KANHA BOOKS International

Brilliant Mathematics

8

Teacher's Manual

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Contents

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Class-8

1 Rational Numbers

Exercise 1.1

1. Identify the positive and negative rational numbers from the following :

   Positive rational numbers— $\frac{-3}{-7}, \frac{17}{18}, \frac{243}{125}, \frac{-81}{-64}$

   Negative rational number — $\frac{13}{-17}, \frac{15}{-21}, \frac{-8}{19}$

2. Express $\frac{-3}{11}$ as a rational number with

   (i) $\frac{-3}{11} \times \frac{7}{7} = \frac{-21}{77}$

   (ii) $\frac{-3}{11} \times \frac{(-5)}{(-5)} = \frac{15}{-55}$

   (iii) $\frac{-3 \times 11}{11 \times 11} = \frac{-33}{121}$

   (iv) $\frac{-3}{11} \times \frac{(-4)}{(-4)} = \frac{12}{-44}$

3. Write four rational numbers equivalent to each of the following :

   (i) $\frac{1}{5} = \frac{1 \times 2}{5 \times 2} = \frac{2}{10}$; $\frac{1 \times 3}{5 \times 3} = \frac{3}{15}$;

   $\frac{1 \times 4}{5 \times 4} = \frac{4}{20}$; $\frac{1 \times 5}{5 \times 5} = \frac{5}{25}$

   Ans. $\frac{2}{10}, \frac{3}{15}, \frac{4}{20}, \frac{5}{25}$

(ii) $\frac{-7}{13} = \frac{-7\times2}{13\times2} = \frac{-14}{26}$; $\frac{-7\times3}{13\times3} = \frac{-21}{39}$

$\frac{-7\times4}{13\times4} = \frac{-28}{52}$; $\frac{-7\times5}{13\times5} = \frac{-35}{65}$

Ans. $\frac{-14}{26}, \frac{-21}{39}, \frac{-28}{52}, \frac{-35}{65}$

(iii) $\frac{-29}{-21} = \frac{-29\times2}{-21\times2} = \frac{-58}{-42}$; $\frac{-29\times3}{-21\times3} = \frac{-87}{-63}$

$\frac{-29\times4}{-21\times4} = \frac{-116}{-84}$; $\frac{-29\times5}{-21\times5} = \frac{-145}{-105}$

Ans. $\frac{-58}{-42}, \frac{-87}{-63}, \frac{-116}{-84}, \frac{-145}{-105}$

(iv) $\frac{19}{-6} = \frac{19\times2}{-6\times2} = \frac{38}{-12}$; $\frac{19\times3}{-6\times3} = \frac{57}{-18}$

$\frac{19\times4}{-6\times4} = \frac{76}{-24}$; $\frac{19\times5}{-6\times5} = \frac{95}{-30}$

4. Fill in the blanks :

(i) $\frac{70}{25} = \frac{70\div5}{25\div5} = \frac{14}{5}$

$\frac{70\times4}{25\times4} = \frac{280}{100}$; $\frac{70\times(-3)}{25\times(-3)} = \frac{-210}{-75}$

Ans. $\frac{70}{25}, \frac{14}{5}, \frac{280}{100}, \frac{-210}{-75}$

(ii) $\frac{-3}{\square} = \frac{-81}{54} = \frac{\square}{12} = \frac{36}{\square}$

$-81\div(-3) = 27 \quad = \frac{-81\div27}{54\div27} = \frac{-3}{2}$

$\frac{-3}{2} = \frac{\square}{12} = 12\div2 = 6 = \frac{-3\times6}{2\times6} = \frac{-18}{12}$

$\frac{-3}{2} = \frac{36}{\square} = 36\div(-3) = -12 = \frac{-3\times-12}{2\times-12} = \frac{36}{-24}$

Ans. $\frac{-3}{2}, \frac{-81}{54}, \frac{-18}{12}, \frac{36}{-24}$

(iii) $\frac{9}{-5} = \frac{\square}{20} = 20 \div (-5) = -4 = \frac{9}{-5} \times \frac{(-4)}{(-4)} = \frac{-36}{20}$

$\frac{9}{-5} = \frac{\square}{-15} = -15 \div (-5) = 3 = \frac{9 \times 3}{-5 \times 3} = \frac{27}{-15}$

$\frac{9}{-5} = \frac{-45}{\square} = -45 \div (-9) = 5$

$= \frac{-9}{5} \times \frac{5}{5} = \frac{-45}{25}$

Ans. $\frac{8}{-5} = \frac{-36}{20} = \frac{27}{-15} = \frac{-45}{25}$

(iv) $\frac{-2}{-11} = \frac{\square}{33} = 33 \div (-11) = -3 = \frac{-2 \times (-3)}{-11 \times (-3)} = \frac{6}{33}$

$\frac{-2}{-11} = \frac{-8}{\square} = -8 \div (-2) = 4 = \frac{-2 \times 4}{-11 \times 4} = \frac{-8}{-44}$

$\frac{-2}{-11} = \frac{\square}{99} = 99 \div (-11) = 9 = \frac{-2 \times 9}{-11 \times 9} = \frac{-18}{99}$

Ans. $\frac{-2}{-11}, \frac{6}{33}, \frac{-8}{-44}, \frac{-18}{99}$

5. Check whether each pair has equal rational numbers :

(i) $\frac{3}{7}, \frac{39}{91}$ $\frac{39 \div 13}{91 \div 13} = \frac{3}{7}$, yes

(ii) $\frac{5}{12}, \frac{60}{25}$ $\frac{60 \div 5}{25 \div 5} = \frac{12}{5}$, No

(iii) $\frac{-4}{9}, \frac{20}{-45}$ $\frac{20 \div (-5)}{-45 \div (-5)} = \frac{-4}{9}$, yes

(iv) $\frac{-21}{-71}, \frac{84}{284}$ $\frac{84 \div (-4)}{284 \div (-4)} = \frac{-21}{-71}$, yes

(v) $\frac{-5}{-8}, \frac{-65}{-117}$ $\frac{-65 \div (13)}{-117 \div (13)} = \frac{-5}{-9}$, No

(vi) $\frac{4}{5}, \frac{48}{-60}$ $\frac{48 \div 12}{-60 \div 12} = \frac{4}{-5}$, No

6. Write the following rational numbers in standard form :

(i) $\frac{28}{70}$, HCF of 28 and 70 is 14

$$\frac{28 \div (14)}{70 \div 14} = \frac{2}{5}$$

(ii) $\frac{216}{-432}$, HCF of 216 and −432 is 216

$$\frac{216 \div 216}{-432 \div 216} = \frac{1}{-2}$$

(iii) $\frac{-299}{-161}$ = HCF of 299 and 161 = 23

$$\frac{-299 \div 23}{-161 \div 23} = \frac{-13}{-7} = \frac{13}{7}$$

(iv) $\frac{-588}{2205}$ HCF of 588 and 2205 = 147

$$\frac{-588 \div 147}{2205 \div 147} = \frac{-4}{15}$$

(v) $\frac{1792}{-1456}$ HCF of 1792 and 1456 = 112

$$\frac{1792 \div 112}{-1456 \div 112} = \frac{16}{-13}$$

(vi) $\frac{-56}{-336}$ HCF of 56 and 336 = 56

$$\frac{-56 \div 56}{-336 \div 56} = \frac{-1}{-6} = \frac{1}{6}$$

(vii) $\frac{49}{91}$ HCF of 49 and 91 = 7

$$\frac{49 \div 7}{91 \div 7} = \frac{7}{13}$$

(viii) $\frac{54}{-216}$ HCF of 54 and 216 = 54

$$\frac{54 \div 54}{-216 \div 54} = \frac{1}{-4}$$

7. Add the following rational numbers :

(i) $\frac{3}{5}$ and $\frac{4}{5} = \frac{3+4}{5} = \frac{7}{5}$

(ii) $\frac{-4}{7}$ and $\frac{3}{7} = \frac{-4}{7} + \frac{3}{7} = \frac{-1}{7}$

(iii) $\frac{11}{13}$ and $\frac{9}{-13}$

$$\frac{9 \times (-1)}{-13 \times (-1)} = \frac{-9}{13}$$ (positive denominator)

$$\frac{11}{13} + \frac{(-9)}{13} \quad \frac{11-9}{13} = \frac{2}{13}$$

(iv) $\frac{-17}{27}$ and $\frac{19}{-27}$ $\frac{19 \times (-1)}{-27 \times (-1)} = \frac{-19}{27}$

$$\frac{-17}{27} + \frac{(-19)}{27} \quad \frac{-17-19}{27} = \frac{-36}{27} = \frac{-4}{3}$$

(v) $\frac{13}{4}$ and $\frac{11}{3}$; LCM of 4 and 3 is 12

$$\frac{39+44}{12} = \frac{83}{12}$$

(vi) -2 and $\frac{5}{13}$; LCM = 13

$$-2 + \frac{5}{13} \quad \frac{-2 \times 13 + 5}{13} = \frac{-26+5}{13} = \frac{-21}{13}$$

8. Subtract :

(i) $\frac{-15}{7}$ from 2 $2 - \frac{(-15)}{7} = \frac{14+15}{7} = \frac{29}{7}$

(ii) -3 from $\frac{11}{13}$ $\quad \frac{11}{13} - \frac{(-3)}{1} \quad \frac{11+39}{13} = \frac{50}{13}$

(iii) $\frac{-4}{5}$ and $\frac{-3}{7}$ $\quad \frac{-3}{7} - \frac{(-4)}{5} \quad \frac{-15-(-28)}{35} = \frac{(-15)+28}{35}$

$= \frac{13}{35}$

(iv) $\frac{2}{5}$ from $\frac{11}{13}$ $\quad \frac{11}{13} - \frac{2}{5} \quad \frac{55-26}{65} = \frac{29}{65}$

(v) $\frac{2}{7}$ from $\frac{9}{-7}$ $\quad \frac{9\times(-1)}{-7\times(-1)} = \frac{-9}{7}$

$\frac{-9}{7} - \frac{2}{7} \quad \frac{-9-2}{7} \quad \frac{-11}{7}$

9. Simplify :

(i) $\frac{2}{5} + \frac{-3}{4} + \frac{1}{2}$ $\quad$ LCM = 20

$\frac{8+(-15)+10}{20} \quad \frac{8-15+10}{20} = \frac{3}{20}$

(ii) $1 + \frac{-2}{5} + \frac{1}{-3} \quad 1 + \frac{(-2)}{5} + \frac{(-1)}{3}$, LCM = 15

$\frac{15+(-6)+(-5)}{15} = \frac{15-6-5}{15} = \frac{4}{15}$

(iii) $\frac{3}{4} - \frac{1}{2} - \frac{1}{3}$ $\quad$ LCM = 12

$\frac{9-6-4}{12} \quad \frac{9-10}{12} = \frac{-1}{12}$

(iv) $\frac{5}{7} - \left(\frac{1}{2} - \frac{1}{3}\right) \quad \frac{5}{7} - \left(\frac{3-2}{6}\right) \quad \frac{5}{7} - \frac{1}{6}$

$\frac{30-7}{42} = \frac{23}{42}$

(v) $\left(\frac{4}{5} - \frac{1}{3}\right) - \frac{1}{2} \quad \left(\frac{12-5}{15}\right) - \frac{1}{2} \quad \frac{7}{15} - \frac{1}{2}$

$$\frac{14-15}{30}=\frac{-1}{30}$$

(vi) $\left(\frac{3}{5}+\frac{1}{2}\right)+\left(\frac{-3}{2}\right)$ $\left(\frac{6}{10}+\frac{5}{10}\right)+\left(\frac{-3}{2}\right)$ $\frac{11}{10}+\frac{(-3)}{2}$

$$\frac{22+(-30)}{20}=\frac{22-30}{20}=\frac{-8}{20}=\frac{-2}{5}$$

10. Multiply the following :

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

(ii) $\frac{2}{15}\times\frac{5}{8}=\frac{10}{120}=\frac{1}{12}$

(iii) $\frac{-7}{30}\times\frac{6}{-11}=\frac{-42}{-330}=\frac{7}{55}$

(iv) $-3\times\frac{2}{9}=\frac{-6}{9}=\frac{-2}{3}$

(v) $\frac{-11}{5}\times\frac{-15}{22}=\frac{165}{110}=\frac{3}{2}$ (Divide by 55)

(vi) $\frac{13}{7}\times\frac{49}{65}=\frac{1}{1}\times\frac{7}{5}=\frac{7}{5}$

11. Divide :

(i) $\frac{6}{7}$ by $\frac{-3}{14}$ $\frac{6}{7}\times\frac{14}{-3}=\frac{-2}{1}\times\frac{2}{1}=-4$

(ii) $\frac{-3}{17}\div\frac{5}{34}$ $\frac{-3}{17}\times\frac{34}{5}=\frac{-3}{1}\times\frac{2}{5}=\frac{-6}{5}$

(iii) $\frac{-28}{7}\div\frac{-5}{9}$ $\frac{-28}{7}\times\frac{9}{-5}=\frac{-252}{-35}=\frac{36}{5}$

(iv) $\frac{-1}{10}\div\frac{-8}{5}$ $\frac{-1}{10}\times\frac{5}{-8}=\frac{-1}{2}\times\frac{1}{-8}$

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

(v) $\frac{-8}{9}\div\frac{3}{-4}$ $\frac{-8}{9}\times\frac{(-4)}{3}=\frac{32}{27}$

12. Simplify :

(i) $\left(\frac{-16}{7}\times\frac{3}{9}\right)+\frac{1}{2}$ $\frac{-48}{63}+\frac{1}{2}$ $\frac{-96+63}{126}$

$\frac{-33}{126}=\frac{-11}{42}$

(ii) $\left(\frac{15}{8}\times\frac{2}{5}\right)+\left(\frac{3}{5}\times\frac{-10}{9}\right)$ $\frac{3}{4}+\frac{(-2)}{3}$ $\frac{9+(-8)}{12}$

$\frac{9-8}{12}=\frac{1}{12}$

(iii) $\frac{-8}{5}\times\frac{-10}{3}\times\frac{21}{-4}\times(-6)$

$\frac{-8}{1}\times\frac{(-2)}{1}\times\frac{7}{-4}\times(-6)$ $-8\times\frac{7}{2}\times(-6)$

$-4\times7\times(-6)=168$

(iv) $\left(\frac{25}{8}\times\frac{2}{5}\right)-\left(\frac{3}{5}\times\frac{(-10)}{9}\right)$ $\left(\frac{5}{4}\right)-\left(\frac{-2}{3}\right)$

$\frac{15-(-8)}{12}$ $\frac{15+8}{12}=\frac{23}{12}$

13. $\frac{49}{17}-\frac{21}{17}$ $\frac{49-21}{17}=\frac{28}{17}$

14. $-\frac{7}{9}+x=2$

$x=2+\frac{7}{9}=\frac{18+7}{9}=\frac{25}{9}$

15. $\frac{-12}{5}-3$ $\frac{-12-15}{5}=\frac{-27}{5}$

16. $\left(\frac{23}{12}+\frac{9}{6}\right)\div\left(\frac{23}{12}-\frac{9}{6}\right)$ $\left(\frac{23+18}{12}\right)\div\left(\frac{23-18}{12}\right)$

