 is a perfect cube

d. $3375 = \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}$

$$= 3 \times 5 = 15$$

Every number is in group of three.

So, 3375 is a perfect cube

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

e. 91125

3	91125	
3	30375	
3	10125	
5	3375	
5	675	
5	135	
		3
		3
		3
		1

$$91125 = \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}$$

Every number is in the group of three.

So 91125 is a perfect cube.

f. 46656

$$46656 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

Every number is in group of three.

So, 46656 is a perfect cube.

3	46656	
3	15552	
3	5184	
2	1728	
2	864	
2	432	
2	216	
		2
		2
		3
		3
		3
		1

g. 175616

2	175616	
2	87808	
2	43904	
2	21952	
2	10976	
2	5488	
2	2744	
		2
		2
		7
		7
		7
		1

$$175616 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{7 \times 7 \times 7}$$

Every number is in the group of three.

So, 175616 is a perfect cube.

h. 27962

$$27962 = 2 \times 11 \times 31 \times 41$$

Every number is not in the group of three.

So, 27962 is not a perfect cube.

2	27962
11	13981
31	1271
41	41
	1

9. a. $5832 = \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}$

2	5832		
2	2916		
2	1458		
3	729		
3	243		
3	81		
		3	27
		3	9
		3	3
			1

$$\begin{aligned}\sqrt[3]{5832} &= \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}} \\ &= 2 \times 3 \times 3 = 18\end{aligned}$$

b. 15625

5	15625		
5	3125		
5	625		
5	125		
		5	25
		5	5
			1

$$\begin{aligned}\sqrt[3]{15625} &= \sqrt[3]{\overline{5 \times 5 \times 5} \times \overline{5 \times 5 \times 5}} \\ &= 5 \times 5 = 25\end{aligned}$$

c. 32768

2	32768				
2	16384				
2	8192				
2	4096				
2	2048				
2	1024				
2	512				
		2	256		
		2	128		
		2	64		
		2	32		
		2	16		
		2	8		
				2	4
				2	2
					1

$$\begin{aligned}32768 &= \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \\ \sqrt[3]{32768} &= \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2}} \\ &= 2 \times 2 \times 2 \times 2 \times 2 = 32\end{aligned}$$

d. 39304

$$39304 = 2 \times 2 \times 2 \times 17 \times 17 \times 17$$

$$\begin{aligned}\sqrt[3]{39304} &= \sqrt[3]{2 \times 2 \times 2 \times 17 \times 17 \times 17} \\ &= 2 \times 17 = 34\end{aligned}$$

2	39304
2	19652
2	9826
17	4913
17	289
17	17
	1

e. 27000

2	27000	
2	13500	
2	6750	
3	3375	
3	1125	
3	375	
		5
		5
		5
		1

$$27000 = \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}$$

$$\begin{aligned}\sqrt[3]{27000} &= \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{5 \times 5 \times 5}} \\ &= 2 \times 3 \times 5 = 30\end{aligned}$$

f. 74088

2	74088	
2	37044	
2	18522	
3	9261	
3	3087	
3	1029	
		7
		7
		7
		1

$$74088 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7$$

$$\begin{aligned}\sqrt[3]{74088} &= \sqrt[3]{\overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{7 \times 7 \times 7}} \\ &= 2 \times 3 \times 7 = 42\end{aligned}$$

g. 250047

3	250047		
3	83349		
3	27783		
3	9261		
3	3087		
3	1029		
		7	343
		7	49
		7	7
			1

$$250047 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7$$

$$\begin{aligned}\sqrt[3]{250047} &= \sqrt[3]{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7} \\ &= 3 \times 3 \times 7 = 63\end{aligned}$$

h. 531441

3	531441		3	2187		3	27
3	177147		3	729		3	9
3	59049		3	243		3	3
3	19683		3	81			1
3	6561						

$$531441 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

$$\begin{aligned}\sqrt[3]{531441} &= \sqrt[3]{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3} \\ &= 3 \times 3 \times 3 \times 3 = 81\end{aligned}$$

10. Original price = ₹ 22,000

New price = ₹ 18,000

Decrease in price = ₹ (22,000 – 18,000) = ₹ 4000

$$\begin{aligned}\text{Decrease percentage} &= \left(\frac{\text{Decrease in value}}{\text{Original value}} \right) \times 100 \\ &= \left(\frac{4,000}{22,000} \right) \times 100 = 18.18\%\end{aligned}$$