$\frac{41}{12}\div\frac{5}{12}$ $\frac{41}{12}\times\frac{12}{5}=\frac{41}{5}$

17. Apples $= \frac{1}{3}$, Oranges $= \frac{1}{4}$, Bananas $= \frac{1}{5}$

$\frac{1}{3} + \frac{1}{4} + \frac{1}{5} +$ mangoes

Mangoes $= 1 - \left(\frac{1}{3} + \frac{1}{4} + \frac{1}{5}\right)$ $\quad 1 - \left(\frac{20 + 15 + 12}{60}\right)$

$1 - \frac{47}{60} = \frac{60 - 47}{60} = \frac{13}{60}$ mangoes

No. of apples $= \frac{1}{3} \times 240 = 80$ apples

No. of oranges $= \frac{1}{4} \times 240 = 60$ oranges

No. of bananas $= \frac{1}{5} \times 240 = 48$ bananas

No. of mangoes $= \frac{13}{60} \times 240 = 52$ mangoes

18. $\frac{5}{26} \div \frac{-8}{39}$ $\quad \frac{5}{26} \times \frac{39}{(-8)} = \frac{195}{-208} = \frac{15}{-16} = \frac{-15}{16}$

19. $\frac{-19}{8} \div \frac{5}{12}$ $\quad \frac{-19}{8} \times \frac{12}{5}$ $\quad \frac{-228}{40} = \frac{-57}{10}$

20. State 'True' or 'False' against the given statements :

(i) true (ii) false (iii) true (iv) false (v) true (vi) true

Exercise-1.2

1. Which of the following pairs of rational numbers is smaller?

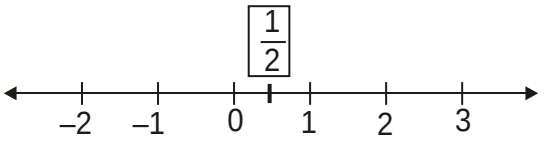
(i) $\frac{-7}{3}$ (ii) $\frac{-11}{13}$ (iii) 0 (iv) $\frac{-6}{11}$

(v) $\frac{3}{-8}, \frac{-8}{12}$ $\quad \frac{-3}{8}, \frac{-8}{12}$ $\quad \frac{-9}{24}, \frac{-16}{24}$ $\quad \frac{-8}{12}$ is smaller

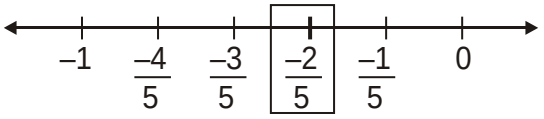
(vi) $\frac{-5}{6}, \frac{-4}{5}$ $\quad \frac{-25}{30}, \frac{-24}{30}$ $\quad \frac{-5}{6}$ is smaller.

2. Represent each of the following rational numbers on the number line.

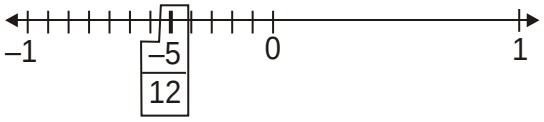
(i) $\frac{1}{2}$



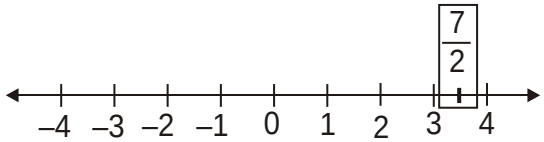
(ii) $\frac{-2}{5}$



(iii) $\frac{-5}{12}$



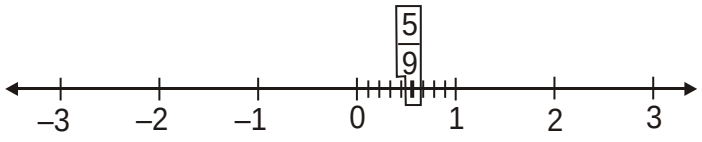
(iv) $\frac{7}{2}$



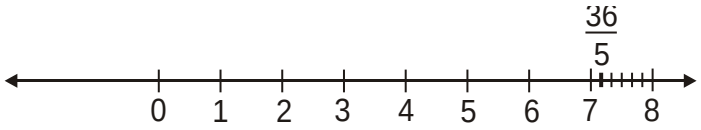
$\frac{7}{2} = 3\frac{1}{2}$ it lies between 3 and 4

(v) $\frac{7}{-3}$ $-2\frac{1}{3}$ lies between −2 and −3

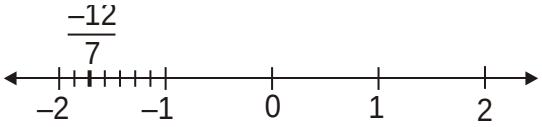
(vi) $\frac{5}{9}$



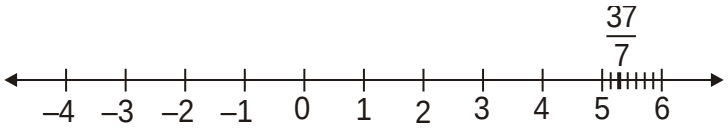
(vii) $\frac{36}{5}$ $7\frac{1}{5}$ lies between 7 and 8



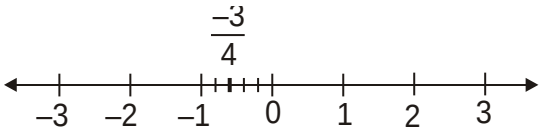
(viii) $\frac{-12}{7} = -1\frac{5}{7}$ lies between −1 and −2



(ix) $\frac{37}{7} = 5\frac{2}{7}$ lies between 5 and 6



(x) $\frac{-3}{4}$



3. Arrange the following rational numbers in ascending order:

(i) $\frac{-3}{5}, \frac{7}{-10}, \frac{-5}{6}$ LCM = 30

$\frac{-18}{30}, \frac{-21}{30}, \frac{-25}{30}$ $\frac{-5}{6} < \frac{7}{-10} < \frac{-3}{5}$

(ii) $\frac{2}{5}, \frac{7}{10}, \frac{8}{15}, \frac{13}{30}$ LCM = 30

$\frac{12}{30}, \frac{21}{30}, \frac{16}{30}, \frac{13}{30}$ $\frac{2}{5} < \frac{13}{30} < \frac{8}{15} < \frac{7}{10}$

(iii) $\frac{-5}{-5}, \frac{4}{15}, \frac{3}{20}, \frac{13}{25}$ LCM = 300

$\frac{300}{300}, \frac{80}{300}, \frac{45}{300}, \frac{156}{300}$ $\frac{45}{300} < \frac{80}{300} < \frac{156}{300} < \frac{300}{300}$

$\frac{3}{20} < \frac{4}{15} < \frac{13}{25} < \frac{-5}{-5}$

(iv) $\frac{9}{13}, \frac{2}{26}, \frac{7}{78}, \frac{4}{-39}$ $\frac{9}{13}, \frac{2}{26}, \frac{7}{78}, \frac{-4}{39}$

LCM = 78 $\frac{54}{78}, \frac{6}{78}, \frac{7}{78}, \frac{-8}{78}$

$\frac{-4}{39} < \frac{2}{26} < \frac{7}{78} < \frac{9}{13}$

4. Arrange the following rational numbers in descending order :

(i) $\frac{-3}{10}, \frac{7}{-15}, \frac{-11}{20}, \frac{17}{-30}$ $\frac{-3}{10}, \frac{-7}{15}, \frac{-11}{20}, \frac{-17}{30}$

LCM = 60 $\frac{-18}{60}, \frac{-28}{60}, \frac{-33}{60}, \frac{-34}{60}$

$\frac{-3}{10} > \frac{7}{-15} > \frac{-11}{20} > \frac{17}{-30}$

(ii) $\frac{17}{-30}, \frac{11}{-15}, \frac{-7}{10}, \frac{3}{5}$ $\frac{-17}{30}, \frac{-11}{15}, \frac{-7}{10}, \frac{3}{5}$

LCM = 30 $\frac{-17}{30}, \frac{-22}{30}, \frac{-21}{30}, \frac{18}{30}$

$\frac{3}{5} > \frac{-17}{30} > \frac{-7}{10} > \frac{-11}{15}$

(iii) $-2, \frac{-13}{6}, \frac{8}{-3}, \frac{1}{3}$ $\frac{-2}{1}, \frac{-13}{6}, \frac{-8}{3}, \frac{1}{3}$

$\frac{-12}{6}, \frac{-13}{6}, \frac{-16}{6}, \frac{2}{6}$

$\frac{1}{3} > -2 > \frac{-13}{6} > \frac{8}{-3}$

(iv) $\frac{7}{8}, \frac{17}{24}, \frac{4}{-12}, \frac{1}{32}$, LCM = 96

$\frac{84}{96}, \frac{68}{96}, \frac{-32}{96}, \frac{3}{96}$ $\quad \frac{7}{8} > \frac{17}{24} > \frac{1}{32} > \frac{4}{-12}$

5. $\frac{-1}{2}$ and $\frac{1}{2}$ $\quad \frac{1}{2}\left(\frac{-1}{2} + \frac{1}{2}\right)$

$\frac{1}{2}\left(\frac{-1+1}{4}\right) = \frac{1}{2} \times 0 = 0$

$\frac{1}{2}\left(\frac{-1}{2} + 0\right)$ $\quad \frac{1}{2}\left(\frac{-1+0}{2}\right)$

$\frac{1}{2} \times \frac{-1}{2} = \frac{-1}{4}$

Rational numbers are $\frac{-1}{4}, 0$

6. $\frac{-3}{5}$ and $\frac{-1}{2}$ $\quad \frac{1}{2}\left(\frac{-3}{5} + \frac{(-1)}{2}\right)$

$\frac{1}{2}\left(\frac{-6+(-5)}{10}\right)$ $\quad \frac{1}{2} \times \frac{-11}{10} = \frac{-11}{20}$

$\frac{1}{2}\left(\frac{-3}{5} + \frac{(-11)}{20}\right)$ $\quad \frac{1}{2}\left(\frac{-12-11}{20}\right) = \frac{1}{2} \times \frac{-23}{20} = \frac{-23}{40}$

$\frac{1}{2}\left(\frac{-3}{5} + \frac{(-23)}{40}\right)$ $\quad \frac{1}{2}\left(\frac{-24-23}{40}\right) = \frac{1}{2} \times \frac{-47}{40} = \frac{-47}{80}$

Rational numbers are $\frac{-11}{20}, \frac{-23}{40}, \frac{-47}{80}$

7. -3 and -2

$\frac{1}{2}(-3 + (-2))$ $\quad \frac{1}{2} \times -5 = \frac{-5}{2}$

$\frac{1}{2}\left(-3 + \left(\frac{-5}{2}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-6-5}{2}\right) = \frac{1}{2} \times \frac{-11}{2} = \frac{-11}{4}$

$\frac{1}{2}\left(-3 + \left(\frac{-11}{4}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-12-11}{4}\right) = \frac{1}{2}\left(\frac{-23}{4}\right) = \frac{-23}{8}$

$$\frac{1}{2}\left(-3+\left(\frac{-23}{8}\right)\right)=\frac{1}{2}\left(\frac{-24-23}{8}\right)=\frac{1}{2}\left(\frac{-47}{8}\right)=\frac{-47}{16}$$

$$\frac{-5}{2},\frac{-11}{4},\frac{-23}{8},\frac{-47}{16}$$

8. $\frac{-3}{11}$ and $\frac{1}{11}$ $\quad \frac{1}{2}\left(\frac{-3}{11}+\frac{1}{11}\right)$ $\quad \frac{1}{2}\left(\frac{-3+1}{11}\right)$

$$=\frac{1}{2}\times\frac{-2}{11}=\frac{-2}{22}=\frac{-1}{11}$$

$\frac{1}{2}\left(\frac{-3}{11}+\left(\frac{-1}{11}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-3-1}{11}\right)=\frac{1}{2}\times\frac{-4}{11}=\frac{-4}{22}=\frac{-2}{11}$

$\frac{1}{2}\left(\frac{-3}{11}+\left(\frac{-2}{11}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-3-2}{11}\right)=\frac{1}{2}\times\frac{-5}{11}=\frac{-5}{22}$

$\frac{1}{2}\left(\frac{-3}{11}+\left(\frac{-5}{22}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-6+(-5)}{22}\right)$ $\quad \frac{1}{2}\times\frac{-11}{22}=\frac{-11}{44}=\frac{-1}{4}$

$\frac{1}{2}\left(\frac{-3}{11}+\left(\frac{-1}{4}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-12-11}{44}\right)=\frac{1}{2}\times\frac{-23}{44}=\frac{-23}{88}$

$$\frac{-1}{11},\frac{-2}{11},\frac{-5}{22},\frac{-1}{4},\frac{-23}{88}$$

9. $-\frac{4}{5}$ and $\frac{-3}{4}$ $\quad \frac{1}{2}\left(\frac{-4}{5}+\left(\frac{-3}{4}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-16-15}{20}\right)=\frac{1}{2}\times\frac{-31}{20}$

$$=\frac{-31}{40}$$

$\frac{1}{2}\left(\frac{-4}{5}+\left(\frac{-31}{40}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-32-31}{40}\right)=\frac{1}{2}\times\frac{-63}{40}=\frac{-63}{80}$

$\frac{1}{2}\left(\frac{-4}{5}+\left(\frac{-63}{80}\right)\right)$ $\quad \frac{1}{2}\left(\frac{-64-63}{80}\right)=\frac{-127}{160}$

$\frac{1}{2}\left(\frac{-127}{160}+\left(\frac{-3}{4}\right)\right)$

$$\frac{1}{2}\left(\frac{-127}{160}-\frac{-120}{}\right)=\frac{1}{2}\times\frac{-247}{160}=\frac{-247}{320}$$

$$\frac{1}{2}\left(\frac{-31}{40}+\frac{-63}{80}\right)\qquad\frac{1}{2}\left(\frac{-62+(-63)}{80}\right)$$

$$=\frac{1}{2}\times\frac{-125}{80}=\frac{-125}{160}$$

Ans. $\frac{-31}{40},\frac{-125}{160},\frac{-63}{80},\frac{-127}{160},\frac{-247}{320}$

10. Fill in the blanks with >, < or = in the following :

(i) $\frac{4}{5}\boxed{>}\frac{2}{5}$

(ii) $\frac{-3}{-7}\square\frac{5}{8}\quad=\frac{24}{56},\frac{35}{56}\qquad\frac{3}{7}<\frac{5}{8}$

(iii) $\frac{-7}{10}\square\frac{-4}{5}\qquad\frac{-7}{10}\square\frac{-8}{10};\quad\frac{-7}{10}>\frac{-4}{5}$

(iv) $\frac{12}{18}\square\frac{2}{3}\qquad\frac{12}{18},\frac{12}{18}\qquad\frac{12}{18}=\frac{2}{3}$

(v) $-2\ \square\ \frac{-13}{5}\qquad\frac{-10}{5},\frac{-13}{5}\qquad-2>\frac{-13}{5}$

(vi) $0\square\frac{-5}{-3}\qquad\frac{0}{3},\ \frac{5}{3}\qquad 0<\frac{5}{3}$

11. State 'True' or 'False' against the given statements :

(i) True (ii) False (iii) True (iv) True

Exercise 1.3

1. Write the additive inverse of each of the following :

(i) $\frac{-43}{7}$ (ii) $\frac{7}{5}$ (iii) $\frac{6}{5}$ (iv) $\frac{-1}{7}$

2. Write the multiplicative inverse of each of the following :

(i) $\frac{7}{-2}$ (ii) 5 (iii) $\frac{-11}{6}$ (iv) $\frac{-9}{7}$

(v) 20 (vi) $\frac{-7}{4}$

3. Verify commutative property for addition and multiplication of rational numbers for each of the following pairs of rational numbers :

(i) $\frac{11}{5}$ and $\frac{4}{-7}$ $= \frac{77+(-20)}{35} = \frac{77-20}{35} = \frac{57}{35}$

$\frac{4}{-7} + \frac{11}{5} = \frac{-20+77}{35} = \frac{57}{35}$ Verified.

$\frac{11}{5} \times \frac{4}{-7} = \frac{44}{-35}$; $\frac{4}{-7} \times \frac{11}{5} = \frac{44}{-35}$, Verified

(ii) $\frac{4}{9}$ and $\frac{7}{12}$ $= \frac{16}{36} + \frac{21}{36} = \frac{37}{36}$

$\frac{7}{12} + \frac{4}{9} = \frac{21+16}{36} = \frac{37}{36}$,

$\frac{4}{9} \times \frac{7}{12} = \frac{7}{27}$

$\frac{7}{12} \times \frac{4}{9} = \frac{7}{27}$ Verified

(iii) 4 and $\frac{-2}{-15}$, $\frac{60+2}{15} = \frac{62}{15}$

$\frac{-2}{-15} + 4 = \frac{2+60}{15} = \frac{62}{15}$ Verified

$4 \times \frac{-2}{-15} = \frac{-8}{-15} = \frac{8}{15}$

$\frac{-2}{-15} \times 4 = \frac{-8}{-15} = \frac{8}{15}$, Verified

(iv) $\frac{-2}{7}$ and $\frac{12}{-35} = \frac{-10+(-12)}{35} = \frac{-22}{35}$

$\frac{12}{-35} + \frac{-2}{7} = \frac{-12+(-10)}{35} = \frac{-22}{35}$ Verified

$\frac{-2}{7} \times \frac{12}{-35} = \frac{-24}{-245} = \frac{24}{245}$,

$$\frac{12}{-35} \times \frac{-2}{7} = \frac{-24}{-245} = \frac{24}{245}$$ Verified

4. Verify associative property for addition and multiplication of rational numbers for each of the following rational numbers :

(i) $\frac{1}{2} + \left(\frac{2}{3} + \frac{(-1)}{5}\right) \quad \frac{1}{2} + \left(\frac{10-3}{15}\right) \quad \frac{1}{2} + \frac{7}{15}$

$$\frac{15+14}{30} = \frac{29}{30}$$

$$= \left(\frac{1}{2} + \frac{2}{3}\right) + \left(\frac{-1}{5}\right)$$

$$= \left(\frac{3+4}{6}\right) + \left(\frac{-1}{5}\right)$$

$$= \frac{35-6}{30}$$

$$= \frac{29}{30}$$

Verified

$$\frac{1}{2}\left(\frac{2}{3} \times \frac{(-1)}{5}\right) \quad \frac{1}{2}\left(\frac{-2}{15}\right) = \frac{-2}{30} = \frac{-1}{15}$$

$$= \left(\frac{1}{2} \times \frac{2}{3}\right) \times \frac{-1}{5}$$

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

(ii) $-2 + \left(\frac{3}{5} + \frac{(-4)}{3}\right) = -2 + \left(\frac{9+(-20)}{15}\right) = -2 + \left(\frac{-11}{15}\right)$

$$\frac{-30-11}{15} = \frac{-41}{15}$$

$$= \left(-2 + \frac{3}{5}\right) + \left(\frac{-4}{3}\right)$$

$= \left(\frac{-10+3}{5}\right) + \frac{-4}{3}$

$= \frac{-7}{5} + \left(\frac{-4}{3}\right)$

$= \frac{-21-20}{15} = \frac{-41}{15}$ verified

$-2\left(\frac{3}{5} \times \frac{(-4)}{3}\right) = -2\left(\frac{-12}{15}\right) = \frac{24}{15}$

$= \left(-2 \times \frac{3}{5}\right) \times \left(\frac{-4}{3}\right)$

$= \frac{-6}{5} \times \frac{-4}{3} = \frac{24}{15}$ Verified

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

$= \left(\frac{3}{5} + \frac{-2}{5}\right) + \frac{-7}{5}$

$= \frac{1}{5} + \frac{-7}{5}$

$= \frac{-6}{5}$ Verified

$\frac{3}{5}\left(\frac{-2}{5} \times \frac{-7}{5}\right) = \frac{3}{5}\left(\frac{14}{25}\right) = \frac{42}{125}$

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

$= \frac{-6}{25} \times \frac{-7}{5} = \frac{42}{125}$ Verified

(iv) $\left(\frac{-9}{28} + \frac{-7}{5}\right) + \frac{-5}{3} = \frac{-45+(-196)}{140} = \left(\frac{241}{140} + \frac{(-5)}{3}\right)$

$\frac{723-700}{420} = \frac{23}{420}$

$$\frac{-9}{8}\times\left(\frac{-7}{5}\times\frac{-5}{3}\right)=\frac{-9}{8}\left(\frac{35}{15}\right)=\frac{-315}{120}=\frac{-21}{8}$$

$$=\left(\frac{-9}{8}\times\frac{-7}{5}\right)\times\frac{-5}{3}$$

$$=\frac{63}{40}\times\frac{-5}{3}$$

$$=\frac{-21}{8}$$

5. Verify the property : $a\times(b+c)=a\times b+a\times c$ for

(i) $a=\frac{8}{3}, b=\frac{-5}{6}, c=\frac{-13}{12}$

$a\times(b+c)=a\times b+a\times c$

$$\frac{8}{3}+\left(\frac{-5}{6}+\frac{-13}{12}\right)=\frac{8}{3}\times\frac{(-5)}{6}+\frac{8}{3}+\frac{(-13)}{12}$$

$$\frac{8}{3}\times\left(\frac{-10-13}{12}\right)=\frac{-40}{18}+\frac{(-104)}{36}$$

$$\frac{8}{3}\times\frac{-23}{12}=\frac{-80-104}{36}\qquad\frac{-184}{36}=\frac{-184}{36}$$

(ii) $a=\frac{2}{7}, b=\frac{4}{5}, c=\frac{7}{9}$

$a\times(b+c)=a\times b+a\times c$

$$\frac{2}{7}\left(\frac{4}{5}+\frac{7}{9}\right)=\frac{2}{7}\times\frac{4}{5}+\frac{2}{7}\times\frac{7}{9}$$

$$\frac{2}{7}\left(\frac{36+35}{45}\right)=\frac{8}{35}+\frac{14}{63}$$

$$\frac{2}{7}\times\frac{71}{45}=\frac{72+70}{315}=\frac{142}{315}=\frac{142}{315}$$

6. Verify the property : $a\times(b-c)=a\times b-a\times c$ for

(i) $a=\frac{-3}{4}, b=-4, c=\frac{3}{-5}$

$a \times (b - c) = a \times b - a \times c$

$\frac{-3}{4} \times \left(-4 - \frac{3}{-5}\right) = \frac{-3}{4} \times (-4) - \left(\frac{-3}{4}\right) \times \frac{3}{(-5)}$

$\frac{-3}{4} \times \left(-4 - \frac{(-3)}{5}\right) = \frac{-3}{4} \times (-4) - \frac{(-3)}{4} \times \frac{(-3)}{5}$

$\frac{-3}{4} \times \left(\frac{-20 + 3}{5}\right) = \frac{12}{4} - \frac{9}{20}$

$\frac{-3}{4} \times \frac{(-17)}{5} = \frac{60 - 9}{20} \qquad \frac{51}{20} = \frac{51}{20}$

(ii) $a = 1, b = \frac{2}{5}, c = \frac{1}{7}$

$1 \times \left(\frac{2}{5} - \frac{1}{7}\right) = 1 \times \frac{2}{5} - 1 \times \frac{1}{7}$

$1 \times \left(\frac{14 - 5}{35}\right) = \frac{2}{5} - \frac{1}{7} \qquad \frac{9}{35} = \frac{14 - 5}{35} = \frac{9}{35}$

7. Evaluate the following using appropriate properties :

(i) $\frac{5}{7} \times \frac{-2}{3} + \frac{5}{7} \times \frac{-1}{9} \qquad \frac{5}{7}\left(\frac{-2}{3} + \frac{(-1)}{9}\right)$

$\frac{5}{7}\left(\frac{-6 - 1}{9}\right) \quad \frac{5}{7} \times \frac{-7}{9} = \frac{-35}{63} = \frac{-5}{9}$

(ii) $\frac{5}{48} + \frac{3}{8} \times \frac{-2}{9} - \frac{5}{3} \times \frac{3}{8}$

$\frac{5}{48} + \frac{3}{8}\left(\frac{-2}{9} - \frac{5}{3}\right) \quad \frac{5}{48} + \frac{3}{8}\left(\frac{-2 - 15}{9}\right)$

$\frac{5}{48} + \frac{3}{8}\left(\frac{-17}{9}\right) \quad \frac{5}{48} + \left(\frac{-51}{72}\right) \quad \frac{15 - 102}{144} = \frac{-87}{144} = \frac{-29}{48}$

(iii) $\frac{15}{9} \times \frac{-2}{3} - \frac{7}{3} \times \frac{15}{9} + \frac{2}{5}$

$\frac{15}{9} \times \frac{(-2)}{3} - \frac{7}{3} \times \frac{15}{9} + \frac{2}{5}$

$\frac{15}{9}\left(\frac{-2}{3}-\frac{7}{3}\right)+\frac{2}{5}$ $\frac{15}{9}\left(\frac{-2-7}{3}\right)+\frac{2}{5}$

$\frac{15}{9}\times\frac{-9}{3}=5\times-1=-5+\frac{2}{5}$ $\frac{-25+2}{5}=\frac{-23}{5}$

(iv) $\frac{2}{7}\times\frac{1}{5}-\frac{2}{7}\times\frac{-4}{15}$ $\frac{2}{7}\left(\frac{1}{5}-\frac{(-4)}{15}\right)$

$\frac{2}{7}\left(\frac{3+4}{15}\right)=\frac{2}{7}\times\frac{7}{15}=\frac{14}{105}=\frac{2}{15}$

8. Name the property of multiplication of rational numbers illustrated by the following statements :

(i) Commutative (ii) Associative

(iii) Property of zero (iv) Distributive

9. $-8-\frac{(-15)}{7}$ $\frac{-8(7)+15}{7}=\frac{-56+15}{7}=\frac{-41}{7}$

10. $\frac{-5}{3}-\frac{5}{6}$ $\frac{-10-5}{6}=\frac{-15}{6}=\frac{-5}{2}$

11. $12\frac{3}{4}\div7\frac{2}{3}$ $\frac{51}{4}\div\frac{23}{3}$

$\frac{51}{4}\times\frac{3}{23}=\frac{153}{92}=1\frac{61}{92}$

12. $\left(\frac{65}{12}+\frac{12}{7}\right)\div\left(\frac{65}{12}-\frac{12}{7}\right)$

$\left(\frac{455+144}{84}\right)\div\left(\frac{455-144}{84}\right)=\frac{599}{84}\div\frac{311}{84}$

$=\frac{599}{84}\times\frac{84}{311}=\frac{599}{311}$

13. $\frac{2}{3}\div\left(\frac{-3}{4}\right)$ $\frac{2}{3}\times\frac{(-4)}{3}=\frac{-8}{9}$

14. $-24\div\frac{8}{13}$ $-24\times\frac{13}{8}=-3\times13=-39$

15. Fill in the blanks :

(i) positive (ii) $\frac{5}{1}$ or 5 (iii) 9 (iv) $\frac{-3}{5}$ (v) 0

MCQs

1.	(a)	2.	(a)	3.	(c)	4.	(c)	5.	(a)	6.	(b)
7.	(d)	8.	(d)	9.	(c)	10.	(d)				

4. $\frac{192}{-168} = \frac{96}{-84} = \frac{48}{-42} = \frac{24}{-21} = \frac{-8}{7}$

6. $\frac{3}{5} - \frac{2}{3}$

$\left|\frac{9-10}{15}\right| = \left|\frac{-1}{15}\right| = \frac{1}{15}$

9. $\frac{11}{4} \times \frac{19}{3} = \frac{209}{12} = 17\frac{5}{12}$

Fill in the blanks

1. 12^{-1} 2. a 3. Positive 4. Positive 5. Negative 6. 0 7. 0

8. $\frac{-15}{16}$ 9. $\frac{-5}{14}$ 10. $\frac{34}{9}$

8. $\frac{-35}{8} \div x = -4\frac{2}{3}$

$\frac{-35}{8} \div x = -4\frac{2}{3}$

$\frac{-105}{112} = \frac{-15}{16}$

9. $x = -1 + \frac{9}{14}$

$= \frac{-14+9}{14}$

$= \frac{-5}{14}$

10. $x = 3 + \frac{7}{9}$

$= \frac{27+7}{9} = \frac{34}{9}$

True or False

1. False 2. False 3. True 4. True 5. True

2 Exponents and Powers

Exercise-2.1

1. Write each of the following in exponent form:

(i) $3\times3\times3\times3\times3\times3\times3\times3 = 3^8$

(ii) $\left(\frac{1}{2}\right)^{10}$ (iii) $\left(\frac{-1}{2}\right)^{5}$ (iv) $(-4)^5$ (v) $3^3 \times x^4y^2z$

(vi) $(-2)^3a^4b^2$ (vii) $(-a)^3b^2c^2$ (viii) $\left(\frac{-2}{7}\right)^{11}$

2. Express each of the following in exponent form :

(i) $\frac{16}{169} = \frac{4\times4}{13\times13} = \left(\frac{4}{13}\right)^2$

(ii) $\frac{-8}{1331} = \frac{-2\times-2\times-2}{11\times11\times11} = \left(\frac{-2}{11}\right)^3$

(iii) $\frac{1}{3125} = \frac{1}{5\times5\times5\times5\times5} = \left(\frac{1}{5}\right)^5$

(iv) $\frac{16}{729} = \frac{4\times4}{27\times27} = \left(\frac{4}{27}\right)^2$

(v) $\frac{-1}{128} = \frac{-1}{2\times2\times2\times2\times2\times2\times2} = \left(\frac{-1}{2}\right)^7$

(vi) $\frac{-243}{100000} = \frac{-3\times-3\times-3\times-3\times-3}{10\times10\times10\times10\times10} = \left(\frac{-3}{10}\right)^5$

3. Express each of the following as a rational number :

(i) $\left(\frac{3}{2}\right)^5 = \frac{3\times3\times3\times3\times3}{2\times2\times2\times2\times2} = \frac{243}{32}$

(ii) $\left(\frac{-8}{7}\right)^3 = \frac{-8\times-8\times-8}{7\times7\times7} = \frac{-512}{343}$

(iii) $\left(\frac{11}{15}\right)^2 = \frac{11\times11}{15\times15} = \frac{121}{225}$

(iv) $\left(\frac{-1}{7}\right)^4 = \frac{-1\times-1\times-1\times-1}{7\times7\times7\times7} = \frac{1}{2401}$

(v) $(-1)^0 = 1$

(vi) $(-1)^9 = -1$

(vii) $\left(\frac{-13}{17}\right)^3 = \frac{-13\times(-13)\times(-13)}{17\times17\times17} = \frac{-2197}{4913}$

(viii) $\left(\frac{-1}{10}\right)^4 = \frac{-1\times(-1)\times(-1)\times(-1)}{10\times10\times10\times10} = \frac{1}{10000}$