Hence, the decrease percentage in the price of LED TV is 18.18%

11. Price of motorcycle last year = ₹ 75,000

Increase in price = ₹ (8% of 75000)

$$= ₹ \left(\frac{8}{100} \times 75000 \right) = ₹ 6000$$

$$\begin{aligned}\text{So, new price of motorcycle} &= ₹ (75000 + 6000) \\ &= ₹ 81000\end{aligned}$$

Hence, the new price of motorcycle is ₹ 81,000

$$\begin{aligned}12. \text{ Students weak in Maths} &= 40\% \text{ of } 60 \\ &= \frac{40}{100} \times 60 = 24 \text{ students}\end{aligned}$$

$$\text{Students good in Maths} = 60 - 24 = 36 \text{ students}$$

Hence, 36 students are good in Maths.

Model Test Paper-II

1. a. Positive, negative b. monomial
c. two terms d. three or 3
2. a. $(-7ab^2c) \times (4a^2b^3c^2) = (-7 \times 4)(a^{1+2}b^{2+3}c^{1+2})$
 $= -28 a^3b^5c^3$
 $= -28 (-2)^3 \times \left(\frac{-1}{2}\right)^5 \times (-3)^3$
 $= -28 \times (-8) \times \left(\frac{-1}{32}\right) \times (-27)^3$
 $= (7 \times 27 = 189)$
- b. $\left(\frac{-7}{5}m^2n\right) \times \left(\frac{10}{14}n^2p\right) = \left(\frac{-7}{5} \times \frac{10}{14}\right) \times (m^2n^{1+2}p)$
 $= \frac{-1}{4} \times (2)^2 \times (-1)^3 \times 3$
 $= \frac{-1}{4} \times 4 \times (-1) \times 3$
 $= \frac{+12}{4} = 3$
- c. $\left(\frac{-5}{7}mn\right) \times \left(\frac{10}{17}n^2p\right) \times \left(\frac{-28}{25}m^2p^2\right)$
 $= \left(\frac{-5}{7} \times \frac{10}{17} \times \frac{-28}{25}\right) \times (m^{2+1} \times n^{1+2} \times p^{2+1})$
 $= \frac{4}{7} \times (m^3n^3p^3)$
 $= \frac{4}{7} \times [(2)^3 \times (-1)^3 \times (3)^3]$
 $= \frac{4}{7} \times 8 \times (-1) \times 27$

$$= \frac{32 \times (-27)}{7} = \frac{-864}{7}$$

$$\begin{aligned} \text{d. } & \left(\frac{-1}{5}a^2b\right) \times \left(\frac{-3}{8}b^2c^3\right) \times \left(\frac{16}{9}a^3b^2\right) \\ &= \left(\frac{-1}{5} \times \frac{-3}{8} \times \frac{16}{9}\right) \times (a^{2+3}b^{2+1+2}c^3) \\ &= \frac{2}{15} \times (a^5b^5c^3) \\ &= \frac{2}{15} \times (2)^5 \times \left(\frac{-1}{2}\right)^5 \times (-7)^3 \\ &= \frac{-2}{15} \times 27 = -\frac{18}{5} \end{aligned}$$

$$3. \text{ a. } (3)^{-9} \times 3^0 \div 5^{-1} = \frac{1}{3^9} \div \frac{1}{5} = \frac{5}{3^9} = \frac{5}{19,683}$$

$$\begin{aligned} \text{b. } & (-4)^{-2} \times (5)^{-3} \times 5^4 = \frac{1}{(-4)^2} \times \frac{1}{(5)^3} \times 5^4 \\ &= \frac{5 \times 5 \times 5 \times 5}{(-4) \times (-4) \times 5 \times 5 \times 5 \times 5} \\ &= \frac{5}{16} \end{aligned}$$

$$\begin{aligned} \text{c. } & 3^{-2} \times \left(\frac{5}{9}\right)^0 \times 4^2 = \frac{1}{3 \times 3} \times 4^2 \\ &= \frac{1}{9} \times 16 = \frac{16}{9} \end{aligned}$$

$$\text{d. } \left[\left(\frac{-2}{7}\right)^0 + \left(\frac{3}{7}\right)^0\right] \div 7^0 = [1 + 1] \div 1 = 2 \div 1 = 2$$