4. Find the reciprocal of the following and express each in exponent form :

(i) $(-4)^3 = -4\times-4\times-4 = \frac{-64}{1} = \frac{-1}{64} = \left(\frac{1}{-4}\right)^3$

(ii) $\frac{125}{64} = \frac{5\times5\times5}{4\times4\times4} = \left(\frac{5}{4}\right)^3 = \left(\frac{4}{5}\right)^3$

(iii) $\frac{-8}{1728} = \frac{-2\times(-2)\times(-2)}{12\times12\times12} = \left(\frac{-2}{12}\right)^3 = \left(\frac{1}{-2}\right)^3$

(iv) $\frac{-2744}{3375} = \frac{(-14)\times(-14)\times(-14)}{15\times15\times15} = \left(\frac{-14}{15}\right)^3 = \left(\frac{15}{-14}\right)^3$

(v) $8^5 = \frac{8}{1} = \left(\frac{1}{8}\right)^5$

5. Express each of the following as a rational number :

(i) $3^{-3} = \frac{1}{(3)^3} = \frac{1}{3\times3\times3} = \frac{1}{27}$

(ii) $(-2)^{-1} = \frac{1}{(-2)^1} = \frac{1}{-2}$

(iii) $(-1)^{-4} = \frac{1}{(-1)^4} = \frac{1}{1} = 1$

(iv) $\left(\frac{-5}{6}\right)^{-4} = \left(\frac{6}{-5}\right)^4 = \frac{6\times6\times6\times6}{(-5)\times(-5)\times(-5)\times(-5)} = \frac{1296}{625}$

(v) $\left(\frac{-2}{5}\right)^{-6} = \left(\frac{5}{-2}\right)^6 = \frac{15625}{64}$

(vi) $\left(\frac{-11}{12}\right)^{-3} = \left(\frac{12}{-11}\right)^3 = \frac{1728}{-1331}$

(vii) $\left(\frac{1}{4}\right)^{-4} = \left(\frac{4}{1}\right)^4 = 256$

(viii) $(-3)^{-4} = \left(\frac{-1}{3}\right)^4 = \frac{1}{81}$

6. Find the value of each of the following:

(i) $7^0 = 1$

(ii) $(-7)^0 + (-8)^0 = 1 + 1 = 2$

(iii) $(-3)^0 + 4^0 = 1 + 1 = 2$

(iv) $7^0 \times 9^0 = 1 \times 1 = 1$

(v) $3^0 \div 2^0 = 1 \div 1 = 1$

(vi) $8^0 - (-2)^0 = 1 - 1 = 0$

Exercise 2.2

1. Using the laws of exponents, simplify in the exponents form :

(i) $2^{12} \times 2^4 = 2^{12+4} = 2^{16}$

(ii) $(-3)^7 \times (-3)^2 = (-3)^{7+2} = (-3)^9$

(iii) $\left(\frac{1}{4}\right)^5 \times \left(\frac{1}{4}\right)^3 \times \left(\frac{1}{4}\right)^4 = \left(\frac{1}{4}\right)^{5+3+4} = \left(\frac{1}{4}\right)^{12}$

(iv) $\left(\frac{-13}{11}\right)^3 \times \left(\frac{-13}{11}\right)^4 \times \left(\frac{-13}{11}\right)^8 = \left(\frac{-13}{11}\right)^{3+4+8} = \left(\frac{-13}{11}\right)^{15}$

(v) $(-6)^{-2} \times (-6)^5 \times (-6)^4 = (-6)^{-2+5+4} = (-6)^{-2+9} = (-6)^7$

(vi) $a^3 \times a^{10} \times a^5 = a^{3+10+5} = a^{18}$

(vii) $\left(\frac{5}{6}\right)^{13} \times \left(\frac{5}{6}\right)^{-8} \times \left(\frac{5}{6}\right)^{-4} = \left(\frac{5}{6}\right)^{13+(-8)+(-4)}$

$= \left(\frac{5}{6}\right)^{13-12} = \left(\frac{5}{6}\right)^1$

(viii) $a^m \times a^{-n} \times a^{2m} \times a^{2n+2} = a^{m+2m+2n-n+2}$

$= a^{3m+n+2}$

(ix) $\left(\frac{21}{17}\right)^8 \times \left(\frac{21}{17}\right)^{-5} \times \left(\frac{21}{17}\right)^4 = \left(\frac{21}{17}\right)^{8+(-5)+4} = \left(\frac{21}{17}\right)^7$

(x) $\left(\frac{-3}{4}\right)^4 \times \left(\frac{-3}{4}\right)^3 \times \left(\frac{-3}{4}\right)^4 = \left(\frac{3}{4}\right)^{4+3+4} = \left(\frac{-3}{4}\right)^{11}$

2. Simplify and express the result in exponential form :

(i) $\left(\frac{5}{7}\right)^{11} \div \left(\frac{5}{7}\right)^8 = \left(\frac{5}{7}\right)^{11-8} = \left(\frac{5}{7}\right)^3$

(ii) $\left(\frac{-7}{8}\right)^{12} \div \left(\frac{-7}{8}\right)^{10} = \left(\frac{-7}{8}\right)^{12-10} = \left(\frac{-7}{8}\right)^{2}$

(iii) $\left(\frac{6}{7}\right)^{12} \div \left(\frac{6}{7}\right)^{-4} = \left(\frac{6}{7}\right)^{12-(-4)} = \left(\frac{6}{7}\right)^{12+4} = \left(\frac{6}{7}\right)^{16}$

(iv) $\left(\frac{31}{43}\right)^{8} \div \left(\frac{31}{43}\right)^{-4} = \left(\frac{31}{43}\right)^{8-(-4)} = \left(\frac{31}{43}\right)^{8+4} = \left(\frac{31}{43}\right)^{12}$

(v) $\left(\frac{x}{y}\right)^{-7} \div \left(\frac{x}{y}\right)^{-3} = \left(\frac{x}{y}\right)^{-7-(-3)} = \left(\frac{x}{y}\right)^{-7+3} = \left(\frac{x}{y}\right)^{-4}$

(vi) $\left(\frac{2}{6}\right)^{8} \div \left(\frac{2}{6}\right)^{-4} = \left(\frac{2}{6}\right)^{8-(-4)} = \left(\frac{2}{6}\right)^{8+4} = \left(\frac{2}{6}\right)^{12}$

(vii) $(6.8)^{10} \div (6.8)^{6} = (6.8)^{10-6} = (6.8)^{4}$

(viii) $\left(\frac{-4}{7}\right)^{11} \div \left(\frac{-4}{7}\right)^{5} = \left(\frac{-4}{7}\right)^{11-5} = \left(\frac{-4}{7}\right)^{6}$

(ix) $\left(\frac{x}{y}\right)^{6} \div \left(\frac{y}{x}\right)^{4} = \left(\frac{x}{y}\right)^{6} \div \left(\frac{x}{y}\right)^{-4} = \left(\frac{x}{y}\right)^{6-(-4)}$

$= \left(\frac{x}{y}\right)^{6+4} = \left(\frac{x}{y}\right)^{10}$

3. Simplify and write the answer in exponential form :

(i) $[(2)^4]^5 = (2)^{4\times5} = (2)^{20}$

(ii) $[(-7)^3]^4 = (-7)^{3\times4} = (-7)^{12}$

(iii) $[8^4]^{-2} = (8)^{4\times(-2)} = (8)^{-8} = \left(\frac{1}{8}\right)^{8}$

(iv) $\left[\frac{1}{(4)^2}\right]^4 = \left(\frac{1}{4}\right)^{8}$

(v) $\left[\left(\frac{-3}{4}\right)^4\right]^2 = \left(\frac{-3}{4}\right)^{4\times 2} = \left(\frac{-3}{4}\right)^8$

(vi) $\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^{-2}\right]^{-1} = \left\{\left(\frac{-1}{4}\right)^2\right\}^{-2\times -1}$

$= \left\{\left(\frac{-1}{4}\right)^2\right\}^2 = \left(\frac{-1}{4}\right)^4$

(vii) $\left[\left(\frac{-3}{4}\right)^{-3}\right]^2 = \left(\frac{-3}{4}\right)^{-3\times 2} = \left(\frac{-3}{4}\right)^{-6} = \left(\frac{4}{3}\right)^6$

(viii) $\left[\left(\frac{4}{5}\right)^3\right]^8 = \left(\frac{4}{5}\right)^{3\times 8} = \left(\frac{4}{5}\right)^{24}$

(ix) $\left[\left\{\left(\frac{-1}{5}\right)^3\right\}^2\right]^{-1} = \left[\left(\frac{-1}{5}\right)^3\right]^{2\times -1} = \left(\frac{-1}{5}\right)^{3\times -2}$

$= \left(\frac{-1}{5}\right)^{-6} = (5)^6$

4. Express the following with a single exponent :

(i) $(3^2)^5 \times (3^4)^2 = 3^{10} \times 3^8 = 3^{10+8} = 3^{18}$

(ii) $(7^4)^3 \times (7^2)^5 = 7^{12} \times 7^{10} = 7^{12+10} = 7^{22}$

(iii) $(10^2)^4 \times (10^3)^{-4} = 10^8 \times 10^{-12} = 10^{8+(-12)}$

$= 10^{8-12} = 10^{-4} = \left(\frac{1}{10}\right)^4$

(iv) $(2^{10})^3 \times (2^{-4})^5 = 2^{30} \times 2^{-20} = 2^{30+(-20)} = 2^{10}$

(v) $(-3)^4 \times [(-3)^4]^2 \times (-3)^{-5} = (-3)^4 \times (-3)^8 \times (-3)^{-5}$

$(-3)^{4+8+(-5)} = (-3)^{4+8-5} = (-3)^{12-5} = (-3)^7$

(vi) $(3^2)^6 \times (3^3)^3 \times (3^4)^{-3} = 3^{12} \times 3^9 \times 3^{-12}$

$= (3)^{12+9+(-12)} = (3)^9$

(vii) $\left[\left(\frac{-1}{2}\right)^2\right]^4 \times \left[\left(\frac{-1}{2}\right)^3\right]^2 \times \left[\left(\frac{-1}{2}\right)^{-3}\right]^3$

$\left(\frac{-1}{2}\right)^8 \times \left(\frac{-1}{2}\right)^6 \times \left(\frac{-1}{9}\right)^{-9} = \left(\frac{-1}{2}\right)^{8+6+(-9)}$

$\left(\frac{-1}{2}\right)^{14-9} = \left(\frac{-1}{2}\right)^5$

5. Simplify :

(i) $\left(\frac{11}{9}\right)^3 \times \left(\frac{11}{9}\right)^4 \div \left(\frac{11}{9}\right)^5 = \left(\frac{11}{9}\right)^{3+4-5} = \left(\frac{11}{9}\right)^2$

$= \frac{11 \times 11}{9 \times 9} = \frac{121}{81}$

(ii) $\frac{3^7}{3^2} \times 3^5 = \frac{3^{7+5}}{3^2} = 3^{12-2} = 3^{10} = 59049$

(iii) $\left(\frac{2}{9}\right)^3 \times \left[\left(\frac{2}{9}\right)^{-2}\right]^4 = \left(\frac{2}{9}\right)^3 \times \left(\frac{2}{9}\right)^{-8} = \left(\frac{2}{9}\right)^{3+(-8)}$

$\left(\frac{2}{9}\right)^{3-8} = \left(\frac{2}{9}\right)^{-5} = \left(\frac{9}{2}\right)^5 = \frac{59049}{32}$

(iv) $\frac{3^8 \times 3^2}{3^4 \times 3^3} = 3^{8+2} \div 3^{4+3} = 3^{10-7} = 3^3 = 27$

(v) $(6^0 + 3^0) \times [(-7)^0 + 5^0]$

$= (1+1) \times (1+1) = 2 \times 2 = 4$

(vi) $(5^0 - 2^0) \times (-7)^0 \div 3^0$

$= (1-1) \times 1 \div 1 = 0 \times 1 = 0$

(vii) $\left(\frac{7}{8}\right)^0 - \left(\frac{5}{7}\right)^0 + \left(\frac{4}{7}\right)^0 = 1 - 1 + 1 = 1$

(viii) $\left[\left(\frac{-4}{5}\right)^0 + \left(\frac{3}{8}\right)^0\right] + \left[\left(\frac{3}{5}\right)^0 + \left(\frac{5}{4}\right)^0\right] = 1 + 1 + 1 + 1 = 4$

6. Simplify :

(i) $\left(2^{-1} + \left(\frac{2}{3}\right)^{-1}\right)^2$

$\left(\frac{1}{2} + \frac{3}{2}\right)^2 = \left(\frac{1+3}{2}\right)^2 = \left(\frac{4}{2}\right)^2 = (2)^2 = 4$

(ii) $\left[(-2)^4 + \left(\frac{1}{3}\right)^{-2}\right]^{-1}$

$\left(16 + \left(\frac{3}{1}\right)^2\right)^{-1} = (16 + 9)^{-1} = \frac{1}{25}$

(iii) $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-1} + \left(\frac{1}{4}\right)^{-2} = (2)^2 + (3)^1 + (4)^2$

$= 4 + 3 + 16 = 23$

(iv) $(2^{-1} + 5^{-1})^2 \times \left(\frac{-5}{8}\right)^{-1} = \left(\frac{1}{2} + \frac{1}{5}\right)^2 \times \left(\frac{-8}{5}\right)^1$

$\left(\frac{5+2}{10}\right)^2 \times \frac{-8}{5} = \left(\frac{7}{10}\right)^2 \times \frac{-8}{5} = \frac{49}{100} \times \frac{(-8)}{5}$

$= \frac{49}{25} \times \frac{(-8)}{5} = \frac{-392}{125}$

(v) $\left(6^{-1} + \left(\frac{3}{2}\right)^{-2}\right)^{-1} \times \left(\frac{3}{2}\right)^{-1} = \left[\frac{1}{6} + \left(\frac{2}{3}\right)^2\right]^{-1} \times \left(\frac{3}{2}\right)^{-1}$

$$\left[\frac{1}{6}+\frac{4}{9}\right]^{-1}\times\left(\frac{3}{2}\right)^{-1}=\left(\frac{3+8}{18}\right)^{-1}\times\left(\frac{3}{2}\right)^{-1}$$

$$\left(\frac{11}{18}\right)^{-1}\times\left(\frac{3}{2}\right)^{-1}=\frac{18}{11}\times\frac{2}{3}=\frac{6\times2}{11}=\frac{12}{11}$$

(vi) $\left(5^{-1}-7^{-1}\right)^{-2}=\left(\frac{1}{5}-\frac{1}{7}\right)^{-2}=\left(\frac{7-5}{35}\right)^{-2}$

$$=\left(\frac{2}{35}\right)^{-2}=\left(\frac{1225}{4}\right)$$

(vii) $\left[\left(\frac{1}{2}\right)^{-2}+\left(\frac{1}{3}\right)^{-7}\times\left(\frac{1}{7}\right)^{-2}\right]$

$(2)^2+(3)^7\times(7)^2$

$4+2187\times49$

$4+107163=107167$

(viii) $\left[5^0+\left(\frac{1}{2}\right)^{-1}\right]^{-4}\times3^3$

$(1+2)^{-4}\times3^3=(3)^{-4}\times3^3$

$\left(\frac{1}{3}\right)^4\times27=\frac{1}{81}\times27=\frac{1}{3}$

7. Find the value of x :

(i) $64\times4^{2x}=4^7=4^3\times4^{2x}=4^7$

$4^{3+2x}=4^7 \qquad 3+2x=7 \qquad 2x=7-3$

$2x=4; \qquad x=2$

(ii) $9\times3^x=3^6 \qquad 3^2\times3^x=3^6$

$3^{2+x}=3^6=2+x=6;\ x=6-2=4$

(iii) $8\times2^{x+2}=32=2^3\times2^{x+2}=2^5$

$2^{3+x+2}=2^5 \qquad 3+x+2=5 \qquad 5+x=5$

$x = 5 - 5;\ x = 0$

(iv) $6^{2x+1} \div 36 = 6^3$

$6^{2x+1} \div (6)^2 = 6^3$

$2x + 1 - 2 = 3$

$2x = 3 - 1 + 2$

$2x = 4$

$x = \frac{4}{2} = 2$

(v) $2^{x-7} \times 5^{x-4} = 1250$

$= 2^{x-7} \times 5^{x-4} = 2 \times 625$

$= 2^{x-7} \times 5^{x-4} = 2^1 \times 5^4$

$x - 7 + x - 4 = 1 + 4$

$2x - 11 = 5 \qquad 2x = 5 + 11$

$2x = 16; \qquad x = \frac{16}{2} = 8$

(vi) $\left(\frac{216}{343}\right)^5 \times \left(\frac{216}{343}\right)^x = \left(\frac{6}{7}\right)^{18}$

$\left(\left(\frac{6}{7}\right)^3\right)^5 \times \left(\left(\frac{6}{7}\right)^3\right)^x = \left(\frac{6}{7}\right)^{18}$

$\left(\frac{6}{7}\right)^{15} \times \left(\frac{6}{7}\right)^{3x} = \left(\frac{6}{7}\right)^{18} \qquad 15 + 3x = 18$

$3x = 18 - 15 \qquad 3x = 3;\ x = 1$

8. Which one is greater?

(i) $(3^2)^4$ or $(3^2) \times 4$

$3^8 \qquad 6561;\ 9 \times 4 = 36$

$(3^2)^4$ is greater

(ii) $(4^3)^5$ or $(4^3)\times 5 = 4^{15}$ or 64×5

4^{15} or 320 $\quad$ 4^{15} is greater, $(4^3)^5$ is greater

(iii) $[(-6)^4]^2$ or $(-6)^2 \times 4$

$(-6)^8$ or 36×4 $\quad$ $(-6)^8$ or 144 ; $(-6)^8$ is greater

(iv) $(2^3)^5$ or $(2^5)\times 8$

2^{15} or $(2)^5 \times (2)^3$ $\quad$ 2^{15} or 2^8

$= 2^{15}$;*i.e.*, $(2^3)^5$ is greater

9. If $\frac{a}{b} = \left(\frac{2}{3}\right)^2 \div \left(\frac{2}{3}\right)^{-3}$ find $\left(\frac{a}{b}\right)^3$

$\left(\frac{2}{3}\right)^{2-(-3)} = \left(\frac{2}{3}\right)^{2+3} = \left(\frac{2}{3}\right)^5$

$\frac{a}{b} = \left(\frac{2}{3}\right)^5$ then $\left(\frac{a}{b}\right)^3 = \left(\frac{2}{3}\right)^{5\times 3} = \left(\frac{2}{3}\right)^{15}$

10. $\left(\frac{2}{5}\right)^{-2} \div x = 5$

$x = \left(\frac{2}{5}\right)^{-2} \div 5$ $\quad$ $\left(\frac{5}{2}\right)^2 \div 5 = \frac{25}{4} \times \frac{1}{5} = \frac{5}{4}$

11. $(-8)^{-1} \times x = 10^{-1}$ $\quad$ $\frac{-1}{8} \times x = \frac{1}{10}$

$x = \frac{1}{10} \div \left(\frac{-1}{8}\right)$ $\quad$ $\frac{1}{10} \times \frac{-8}{1} = \frac{-8}{10} = \frac{-4}{5}$

12. $(-3)^{-1} \times x = (8)^{-1}$ $\quad$ $\frac{-1}{3} \times x = \frac{1}{8}$

$x = \frac{1}{8} \div \left(\frac{-1}{3}\right) = \frac{1}{8} \times \frac{-3}{1} = \frac{-3}{8}$

Exercise-2.3

1. Express the following in standard form :

(i) $13790000 = 1379 \times 10000$

$= 1.379 \times 1000 \times 10000 \quad 1.379 \times 10^3 \times 10^4$

$= 1.379 \times 10^7$

(ii) $20800000000 = 208 \times 100000000$

$= 2.08 \times 10^2 \times 10^8 = 2.08 \times 10^{10}$

(iii) $150000000000 = 15 \times 10^{10} \quad 1.5 \times 10^1 \times 10^{10}$

$= 1.5 \times 10^{11}$

(iv) $374180000000 = 37418 \times 10^7 = 3.7418 \times 10^4 \times 10^7$

$= 3.7418 \times 10^{11}$

(v) $0.000000315 = \frac{315}{1000000000} = \frac{315}{10^9}$

$= 315 \times 10^{-9} = 3.15 \times 10^2 \times 10^{-9}$

$= 3.15 \times 10^{2+(-9)} = 3.15 \times 10^{-7}$

(vi) $0.00001547 = \frac{1547}{100000000} = \frac{1547}{10^8}$

$= 1547 \times 10^{-8} = 1.547 \times 10^3 \times 10^{-8}$

$= 1.547 \times 10^{-5}$

(vii) $\frac{49}{1000000000000} = 49 \times 10^{-12}$

$= 4.9 \times 10^1 \times 10^{-12} = 4.9 \times 10^{-11}$

(viii) $0.0000125 = \frac{125}{10000000} = 125 \times 10^{-7}$

$1.25 \times 10^2 \times 10^{-7} = 1.25 \times 10^{-5}$

2. Express the following in usual form :

(i) $2.4\times10^{4} = 24\times1000 = 24000$

(ii) $3.15\times10^{8} = 315\times1000000 = 315000000$

(iii) $7.25\times10^{6} = 725\times10000 = 7250000$

(iv) $2.9\times10^{11} = 29\times10000000000 = 290000000000$

(v) $2.3\times10^{-8} = \frac{23}{1000000000} = 0.000000023$

(vi) $1\times10^{-7} = \frac{1}{10000000} = 0.0000001$

(vii) $7.52\times10^{-11} = \frac{752}{10000000000000}$

$= 0.0000000000752$

(viii) $1.3124\times10^{-9} = \frac{13124}{1000000000}$

$= 0.0000000013124$

MCQs

1.	(d)	2.	(b)	3.	(d)	4.	(d)	5.	(b)	6.	(a)
7.	(a)	8.	(a)	9.	(a)	10.	(c)	11.	(b)	12.	(c)

Fill in the blanks

1. a^{m+n} 2. a^{m-n} 3. a^{mn} 4. $(ab)^{m}$ 5. $\left(\frac{a}{b}\right)^{m}$

6. 10 7. 3^{2} 8. a^{-m}

True or False

1. T 2. T 3. F 4. F 5. F 6. T 7. T 8. F 9. T 10. F

3 Square and Square Roots

Exercise 3.1

1. Which of the following numbers are perfect squares?
   (i) $625 = 25 \times 25 = 625$
   (ii) $841 = 29 \times 29 = 841$
   (iii) , (iv), not a perfect square
   (v) $576 = 24 \times 24 = 576$
2. Which of the following numbers are not perfect squares? Give reasons :
   (i) 753 = number at unit place is 3. This is not a perfect square.
   (ii) 1285 is not a perfect square because the square of 35 is 1225 and 45 is 2025.
   (iii) 1296 is the perfect square of 36.
   (iv) 5625 is the perfect square of 75.
   (v) 164 is not a perfect square as square of 12 is 144 and then the square of 18 is 324.
3. Find the smallest number by which the given number must be multiplied so that the product is a perfect square :
   (i) 1331

   $11 \times 11 \times 11 = 1331$

   To make it perfect square number should be multiplied to 11.

11	1331
11	121
11	11
	1

   (ii) 700

   $\underline{2 \times 2} \times \underline{5 \times 5} \times 7$

700 should be multiplied by 7 to make it a perfect square.

2	700
2	350
5	175
5	35
7	7
	1

(iii) 12150

$2 \times \underline{3} \times \underline{3} \times \underline{3} \times 3 \times \underline{5} \times \underline{5}$

$2 \times 3 = 6$ Ans.

12150 should be multiplied by 6 to make it a perfect square.

2	12150
3	6075
3	2025
3	675
3	225
3	75
5	25
5	5
	1

(iv) 76800

$\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}$

$\times 3 \times \underline{5 \times 5}$

= 3 Ans.

76800 should be multiplied by 3 to make it a perfect square.

2	76800
2	38400
2	19200
2	9600
2	4800
2	2400
2	1200
2	600
2	300
2	150
3	75
5	25
5	5
	1

4. Find the smallest number by which the given number must be divided to make it a perfect square:

(i) $\underline{3\times3}\times3\times\underline{23\times23}$

No. should be divided by 3.

3	14283
3	4761
3	1587
23	529
23	23
	1

(ii) $\underline{2\times2}\times\underline{2\times2}\times5\times\underline{7\times7}$

No. should be divided by 5.

2	3920
2	1960
2	980
2	490
5	245
7	49
7	7
	1

(iii) $2\times\underline{3\times3}\times\underline{3\times3}\times\underline{13\times13}$

No. should be divided by 2.

2	27378
3	13689
3	4563
3	1521
3	507
13	169
13	13
	1

(iv) $\underline{2\times2}\times7\times\underline{71\times71}$

No. should be divided by 7.

2	141148
2	70574
7	35287
71	5041
71	71
	1

5. The largest two digit number which is a perfect square is 81 $9 \times 9 = 81$
6. The least number of three digits which is perfect square is 100.
7. Numbers ending with 2, 3, 7, 8 are not perfect squares. 16000 is only the perfect square.
8. (i) 731 and (iii) 5559 because there unit digit is odd number.
9. Which of the following perfect squares are squares of even numbers :
   (i) $256 = 16 \times 16$ Yes
   (ii) $676 = 26 \times 26$ Yes
   (iii) $841 = 29 \times 29$ No
   (iv) $225 = 15 \times 15$ No
   (v) $324 = 18 \times 18$ Yes
10. Which of the following perfect squares are squares of odd numbers :
    (i) $169 = 13 \times 13 =$ Yes
    (ii) $100 = 10 \times 10 =$ No
    (iii) $729 = 27 \times 27 =$ Yes
    (iv) $484 = 22 \times 22 =$ No
    (v) $289 = 17 \times 17 =$ Yes
11. What will be the units digit of the squares of the following numbers?
    (i) $\underline{1} \times \underline{1} = 1 \times 1 = 1$
    (ii) $\underline{0} \times \underline{0} = 0 \times 0 = 0$
    (iii) $\underline{4} \times \underline{4} = 4 \times 4 = \underline{6} = 6$
    (iv) $2796 \times 2796 = 6 \times 6 = \underline{6} = 6$
12. Express each of the following perfect squares as sum of odd numbers :

(i) 81 $= 1+3+5+7+9+11+13+15+17$

(ii) 49 $= 1+3+5+7+9+11+13$

(iii) 36 $= 1+3+5+7+9+11$

(iv) 16 $= 1+3+5+7$

13. Without adding, find the following sum :

(i) $1+3+5+7+9+11 = (6)^2 = 36$

(ii) $1+3+5+7+9+11+13 = (7)^2 = 49$

(iii) $1+3+5+7+9+11+13+15+17+19+21$
$= (11)^2 = 121$

14. How many natural numbers lie between squares of the following natural numbers?

(i) 25 and 26

n^2 and $(n+1)^2 = n = 25 = 2n$ $\quad 2 \times 25 = 50$

(ii) 99 and 100

$n = 99$ $\quad 2n = 2 \times 99 = 198$

15. Which of the following triplets are Pythagorean?

(i) (6, 7, 8) $= (6)^2 + (7)^2 = (8)^2$

$36 + 49 \neq 64$, No

(ii) (10, 24, 26) $= (10)^2 + (24)^2 = (26)^2$

$100 + 576 = 676$, Yes

(iii) (14, 48, 51) $= (14)^2 + (48)^2 = (51)^2$

$196 + 2304 \neq 2601$, No

(iv) (8, 15, 17) $= (8)^2 + (15)^2 = (17)^2$

$64 + 225 = 289$, Yes

(v) (12, 35, 38) $= (12)^2 + (35)^2 = (38)^2$

$144 + 1225 \neq 1444$, No

16. (i) $\underline{2\times2}\times\underline{3\times3}\times5$

$=180\times5=900$

2	6, 9, 15, 20
3	3, 9, 15, 10
5	1, 3, 5, 10
2	1, 3, 1, 2
3	1, 3, 1, 1
	1, 1, 1, 1

(ii) $2\times2\times2\times3\times3\times5$

$360\times5\times2=3600$

2	8, 9, 10
2	4, 9, 5
2	2, 9, 5
3	1, 9, 5
3	1, 3, 5
5	1, 1, 5
	1, 1, 1

Exercise 3.2

1. Find the square root of following by prime factorisation method:

(i) $\underline{3\times3}\times\underline{3\times3}\times\underline{11\times11}$

$3\times3\times11=99$

3	9801
3	3267
3	1087
3	363
11	121
11	11
	1

(ii) $=\underline{3\times3}\times\underline{5\times5}\times\underline{7\times7}$

$3\times5\times7=105$

3	11025
3	3675
5	1225
5	245
7	49
7	7
	1

(iii) $= \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7} \times \underline{13 \times 13}$

$2 \times 3 \times 7 \times 13 = 546$

2	298116
2	149058
3	74529
3	24843
7	8281
7	1183
13	169
13	13
	1

(iv) $= \underline{3 \times 3} \times \underline{25 \times 25}$

$3 \times 25 = 75$

3	5625
3	1875
25	625
25	25
	1

(v) $= \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{17 \times 17}$

$2 \times 2 \times 17 = 68$

2	4624
2	2312
2	1156
2	578
17	289
17	17
	1

(vi) $= \underline{2 \times 2} \times \underline{383 \times 383}$

$= 2 \times 383 = 766$

2	586756
2	293378
383	146689
383	383
	1

2. Find the square root of the following by long division method :

(i) 54756 $\sqrt{54756} = 234$

	234
2	$\overline{54}\,\overline{56}$
	–4
43	147
	–129
464	1856
	–1856
	×

(ii) 4937284 $\sqrt{4937284} = 2222$

	2222
2	$\overline{49}\,\overline{37}\,\overline{84}$
	–4
42	93
	–84
442	972
	–884
4442	8884
	–8884
	×

(iii) 720801 $\sqrt{720801} = 849$

	849
8	$\overline{72}\,\overline{08}\,\overline{01}$
	–64
164	808
	–656
1689	15201
	–15201
	×

(iv) 363609 $\sqrt{363609} = 603$

	603
6	$\overline{36}\,\overline{36}\,\overline{09}$
	–36
1203	3609
	–3609
	×

3. Find the square root of the following :

(i) $\frac{7225}{1089} = \frac{\sqrt{85\times85}}{\sqrt{33\times33}} = \frac{85}{33}$

(ii) $6\frac{115}{289} = \frac{1849}{289} = \frac{43\times43}{17\times17} = \frac{43}{17}$

(iii) $\frac{1587}{1728}$ Not a perfect square

(iv) $3\frac{334}{3025} = \frac{9409}{3025} = \frac{97\times97}{55\times55} = \frac{97}{55}$

4. Find the value of the following :

(i) $\sqrt{99}\times\sqrt{396}$

$\sqrt{3\times3\times11}\times\sqrt{2\times2\times3\times3\times11}$

$\sqrt{3\times3\times11\times2\times2\times3\times3\times11}$

$3\times11\times2\times3 = 198$

3	99
3	33
11	11
	1

2	396
2	198
3	99
3	33
11	11
	1

(ii) $\sqrt{45}\times\sqrt{20} = \sqrt{900} = \sqrt{30\times30} = 30$

(iii) $\sqrt{25.6\times52.9} = \sqrt{1354.24}$

	36.8
3	$\overline{13}\,\overline{54}.\overline{24}$
	–9
66	454
	–396
728	582.4
	–582.4
	×

$= \sqrt{1354.24} = 36.8$

(iv) $\sqrt{\frac{0.4225}{0.0169}} = \sqrt{\frac{0.65 \times 0.65}{0.13 \times 0.13}} = \frac{0.65}{0.13} = 5$

(v) $\frac{\sqrt{441}}{\sqrt{625}} = \frac{\sqrt{21 \times 21}}{\sqrt{25 \times 25}} = \frac{21}{25}$

5. Find the square root of the following :

(i)

	9.2
9	$\overline{84}.\overline{64}$
	–81
182	364
	–364
	×

= 9.2 Ans.