$$\begin{aligned} 4. \text{ a. } & 25x^2 + 30 + 9 = (5x)^2 + 2 \times 5x \times 3 + (3)^2 \\ &= (5x + 3)^2 = (5x + 3)(5x + 3) \end{aligned}$$

$$\begin{aligned} \text{b. } & p^2 - 10p + 25 = (p)^2 - 2 \times 5 \times p + (5)^2 \\ &= (p - 5)^2 = (p - 5)(p - 5) \end{aligned}$$

$$\text{c. } 64 - 16y + y^2 = (8)^2 - 2 \times 8 \times y + (y)^2 = (8 - y)^2$$

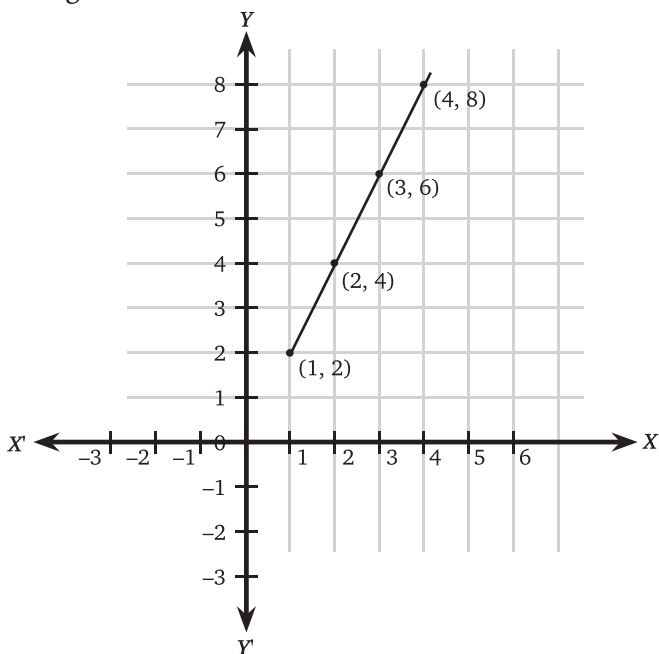
$$\begin{aligned} \text{d. } & 2m^2 + 12m + 18 = 2(m^2 + 2 \times 3m + 3^2) \\ &= 2(m + 3)^2 = 2(m + 3)(m + 3) \end{aligned}$$

$$\begin{aligned} \text{e. } & 49m^4 - 112m^2n^2 + 64n^4 \\ &= (7m^2)^2 - 2 \times 7m^2 \times 8n^2 + (8n^2)^2 \\ &= (7m^2 - 8n^2)^2 = (7m^2 - 8n^2)(7m^2 - 8n^2) \end{aligned}$$

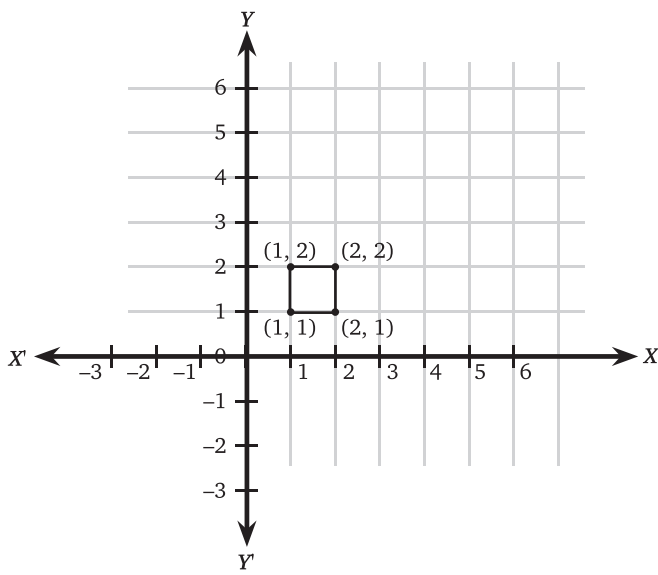
$$\begin{aligned} \text{f. } 16a^2 + 40a + 25 &= (4a)^2 + 2 \times 4 \times 5 + (5)^2 \\ &= (4a + 5)^2 = (4a + 5)(4a + 5) \end{aligned}$$