(ii)

	13.42
1	$1\overline{80}.\overline{09}\overline{64}$
	–1
23	80
	–69
264	1109
	–1056
2682	5364
	–5364
	×

= 13.42 Ans.

(iii)

	6.09
6	$\overline{37}.\overline{08}\overline{81}$
	–36
120	108
	–0
1209	10881
	–10881
	×

= 6.09 Ans.

(iv)

	0.324
3	0.10̄4̄9̄7̄6̄
	–9
62	149
	–124
644	2576
	–2576
	×

= 0.324 Ans.

6. Find the square root of the following upto 3 decimal places :

(i) 24.8

	4.979
4	24.̄8̄0̄0̄0̄0̄
	–16
89	880
	–801
987	7900
	–6909
9949	109100
	–89541
	19559

= 4.979 Ans.

(ii) 3

	1.732
1	3.̄0̄0̄0̄0̄0̄0̄
	–1
27	200
	–189
343	1100
	–1029
3462	7100
	–6924
	17600

= 1.732 Ans.

(iii) 125

	11.180
1	$1\overline{25}\,\overline{00}\,\overline{00}\,\overline{00}$
	–1
21	25
	–21
221	400
	–221
2228	17900
	–17824
	7600

= 11.180 Ans.

(iv) 3460

	58.821
5	$\overline{34}\,\overline{60}.\overline{00}\,\overline{00}\,\overline{00}$
	–25
108	960
	–864
1168	9600
	–9344
11762	25600
	–23524
117641	207600
	–117641
	89959

= 58.821 Ans.

7. Area of field = 425.5969

	20.63
2	$4\overline{25}\,\overline{59}\,\overline{69}$
	–4
40	25
	–0
406	2559
	–2436
4123	12369
	–12369
	×

= 20.63 Ans.

8. $(316)^2 = (100000 - 144) = 99856$

$(317)^2 = 100489$ is the perfect square.

	316
3	$\overline{10}\,\overline{00}\,\overline{00}$
	–9
61	100
	–61
626	3900
	–3756
	0144

9. $553 + 1 = (554)^2 - 306452$

$306916 - 306452$

$= 464$

	553
5	$\overline{30}\,\overline{64}\,\overline{52}$
	–25
105	564
	–525
1103	3952
	–3309
	643

10. $18265 - 40 = 18225$

$(135)^2 = 18225$

40, Ans.

	135
1	$\overline{18}\,\overline{26}\,\overline{5}$
	–1
23	82
	–69
265	1365
	–1325
	40

11.

	67
6	$\overline{4}\,\overline{5}\,\overline{00}$
	–36
127	900
	–889
	11

11 students will be left out.

12. $2 \times 2 \times 3 \times 3 \times 7 \times 7$

$= 2 \times 3 \times 7$

$= 42$ rows.

2	1764
2	882
3	441
3	147
7	49
7	7
	1

MCQs

1.	(d)	2.	(a)	3.	(b)	4.	(d)	5.	(d)	6.	(b)
7.	(c)	8.	(a)	9.	(c)	10.	(a)				

1. Greatest 5 digit number = 99999

	316
3	99999
	9 ↓
61	099
	61 ↓
626	3899
	3756
	143

$(316)^2 = 99856$

$99999 - 143 = 99856$

2. $\sqrt{393129}$

$= 627$

	627
6	393129
	36 ↓
122	331
	244 ↓
1247	8729
	8729
	0

5. $(6)^2 + (8)^2 = (10)^2$

$36 + 64 = 100$

$100 = 100$

6. $(21)^2 - (20)^2 = 441 - 400 = 41$

8.
$$\begin{array}{r|l} & 2.5 \\ \hline 2 & 6.\overline{25} \\ & 4 \downarrow \\ \hline 45 & 225 \\ & 225 \\ \hline & 0 \end{array}$$

9.
$$\begin{array}{r|l} & 3.1 \\ \hline 3 & 9.\overline{61} \\ & 9 \downarrow \\ \hline 61 & 061 \\ & 61 \\ \hline & 0 \end{array}$$

10. $(305)^2 = 93025$

$(304)^2 = 92416$

Difference = 609

Fill in the blanks

1. Positive, negative 2. zero 3. even 4. Negative 5. no 6. odd.

True or False

1. F 2. F 3. F 4. F 5. T 6. T

4 Cube and Cube Roots

Exercise 4.1

1. Find the cubes of the following numbers :

(a) 3 $= 3 \times 3 \times 3 = 27$

(b) $-20 = (-20)\times(-20)\times(-20) = -8000$

(c) $202 = 202\times202\times202 = 82,42,408$

(d) $0.1 = 0.001$

(e) $-0.09 = (-0.09)\times(-0.09)\times(-0.09) = -0.000729$

(f) $42 = 42\times42\times42 = 74088$

(g) $4\frac{1}{3} = \frac{13}{3} = \frac{13\times13\times13}{3\times3\times3} = \frac{2197}{27} = 81\frac{10}{27}$

(h) $\frac{11}{12} = \frac{11\times11\times11}{12\times12\times12} = \frac{1331}{1728}$

2. Which of the following numbers are perfect cube :

(a) $\underline{2\times2\times2}\times\underline{2\times2\times2}$

$(2)^3 = 64$, Yes

2	64
2	32
2	16
2	8
2	4
2	2
	1

(b)

2	216
2	108
2	54
3	27
3	9
3	3
	1

$\underline{2\times2\times2}\times\underline{3\times3\times3}$

$= 2\times3 = (6)^3 = 216$, Yes

(c) $1728 = (12)^3$, Yes

(d) 243, No

(e) $\frac{64}{729} = \left(\frac{4}{9}\right)^3$, Yes

(f) 5400, No

(g) $512 = (8)^3$, Yes

(h) $8000 = (20)^3$, Yes

3. (a), (c), (d), (f) — all the numbers are ending with even numbers.

4. (b), (e), (f), (h)— all the numbers are ending with odd numbers.

5. Find the cubes of the following numbers by using column method:

(a) $64 = a = 6, b = 4$

Col I	Col II	Col III	Col IV
a^3	$3 \times a^2 \times b$	$3 \times a \times b^2$	b^3
$(6)^3 = 216$	$3 \times 6^2 \times 4$	$3 \times 6 \times 4^2$	$(4)^3$
+46	= 432	= 288	= 64
	+ 29	+ 6	
262	461	294	4

$(64)^3 = 262144$

(b) 35, $a = 3, b = 5$

$(3)^3$	$3 \times 3^2 \times 5$	$3 \times 3 \times 5^2$	5^3
= 27	= 135	= 225	= 125
+15	+23	+12	
42	158	237	5

$(35)^3 = 42875$

(c) 56, $a = 5, b = 6$

$(5)^3$	$3 \times 5^2 \times 6$	$3 \times 5 \times 6^2$	$(6)^3$
125	450	540	216
+50	+56	+21	—
175	506	561	6

$(56)^3 = 175616$

(d) 72, $a = 7$, $b = 2$

$(7)^3$	$3 \times 7^2 \times 2$	$3 \times 7 \times 2^2$	$(2)^3$
343	294	84	8
+30	+8		
373	302	84	8

$(72)^3 = 373248$

(e) $a = 4$; $b = 0$; 40

$(4)^3$	$3 \times 4^2 \times 0$	$3 \times 4 \times 0^2$	0^3
64	0	0	0

$(40)^3 = 64000$

6. $3 \times 3 \times 3 \times 5 \times 5 \times 5 \times 5 \times 5$

Smallest number to be multiplied should be 5.

3	84375
3	28125
3	9375
5	3125
5	625
5	125
5	25
5	5
	1

7. By which smallest number must the following numbers be divided so that the quotient is a perfect cube?

(a)

3	675
3	225
3	75
5	25
5	5
	1

$3 \times 3 \times 3 \times 5 \times 5$

= 25 Ans.

(b)

2	8640
2	4320
2	2160
2	1080
2	540
2	270
3	135
3	45
3	15
5	5
	1

$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5$

= 5 Ans.

(c)

2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

$\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 5 \times 5$

= 25 Ans.

(d)

2	8788
2	4394
13	2197
13	169
13	13
	1

$2 \times 2 \times \underline{13 \times 13 \times 13}$

= 4 Ans.

8. Find the smallest number which should be multiplied to the given number so that the product is a perfect cube.

(a)

2	392
2	196
2	98
7	49
7	7
	1

$\underline{2 \times 2 \times 2} \times 7 \times 7$

= 7 Ans.

(b)

3	675
3	225
3	75
5	25
5	5
	1

$\underline{3 \times 3 \times 3} \times 5 \times 5$
$= 5$ Ans.

(c)

2	2560
2	1280
2	640
2	320
2	160
2	80
2	40
2	20
2	10
5	5
	1

$\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$
$\times \underline{2 \times 2 \times 2} \times 5$
$= 25$ Ans.

(d)

2	8788
2	4394
13	2197
13	169
13	13
	1

$2 \times 2 \times \underline{13 \times 13 \times 13}$
$= 2$ Ans.

Exercise 4.2

1. Find the cube root of the following by prime factorisation :

(i) $-13 \times -13 \times -13 = -2197$

$\sqrt[3]{-2197} = -13$

13	2197
13	169
13	13
	1

(ii) $3\times3\times3\times3\times3\times3\times5\times5\times5$

$=3\times3\times5$

$\sqrt[3]{91125}=45$

3	91125
3	30375
3	10125
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

(iii) $\underline{2\times2\times2}\times\underline{9\times9\times9}$

$\sqrt[3]{-5832}=-18$

2	–5832
2	2916
2	1458
9	729
9	81
9	9
	1

(iv) $2\times2\times2\times3\times3\times3\times7\times7\times7$

$=2\times3\times7$

$\sqrt[3]{-74088}=-42$

2	–74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

(v) $2\times2\times2\times2\times2\times2\times2\times2\times2\times3\times3\times3$

$=2\times2\times2\times3=24$

$=(24)^3$

$\sqrt[3]{13824}=24$

2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

(vi) -175616

$2\times2\times2\times2\times2\times2\times2\times2\times2\times7\times7\times7$

$=2\times2\times2\times7$

$=-56$

$=(-56)^3$

$\sqrt[3]{-175616}=56$

2	175616
2	87808
2	43904
2	21952
2	10976
2	5488
2	2744
2	1372
2	686
7	343
7	49
7	7
	1

(vii) $2\times2\times2\times2\times2\times2\times7\times7\times7$

$=2\times2\times7$

$=(28)^3$

$\sqrt[3]{21952}=28$

2	21952
2	10976
2	5488
2	2744
2	1372
2	686
7	343
7	49
7	7
	1

(viii) $3\times3\times3\times3\times3\times3\times3\times3\times3$
$\times3\times3\times3$
$=3\times3\times3\times3=81$
$=(81)^3$ Ans.
$\sqrt[3]{531441}=81$

3	531441
3	177147
3	59049
3	19683
3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

2. Find the cube root of the following numbers :

(i) $\frac{729}{1728}=\frac{\sqrt[3]{9\times9\times9}}{\sqrt[3]{12\times12\times12}}=\frac{9}{12}=\frac{3}{4}$

(ii) $\frac{-343}{2197}=\frac{\sqrt[3]{(-7)\times(-7)\times(-7)}}{\sqrt[3]{13\times13\times13}}=\frac{-7}{13}$

(iii) $\frac{1000}{9261}=\frac{\sqrt[3]{10\times10\times10}}{\sqrt[3]{21\times21\times21}}=\frac{10}{21}$

(iv) $\frac{3375}{4913}=\frac{\sqrt[3]{15\times15\times15}}{\sqrt[3]{17\times17\times17}}=\frac{15}{17}$

(v) $\frac{-9261}{42875}=\frac{\sqrt[3]{(-21)\times(-21)\times(-21)}}{\sqrt[3]{35\times35\times35}}=\frac{-21}{35}=\frac{-3}{5}$

(vi) $\frac{-125}{2744}=\frac{\sqrt[3]{(-5)\times(-5)\times(-5)}}{\sqrt[3]{14\times14\times14}}=\frac{-5}{14}$

3. Find the cube root of the following :

(i) $1.331=\frac{1331}{1000}=\frac{\sqrt[3]{11\times11\times11}}{\sqrt[3]{10\times10\times10}}=\frac{11}{10}$

(ii) $0.001 = \sqrt[3]{\frac{1}{1000}} = \frac{\sqrt[3]{1\times1\times1}}{\sqrt[3]{10\times10\times10}} = \frac{1}{10} = 0.1$

(iii) $0.001728 = \frac{1728}{1000000} = \frac{\sqrt[3]{12\times12\times12}}{\sqrt[3]{100\times100\times100}} = \frac{12}{100} = 0.12$

(iv) $-125\times216 \quad \sqrt{(-5)^3\times(6)^3} = -5\times6 = -30$

(v) $-0.008\times0.125 = \sqrt[3]{\frac{-8}{1000}\times\frac{125}{1000}} = \frac{-2}{10}\times\frac{5}{10} = \frac{-10}{100} = -0.1$

(vi) $0.009261 = \sqrt[3]{\frac{9261}{1000000}} = \frac{21}{100} = 0.21$

4. $43200 = 2\times2\times2\times2\times2\times2\times3\times3\times3\times5\times5$

$= 2^6\times3^3\times5^2$

$= 5$ Ans.

2	216000
2	108000
2	54000
2	27000
2	13500
2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

5. Find the smallest number, by which following numbers can be divided to find perfect cube root of the quotient :

(i) $15552 = 2^6\times3^5 = 3^{5-3} = 3^2 = 9$

(ii) $3087 = 3^2\times7^3 = 3\times3 = 9$

(iii) $31250 = 2\times5^6 = 2$

(iv) $120393 = 3^3 \times 7^3 \times 13^1 = 13$

6. Find the smallest perfect number by which following numbers are multiplied so that the product is a perfect cube and find out the cube root.