5. $A(4, 7), B(7, 4), C(4, 1), D(1, 4), E(3, 5), F(5, 5), G(5, 3),$
 $H(3, 3), I(4, 5), J(5, 4), K(4, 3), L(3, 4)$

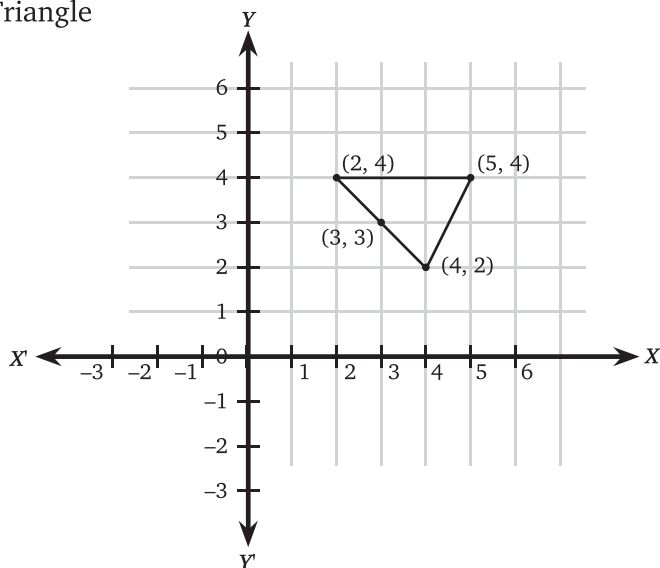
6. a. Straight line



b. Square



c. Triangle



$$\begin{aligned}
 7. \quad a. \quad \sqrt[4]{\frac{49}{64}} \times \sqrt[3]{\frac{343}{512}} &= \left(\frac{49}{64}\right)^{\frac{1}{2}} \times \left(\frac{343}{512}\right)^{\frac{1}{3}} \\
 &= \left[\left(\frac{7}{8}\right)^2\right]^{\frac{1}{2}} \times \left[\left(\frac{7}{8}\right)^3\right]^{\frac{1}{3}} \\
 &= \frac{7}{8} \times \frac{7}{8} = \frac{49}{64}
 \end{aligned}$$

$$\begin{aligned}
 c. \quad \sqrt[4]{\frac{81}{256}} \times \sqrt[5]{\frac{32}{243}} &= \left[\left(\frac{3}{4}\right)^4\right]^{\frac{1}{4}} \times \left[\left(\frac{2}{3}\right)^5\right]^{\frac{1}{5}} \\
 &= \left(\frac{3}{4}\right)^{4 \times \frac{1}{4}} \times \left(\frac{2}{3}\right)^{5 \times \frac{1}{5}} \\
 &= \frac{3}{4} \times \frac{2}{3} = \frac{1}{2}
 \end{aligned}$$

$$d. \quad \sqrt[5]{\frac{16}{625}} \times \sqrt[5]{\frac{2}{5}} = \sqrt[5]{\frac{16}{625} \times \frac{2}{5}} = \left[\left(\frac{2}{5}\right)^5\right]^{\frac{1}{5}} = \frac{2}{5}$$

$$\begin{aligned}
 8. \quad a. \quad 4x^{\frac{-2}{5}} \times 5x^{\frac{-3}{10}} &= 5 \times 4 \times x^{\frac{-2}{5} + \frac{-3}{10}} \\
 &= 20x^{\frac{-4-3}{10}} = 20x^{\frac{-7}{10}} = \frac{10}{x^{\frac{7}{10}}}
 \end{aligned}$$

$$b. \quad (y^{-3})^4 \times (x^{\frac{-3}{5}})^{10} = y^{-12} \times x^{\frac{-3}{5} \times 10}$$

$$= y^{-12} \times x^{-6} = x^{-6} y^{-12} = \frac{1}{x^6 y^{12}}$$

c. $\left[\sqrt[3]{\left(\frac{a}{b}\right)^9} \right]^{-15} = \left[\left(\frac{a}{b}\right)^{\frac{1}{3} \times 9} \right]^{-15}$
 $= \left[\left(\frac{a}{b}\right)^3 \right]^{-15} = \left(\frac{a}{b}\right)^{-45} = \left(\frac{b}{a}\right)^{45}$

d. $\left[\sqrt[4]{\left(\frac{m}{n}\right)^{-16}} \right]^{\frac{1}{4}} = \left[\left(\frac{m}{n}\right)^{\frac{1}{4} \times (-16)} \right]^{\frac{1}{4}}$
 $= \left(\frac{m}{n}\right)^{-4 \times \frac{1}{4}} = \left(\frac{m}{n}\right)^{-1} = \frac{n}{m}$

9. a. $\frac{3^{-4} \times 5^{-2} \times 27^{\frac{2}{3}}}{6^3 \times (125)^{\frac{1}{3}} \times (49)^{\frac{-1}{2}}} = \frac{3^{-4} \times 5^{-2} \times 3^{3 \times \frac{2}{3}}}{6^3 \times (5^{\frac{1}{3}})^3 \times (7^2)^{\frac{-1}{2}}}$
 $= \frac{3^{-4} \times 5^{-2} \times 3^2}{6^3 \times (5^3)^{\frac{1}{3}} \times (7^2)^{\frac{-1}{2}}} = \frac{3^{-4} \times 5^{-2} \times 3^{3 \times \frac{2}{3}}}{6^3 \times 5 \times 7^{-1}}$
 $= \frac{3^{-4} \times 5^{-2} \times 3^2}{6^3 \times 5 \times 7^{-1}} = \frac{7 \times 3^{-4+2} \times 5^{-2-1}}{2^3 \times 3^3}$
 $= \frac{7 \times 3^{-2-3} \times 5^{-3}}{2^3} = \frac{7 \times 3^{-5} \times 5^{-3}}{2^3}$
 $= \frac{7}{2^3 \times 3^5 \times 5^3}$

b. $\frac{(2^2)^{-2} \times 5^3 \times 4^{3 \times \frac{2}{3}}}{(5^3) \times (10^3)^{\frac{2}{3}} \times 3^2} = \frac{2^{-4} \times 5^{-3} \times 16}{5^{-2} \times 10^2 \times 3^2}$
 $= \frac{2^{-4} \times 5^{-3} \times 2^4}{5^{-2} \times 2^2 \times 5^2 \times 3^2} = \frac{2^{-4+4} \times 5^{-3-(-2)-2}}{2^2 \times 3^2}$
 $= \frac{1}{5^3 \times 2^2 \times 3^2} = \frac{1}{125 \times 4 \times 9} = \frac{1}{4500}$

c. $(x^{-15} y^{10})^{\frac{1}{5}} \div (x^{14} y^{-7})^{\frac{1}{7}} = x^{-15 \times \frac{1}{5}} y^{10 \times \frac{1}{5}} \div x^{14 \times \frac{1}{7}} y^{-7 \times \frac{1}{7}}$
 $= x^{-3} y^2 \div x^{y^{-1}} = \frac{x^{-3} y^2}{x^2 y^{-1}} = x^{-3-2} y^{2-(-1)}$
 $= x^{-5} y^3 = \frac{y^3}{x^5}$

d. $\sqrt[3]{x^{-6} y^9} \div \sqrt[5]{x^{-5} y^{20}} = (x^{-6} y^9)^{\frac{1}{3}} \div (x^{-5} y^{20})^{\frac{1}{5}}$

$$\begin{aligned} &= x^{-6 \times \frac{1}{3}} y^{9 \times \frac{1}{3}} \div x^{-5 \times \frac{1}{5}} y^{20 \times \frac{1}{3}} \\ &= x^{-2} y^3 \div x^{-1} y^4 = \frac{x^{-2} y^3}{x^{-1} y^4} = x^{-2 - (-1)} y^{3-4} \\ &= x^{-2+1} y^{-1} = x^{-1} y^{-1} = \frac{1}{xy} \end{aligned}$$

10. $P = ₹ 3,50,000$, $n = 4$, $r = 6\%$

$$\begin{aligned} \text{Value of car after 4 years} &= 350000 \left(1 - \frac{6}{100}\right)^4 \\ &= 350000 \left(\frac{94}{100}\right)^4 \\ &= ₹ 2,73,262.14 \end{aligned}$$

11. Here, $P = ₹ 2,00,000$, $r_1 = 10\%$, $r_2 = 7.5\%$

$$\begin{aligned} \text{Value of machine after 3 years} &= 200000 \left(1 - \frac{10}{100}\right) \left(1 - \frac{7.5}{100}\right)^2 \\ &= ₹ 1,54,012.50 \end{aligned}$$

12. Here, $P = 20$ lakhs, $r = 3.5\%$, $n = 2$

$$\begin{aligned} \text{Population after 2 years} &= 20 \left(1 + \frac{3.5}{100}\right)^2 \\ &= 21.4245 \text{ lakhs} \end{aligned}$$