(i) $15552 = 2^6 \times 3^5 = 3$

$= 15552 \times 3$

$= 46656$

$= 2^6 \times 3^6$

$\sqrt[3]{46656} = 2 \times 2 \times 3 \times 3$

$= 4 \times 9$

$\sqrt[3]{46656} = 36$

(ii) $33275 = 5^2 \times 11^3 = 5$

$= 33275 \times 5$

$= 166375$

$= 5^3 \times 11^3$

$\sqrt[3]{166375} = 55$

(iii) $6750 = 2 \times 3^3 \times 5^3 = 2$

$= 6750 \times 4$

$= 27000$

$= 2^3 \times 3^3 \times 5^3$

$\sqrt[3]{27000} = 2 \times 3 \times 5$

$\sqrt[3]{27000} = 30$

(iv) $3087 = 3^2 \times 7^3 = 3$

$= 3087 \times 3$

$= 9261$

$\sqrt[3]{9261} = 3^3 \times 7^3$

$= 3 \times 7$

$= 21$

7. $(1x)^3 + (2x)^3 + (3x)^3 = 98784$

$1x^3 + 8x^3 + 27x^3 = 98784$

$36x^3 = 98784$

$x^3 = \frac{98784}{36} = 2744, \quad x = \sqrt[3]{2744} = 14$

Numbers are = 14; $2x = 14 \times 2 = 28$, $3x = 14 \times 3 = 42$

8. $512 = \sqrt{8 \times 8 \times 8} = 8$

9. $963144 = 2^3 \times 3^3 \times 7^3 \times 13 = 13$ Ans.

MCQs

1.	(a)	2.	(a)	3.	(b)	4.	(c)	5.	(d)	6.	(c)
7.	(d)	8.	(d)	9.	(d)	10.	(c)				

5. $12 \times 12 \times 12 = 1728$

6.

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

$= 2 \times 11 = 22$

7.

2	5400
2	2700
2	1350
3	675
3	225
3	75
5	25
5	5
	1

Fill in the blanks

1. even 2. x 3. raised to power 4. 8 5. odd 6. less 7. negative
8. three times

True or False

1. True 2. True 3. True 4. True 5. False 6. False 7. True 8. True

5 Algebraic Expressions

Exercise 5.1

1. Write the coefficient of

   (i) $3y$ (ii) $\frac{-7}{2}$ (iii) $9x$ (iv) 1 (v) 3 (vi) $\frac{-5}{7}y^2$

2. Identify the following expression as monomials, binomials and trinomials.

   Monomial = (i), (iv) ,(x)

   Binomial = (ii), (iii), (vi)

   Trinomial = (v), (vii), (viii), (ix)

3. Write the numerical coefficient of each term of the following expressions:

   (i) 9, 110, −11 (ii) $\frac{-4}{5}$,8,9

   (iii) $-1,-2,15,-18$ (iv) −15,–30, 6, 4

4. Write the coefficient of y^2 in the following:

   (i) $10y^2z = 10z$ (ii) $-8xy^3z = -8xyz$

   (iii) $-6y^2 = -6$ (iv) $\frac{6}{5}x^2y^3z = \frac{6}{5}x^2yz$

(v) $\frac{-7}{9}xy^2 = \frac{-7}{9}x$ (vi) $32x^4y^4z = 32x^4y^2z$

5. What is the degree of each term of the following expressions, hence, state the degree of the expression:

(i) $x^2 + 4$ = 2, 0; 2

(ii) $x^2y + 3xy - y$ = 3, 2, 1; 3

(iii) $8 - y^3$ = 0, 3; 3

(iv) $7 - 5p^4 - 4p^3q^2$ = 0, 4, 5 = 5

(v) $xy^2 + 4x^2y - 7x^2y^2 - 3x^3y^2 - 3x^2y^3 + 3$

$1 + 2, 2 + 1, 2 + 2, 3 + 2, 2 + 3, 0$

3, 3, 4, 5, 5, 0 = 5

(vi) $x^2y - xy^2 + 7xy - 9$ $= 2 + 1, 1 + 2, 1 + 1, 0$

= 3, 3, 2, 0 = 3

(vii) $8x^3 - 4x^2 + 7x - 11$ = 3, 2, 1, 0 = 3

(viii) $x^3 - 7x^2y + 5xy^2 - 2$ $= 3, 2 + 1, 1 + 2, 0$

= 3, 3, 3, 0 = 3

6. Identify which of the following expressions are polynomials. If so write their degrees :

(i) Polynomial, 4 (ii) No (iii) No (iv) Polynomial, 7

7. Find the values of following expressions when x = 3

(i) $3x - 7$ $3 \times 3 - 7 = 9 - 7 = 2$

(ii) $\frac{1}{3}x + 4$ $\frac{1}{3} \times 3 + 4 = 1 + 4 = 5$

(iii) $-x + 5$ $-3 + 5 = 2$

(iv) $4x + 5$ $4 \times 3 + 5 = 12 + 5 = 17$

8. Find the values of the following expressions when x = −1, y = 2

(i) $2x + y$ $= 2 \times (-1) + 2 = 0$

(ii) $3x - y \quad = 3 \times (-1) - 2 = -3 - 2 = -5$

(iii) $x^2 + y^2 + z = (-1)^2 + (2)^2 + z = 1 + 4 + z = 5 + z$

(iv) $x^2 + 5 - 2y^2 = (-1)^2 + 5 - 2 \times (2)^2$

$= 1 + 5 - 8 = 6 - 8 = -2$

9. Find the values of the following expressions, if $a = 2, b = 1, c = 3$.

(i) $a^2b - ab^2$

$(2)^2 \times 1 - 2 \times (1)^2$

$= 4 \times 1 - 2 \times 1 = 4 - 2 = 2$

(ii) $-ab^2c + a^2bc - abc^2$

$-2 \times (1)^2 \times 3 + (2)^2 \times 1 \times 3 - 2 \times 1 \times (3)^2$

$= -6 + 12 - 18 \qquad -24 + 12 = -12$

(iii) $a^2 - b^2 - c^2 - 2ab - 2bc - 2ac$

$(2)^2 - (1)^2 - (3)^2 - 2 \times 2 \times 1 - 2 \times 1 \times 3 - 2 \times 2 \times 3$

$4 - 1 - 9 - 4 - 6 - 12 = -28$

(iv) $a^3 + b^3 + c^3 - 3abc$

$(2)^3 + (1)^3 + (3)^3 - 3 \times 2 \times 1 \times 3$

$= 8 + 1 + 27 - 18 = 36 - 18 = 18$

10. Simplify the expression and find their values if $p = -1, q = 1, r = 2$.

(i) $10pq - 2qr - 6pr + 4pq$

$10 \times (-1) \times 1 - 2 \times 1 \times 2 - 6 \times (-1) \times 2 + 4 \times (-1) \times 1$

$-10 - 4 + 12 - 4 = -6$

(ii) $pqr - 6pqr + 7q^2 - 4p^2$

$-1 \times 1 \times 2 - 6 \times (-1) \times 1 \times (2) + 7 \times (1)^2 - 4 \times (-1)^2$

$-2 + 12 + 7 - 4 = 19 - 6 = 13$

(iii) $5(p + q) - 3p - 2q$

$5(-1 + 1) - 3 \times (-1) - 2 \times 1 \qquad 3 - 2 = 1$

(iv) $p^2q + pqr - qr^2 + 2pq - 3p^2q$

$(-1)^2 \times 1 + (-1) \times 1 \times 2 - 1 \times (2)^2 + 2 \times (-1) \times 1 - 3 \times (-1)^2 \times 1$

$1 \times 1 + (-2) - 4 + (-2) - 3$

$1 - 2 - 4 - 2 - 3 = -10$

Exercise 5.2

1. Add the following expressions:

(i) $24xy, 19xy, -4xy$

$24xy + 19xy + (-4xy)$

$42xy - 4xy = 39xy$

(ii) $(x + y - 7), (3x + 8y - 4)$

$x + 3x + y + 8y - 7 - 4 = 4x + 9y - 11$

(iii) $(5ax - 3by + 7cz), (7by - 11ax - 3cz), (12cz - ax - 3by)$

$5ax - 11ax - ax - 3by + 7by - 3by + 7cz - 3cz + 12cz$

$5ax - 12ax - 6by + 7by + 19cz - 3cz = -7ax + by + 16cz$

(iv) $\left(\frac{3}{2}x^3 - \frac{1}{4}x^2 + \frac{5}{3}\right), \left(\frac{-5}{4}x^3 + \frac{3}{5}x^2 - x + \frac{1}{5}\right), \left(-x^2 + \frac{3}{8}x - \frac{8}{15}\right)$

$\left(\frac{3}{2}x^3 - \frac{5}{4}x^3\right) + \left(-\frac{1}{4}x^2 + \frac{3x^2}{5} - x^2\right) + \left(-x + \frac{3}{8}x\right) + \left(\frac{5}{3} + \frac{1}{5} - \frac{8}{15}\right)$

$\left(\frac{6x^3 - 5x^3}{4}\right) + \left(\frac{-5x^2 + 12x^2 - 20x^2}{20}\right) + \left(\frac{-8x + 3x}{8}\right) + \left(\frac{25 + 3 - 8}{15}\right)$

$$\frac{x^3}{4}-\frac{13x^2}{20}-\frac{5x}{8}+\frac{20}{15} \qquad \frac{x^3}{4}-\frac{13x^2}{20}-\frac{5x}{8}+\frac{20}{15}$$

$$\frac{x^3}{4}-\frac{13x^2}{20}-\frac{5x}{8}+\frac{4}{3}$$

(v) $(3x^2-5xy+4y^2-1),(7y^2-9xy+5),$

$$(7xy-4x^2+y^2-13)$$

$$3x^2-4x^2-5xy-9xy+7xy+4y^2+7y^2+y^2-1+5-13$$

$$=-x^2-7xy+12y^2-9$$

2. Subtract

(i) $-a^2b$ from $7a^2b$ $\qquad 7a^2b-(-a^2b)$

$$=7a^2b+a^2b=8a^2b$$

(ii) $9ab$ from $-15ab$

$-15ab-(9ab) \qquad =-15ab-9ab=-24ab$

(iii) (x^2+y^2) from $\left(2x^2-\frac{1}{2}y^2+3\right)$

$\left(2x^2-\frac{1}{2}y^2+3\right)-(x^2+y^2)$

$$2x^2-x^2-\frac{1}{2}y^2-y^2+3$$

$$x^2-\frac{1y^2-2y^2}{2}+3=x^2-\frac{3y^2}{2}+3$$

(iv) $(2a^2+3b^2-4c)$ from 0

$$0-(2a^2+3b^2-4c)=-2a^2-3b^2+4c$$

(v) $a^2+5b^2-4c^2+9abc$ from $8b^2-5a^2-7c^2-2a^2b^2c^2$

$$8b^2-5a^2-7c^2-2a^2b^2c^2-(a^2+5b^2-4c^2+9abc)$$

$$8b^2-5a^2-7c^2-2a^2b^2c^2-a^2-5b^2+4c^2-9abc$$

$$-5a^2-a^2+8b^2-5b^2-7c^2+4c^2-2a^2b^2c^2-9abc$$

$= -6a^2 + 3b^2 - 3c^2 - 2a^2b^2c^2 - 9abc$

(vi) $4p^3 + 3p^2 - 2p$ from $9p^3 - 4p$

$9p^3 - 4p^3 - 4p + 2p - 3p^2 = 5p^3 - 2p - 3p^2$

$= 5p^3 - 3p^2 - 2p$

3. $5x^3 - 11x^2 - 4 - (10x^3 - 4x^2 + 6)$

$5x^2 - 11x^2 - 4 - 10x^3 + 4x^2 - 6$

$= 5x^3 - 7x^2 - 10$

4. $14xyz + 6xy - (-xyz + 7xy)$

$14xyz + 6xy + xyz - 7xy$

$14xyz + xyz + 6xy - 7xy = 15xyz - xy$

5. $3x^3 - 7x^2 + 8 - (5x^2 - 3x - 1)$

$3x^3 - 7x^2 + 8 - 5x^2 + 3x + 1$

$3x^3 - 12x^2 + 3x + 9$

6. $9x^2 - 10y^2 - z^2 - (x^2 - 4y^2 - z^2)$

$9x^2 - x^2 - 10y^2 + 4y^2 - z^2 + z^2$

$8x^2 - 6y^2$

7. $[(11xy - x^2 - 4) + (-14xy + 5x^2)] + 15xy + x^2 - 2$

$[11xy - 14xy - x^2 + 5x^2 - 4] + 15xy + x^2 - 2$

$-3xy + 4x^2 - 4 + 15xy + x^2 - 2$

$12xy + 5x^2 - 6$

8. $P + Q - R = 0$

$(2x^2 + 3xy - 5y^2) + (-5x^2 + 2xy + 3y^2) - (-3x^2 + 5xy - 2y^2)$

$= 2x^2 + 3xy - 5y^2 - 5x^2 + 2xy + 3y^2 + 3x^2 - 5xy + 2y^2 = 0$

$2x^2 - 5x^2 + 3x^2 + 3xy + 2xy - 5xy - 5y^2 + 3y^2 + 2y^2 = 0$

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

9. $x^2 - y^2 + 3y - 5 - (2y^2 + 2x - y - 10)$

$x^2 - y^2 + 3y - 5 - 2y^2 - 2x + y + 10$

$x^2 - y^2 - 2y^2 + 3y + y - 5 + 10 - 2x$

$x^2 - 3y^2 + 4y + 5 - 2x$

$= x^2 - 3y^2 + 4y - 2x + 5$

10. $[(a + 3b - 4c) + (4a - b + 9c) + (-2b + 3c - a)] - (2a - 3b + 4c)$

$[a + 3b - 4c + 4a - b + 9c - 2b + 3c - a] - (2a - 3b + 4c)$

$a + 4a - a + 3b - b - 2b - 4c + 9c + 3c - (2a - 3b + 4c)$

$(4a + 3b - 3b + 8c) - (2a - 3b + 4c)$

$4a + 8c - 2a + 3b - 4c$

$2a + 3b + 4c$

Exercise 5.3

❖ Find each of the following products (1-17):

1. $(4x^3)(-3xy) = 4 \times (-3) \times x^3 \times x \times y$

$= -12x^4y$

2. $\frac{7}{9}ab^2 \times \frac{15}{7}ac^2b = \frac{7}{9} \times \frac{15}{7} \times a \times a \times b^2 \times b \times c^2$

$= \frac{15}{9}a^2b^3c^2 = \frac{5}{3}a^2b^3c^2$

3. $\left(\frac{-24}{25}a^3c\right) \times \left(\frac{-15}{16}abc^2\right)$

$\frac{-24}{25} \times \frac{(-15)}{16} \times a^3 \times a \times b \times c \times c^2$

$\frac{-3}{5} \times \frac{(-3)}{2} = \frac{9}{10}a^4bc^3$

4. $0.5xy^2 \times 1.2x^2y^2 = 0.5 \times 1.2 \times x \times x^2 \times y^2 \times y^2$

$= 0.6x^3y^4$

5. $(3ab),(-5ab^2c)$ and $(6abc^2)$

$3\times(-5)\times6\times a\times a\times a\times b\times b^2\times b\times c\times c^2$

$-90a^3b^4c^3$

6. $\left(\frac{4}{3}ab^2\right)\left(\frac{-1}{4}b^2c\right)(9a^2b^2c^2)$

$\frac{4}{3}\times\frac{-1}{4}\times9\times a\times a^2\times b^2\times b^2\times b^2\times c\times c^2$

$=-3a^3b^6c^3$

7. $2x\times(3x+5y)=2x\times3x+2x\times5y$

$=6x^2+10xy$

8. $\frac{-8}{27}abc\left(\frac{3}{2}abc^2-\frac{9}{4}ab^2c^3\right)$

$\frac{-8}{27}abc\left(\frac{3}{2}abc^2\right)-\left(\frac{-8}{27}abc\right)\left(\frac{9}{4}ab^2c^3\right)$

$\frac{-4}{9}a^2b^2c^3-\left(\frac{-2}{3}a^2b^3c^4\right)$

$=\frac{-4}{9}a^2b^2c^3+\frac{2}{3}a^2b^3c^4$

9. $0.1x(0.01x+0.001y)$

$0.001\,x^2+0.0001\,xy$

10. $(2x+3y)$ and $(5x+3y)$

$10x^2+6xy+15xy+9y^2$

$=10x^2+21xy+9y^2$

11. $\left(4x+\frac{3y}{5}\right)\left(3x-\frac{4y}{5}\right)$

$12x^2-\frac{16xy}{5}+\frac{9xy}{5}+\frac{12y^2}{25}$

$= 12x^2 - \frac{7xy}{5} + \frac{12y^2}{25}$

12. $\left(-\frac{x}{7} + \frac{x^2}{9}\right)\left(\frac{y}{2} - \frac{y^2}{3}\right)$

$\frac{-xy}{14} + \frac{xy^2}{21} + \frac{x^2y}{18} - \frac{x^2y^2}{27}$

$\frac{1xy}{14} + \frac{1xy^2}{21} + \frac{1x^2y}{18} - \frac{1x^2y^2}{27}$

13. $x^2y\ (3x^2 + 4y^2 - 2xy)$

$x^2y \times 3x^2 + x^2y \times 4y^2 - x^2y \times (-2xy)$

$3x^4y + 4x^2y^3 - 2x^3y^2$

14. $-\frac{5}{7}x\left[\frac{14}{3}xy - \frac{7}{25}y^2 + \frac{1}{5}x^2y\right]$

$-\frac{5}{7}x \times \frac{14}{3}xy - \frac{5}{7}x \times \left(\frac{-7}{25}y^2\right) - \frac{5}{7}x\left(\frac{1}{5}x^2y\right)$

$\frac{-10}{3}x^2y + \frac{1}{5}xy^2 - \frac{1}{7}x^3y$

15. $(5x + 2)$ and $(2x^2 - 3x + 5)$

$5x \times 2x^2 + 5x \times (-3x) + 5x \times 5 + 2 \times 2x^2 + 2 \times (-3x) + 2 \times 5$

$= 10x^3 - 15x^2 + 25x + 4x^2 - 6x + 10$

$= 10x^3 - 11x^2 + 19x + 10$

16. $(x^2 - 2y^2)(x + 4y + 3)$

$x^2 \times x + x^2 \times 4y + x^2 \times 3 - 2y^2 \times x - 2y^2 \times 4y - 2y^2 \times 3$

$= x^3 + 4x^2y + 3x^2 - 2xy^2 - 8y^3 - 6y^2$

17. $(2x^2 + 3x - 5)(3x^2 - 5x + 4)$

$2x^2 \times 3x^2 + 2x^2 \times (-5x) + 2x^2 \times 4 + 3x \times 3x^2 + 3x \times (-5x)$

$+ 3x \times 4 - 5 \times 3x^2 - 5 \times (-5x) - 5 \times 4$

$6x^4 - 10x^3 + 8x^2 + 9x^3 - 15x^2 + 12x - 15x^2 + 25x - 20$

$6x^4 - x^3 - 22x^2 + 37x - 20$

18. $-\frac{3}{2}x^2y^3(2x - y)$

$\frac{-3}{2}x^2y^3 \times 2x - \frac{3}{2}x^2y^3 \times (-y)$

$-3x^3y^3 + \frac{3}{2}x^2y^4 ; \qquad x = 1, y = 2$

$-3 \times (1)^3 \times (2)^3 + \frac{3}{2} \times (1)^2 \times (2)^4$

$-3 \times 8 + \frac{3}{2} \times 16$

$-3 \times 8 + 3 \times 8 = 0$

19. $\left(\frac{1}{3}x - \frac{y^2}{5}\right)\left(\frac{1}{3}x + \frac{y^2}{5}\right)$

$\frac{1}{3}x \times \frac{1}{3}x + \frac{1}{3}x \times \frac{y^2}{5} - \frac{y^2}{5} \times \frac{1}{3}x - \frac{y^2}{5} \times \frac{y^2}{5}$

$\frac{1}{9}x^2 + \frac{1}{15}xy^2 - \frac{1xy^2}{15} - \frac{y^4}{25}$

$= \frac{1}{9}x^2 - \frac{y^4}{25}$

20. Simplify :

(i) $2x^2(x^3 - x) - 3x(x^4 + 2x) - 2(x^4 - 3x^2)$

$2x^2 \times x^3 + 2x^2 \times (-x) - 3x \times x^4 - 3x \times 2x - 2 \times x^4$

$-2 \times (-3x^2)$

$2x^5 - 2x^3 - 3x^5 - 6x^2 - 2x^4 + 6x^2$

$2x^5 - 3x^5 - 2x^3 - 6x^2 + 6x^2 - 2x^4$

$-x^5 - 2x^4 - 2x^3$

(ii) $a(b - c) - b(c - a) - c(a - b)$

$ab - ac - bc + ab - ac + bc$

$2ab - 2ac$

(iii) $a(b-c) + b(c-a) + c(a-b)$

$ab - ac + bc - ab + ac - bc = 0$

(iv) $4xy(x-y) - 6x^2(y-y^2) - 3y^2(2x^2 - x) + 2xy(x-y)$

$4x^2y - 4xy^2 - 6x^2y + 6x^2y^2 - 6x^2y^2 + 3xy^2 + 2x^2y - 2xy^2$

$4x^2y - 6x^2y + 2x^2y - 4x^2y + 3xy^2 - 2xy^2 + 6x^2y^2 - 6x^2y^2$

$-2x^2y + 2x^2y - 6xy^2 + 3xy^2$

$= -3xy^2$

MCQs

1.	(c)	2.	(a)	3.	(b)	4.	(d)	5.	(d)	6.	(b)
7.	(a)	8.	(a)	9.	(b)	10.	(c)				

1. $4x^2 - 3x + x^2 + x$

   $= 5x^2 - 2x$

2. $3a^2b - (-8a^2b)$

   $= 3a^2b + 8a^2b$

   $= 11a^2b$

3. $3x^2 - 2x^2 + 5x + x + 4y - 2y$

   $x^2 + 6x + 2y$

4. $a^2 + a^2 + 2a^2 + b^2 + b^2 - 2b^2 + 2ab - 2ab + 3ab$

   $4a^2 + 3ab$

5. $a^3 + b^3 - 3ab - (a^3 + b^3 + 3ab)$

   $a^3 + b^3 - 3ab - a^3 - b^3 - 3ab$

$-6ab$

6. $2ab \times 3a^2b^3 \frac{4}{3}a = 8a^4b^4$

7. $12x^5y^3$

8. $a^2b(a-b^2) + ab^2(4ab - 2a^2) - a^3b(1-2b)$

   $a^3b - a^2b^3 + 4a^2b^3 - 2a^3b^3 - 2a^3b^2 - a^3b + 2a^3b^2$

   $3a^2b^3$

9. $p(p-q) + q(q-r) + r(r-p)$

   $p^2 - pq + q^2 - qr + r^2 - pr$

   $p^2 + q^2 + r^2 - pq - qr - pr$

10. $3.2(1)^6(0.5)^3 \times 2.1(1)^2(0.5)^2$

    $= 0.4 \times 0.525$

    $= 0.21$

True or False

1. True 2. False 3. True 4. True 5. True 6. True 7. False
8. True

Fill in the blanks

1. algebraic factors 2. zero 3. $\frac{-3}{2}y$ 4. –1 5. binomial
6. monomial 7. $66\frac{6}{7}$ 8. 21

1. $2(-1)^2(1) + 3(-1)(1)^2$

   $= 2 - 3$

   $= -1$

7. $\left(3 + \frac{2}{7} \times 9\right) \div (7(3) - (3)^2)$

$$= \left(3 + \frac{18}{7}\right)(21 - 9)$$

$$= \left(\frac{21 + 18}{7}\right)(12)$$

$$= \frac{39}{7} \times 12$$

$$= \frac{468}{7}$$

$$= 66\frac{6}{7}$$

8. $3(-2)(2(-2) - 7) - 3(-2 - 4) - 63$

$-6(-4 - 7) - 3(-6) - 63$

$-6(-11) + 18 - 63$

$-66 + 18 - 63$

$= 84 - 63$

$= 21$

6 Factorization

❖ Factorise the following (1 to 20) :

1. $15x - 5x^2$

$3 \times 5x - 5x \times x$

$5x(3 - x)$

2. $72x^6y^7 - 96x^7y^6$

$12 \times 6 \times x^6 \times y^7 - 12 \times 8 \times x^7 \times y^6$

$2 \times 2 \times 3 \times 2 \times 3 \times x^6 \times y^7 - 2 \times 2 \times 3 \times 2 \times 2 \times 2 \times x^7 \times y^6$

$2 \times 2 \times 3 \times 2 \times x^6 \times y^6(3y - 2 \times 2 \times x)$

$24x^6y^6(3y-4x)$

3. $6x^3+8x^2y$

$2\times3\times x^3+2\times2\times2\times x^2\times y$

$2x^2(3x+4y)$

4. $15a^{12}b^2-20a^8b^4$

$15a^{12}b^2-20a^8b^4 \qquad 3\times5\times a^{12}\times b^2-4\times5\times a^8\times b^4$

$5a^8b^2(3a^4-4b^2)$

5. $x^2+xy+8x+8y$

$(x^2+xy)+(8x+8y)$

$x(x+y)+8(x+y)$

$(x+8)(x+y)$

6. $2px+qx+2py+qy$

$x(2p+q)+y(2p+q) \qquad (x+y)(2p+q)$

7. $a^2+2a+ab+2b$

$a(a+2)+b(a+2) \qquad (a+b)(a+2)$

8. x^3+x^2+x+1

$x^2(x+1)+1(x+1)$

$=(x^2+1)(x+1)$

9. $2a^2bc-3ab^2c+4abc^2$

$2\times a^2\times b\times c-3\times a\times b^2\times c+4\times a\times b\times c^2$

$abc(2a-3b+4c)$

10. $x^4y-3x^2y^2-6xy^3$

$x^4\times y-3\times x^2\times y^2-2\times3\times x\times y^3$

$xy(x^3-3xy-6y^2)$

11. $x^2yz+xy^2z+xyz^2$

$x^2\times y\times z+x\times y^2\times z+x\times y\times z^2$

$xyz(x + y + z)$

12. $ax^2 - bx^2 + ay^2 - by^2 + az^2 - bz^2$

$ax^2 + ay^2 + az^2 - bx^2 - by^2 - bz^2$

$a(x^2 + y^2 + z^2) - b(x^2 + y^2 + z^2)$

$= (a - b)(x^2 + y^2 + z^2)$

13. $(ax + by)^2 + (bx - ay)^2$

$ax^2 + by^2 + bx^2 - ay^2$

$a^2x^2 + b^2x^2 + b^2y^2 - a^2y^2$

$x^2(a^2 + b^2) + y^2(b^2 + a^2)$

$(x^2 + y^2)(a^2 + b^2)$

14. $a^2b + ab^2 - abc - b^2c + axy + bxy$

$ab(a + b) - bc(a + b) + xy(a + b)$

$(ab - bc + xy)(a + b)$

15. $ab(x^2 + y^2) - xy(a^2 + b^2)$

$abx^2 + aby^2 - xya^2 - xyb^2$

$abx^2 - xyb^2 - xya^2 + aby^2$

$bx(ax - by) - ay(ax - by)$

$(bx - ay)(ax - by)$

16. $(x - y)^2 + (x - y)$

$(x - y)(x - y) + (x - y)$

$x^2 - xy - xy + y^2 + x - y$

$x^2 - 2xy + y^2 + x - y$

$(x - y)^2 + x - y$

$(x - y)(x - y + 1)$

17. $16(2a - 3b)^2 - 12(3b - 2a)$

$16(2a - 3b)^2 - 12 \times (-2a - 3b)$

$16(2a-3b)^2+12(2a-3b)$

$4(2a-3b)4(2a-3b)+3$

$4(2a-3b)(8a-12b+3)$

18. $a^3x+a^2(x-y)-a(y+z)-z$

$a^3x+a^2(x-y)-a(y+z)-z$

$a^3x+a^2x-a^2y-ay-az-z$

$a^2x(a+1)-ay(a+1)-z(a+1)$

$(a+1)(a^2x-ay-z)$

19. $a(a+b-c)-bc$

$a^2+ab-ac-bc$

$a(a+b)-c(a+b)$

$(a+b)(a-c)$

20. $a(a-2b-c)+2bc$

$a^2-2ab-ac+2bc$

$a(a-2b)-c(a-2b)$

$(a-2b)(a-c)$

Exercise 6.2

❖ Factorise the following (1 to 29)

1. $16a^2-9b^2$

$a^2-b^2=(a-b)(a+b)$

$(4a)^2-(3b)^2=(4a-3b)(4a+3b)$

2. $x^2-\frac{y^2}{4}$ $x^2-\frac{y^2}{(2)^2}$

$a^2-b^2=(a-b)(a+b)$

$\left(x+\frac{y}{2}\right)\left(x-\frac{y}{2}\right)$

3. $1-\frac{25}{x^2}=(1)^2-\frac{(5)^2}{x^2}$

$\left(1+\frac{5}{x}\right)\left(1-\frac{5}{x}\right)$

4. $2x-8x^3$

$2x(1-4x^2)$

$2x((1)^2-(2x)^2)$ $\qquad a^2-b^2=(a-b)(a+b)$

$2x(1+2x)(1-2x)$

5. x^4-16

$(x^2)^2-(4)^2$

$(x^2+4)(x^2-4)$

$(x^2+4)(x^2-(2)^2)$

$(x^2+4)(x+2)(x-2)$

6. $1-(a-b)^2$

$(1)^2-(a-b)^2$

$a^2-b^2=(a-b)(a+b)$

$(1-(a-b))(1+(a-b))$

$(1-a+b)(1+a-b)$

7. $3a^5-75a^3$

$3a^3(a^2-25)$ $\qquad$ (Taking $3a^3$ common)

$3a^3(a^2-(5)^2)$

$3a^3(a-5)(a+5)$

8. $(x-1)^2-y^2$

$a^2-b^2=(a-b)(a+b)$

$((x-1)-y)((x-1)+y)$

$(x-1-y)(x-1+y)$

9. $(x-1)^2-(x-2)^2$

$((x-1)-(x-2))((x-1)+(x-2))$

$(x-1-x+2)(x-1+x-2)$

$(2x-3)$

10. $a^4-(2b-3c)^2$

$(a^2)^2-(2b-3c)^2$ $\qquad a^2-b^2=(a-b)(a+b)$

$(a^2-(2b-3c))(a^2+(2b-3c))$

$(a^2-2b+3c)(a^2+2b-3c)$

11. $a^4-16(b-c)^4$

$a^2-(4(b-c)^2)^2$ $\qquad a^2-b^2=(a-b)(a+b)$

$(a^2-4(b-c)^2)(a^2+4(b-c)^2)$

$(a-2(b-c))(a+2(b-c))(a^2+4(b-c)^2)$

$(a-2(b-c))(a+2(b-c))(a^2+4(b^2-2bc+c^2))$

$(a-2b+2c)(a+2(b-c))(a^2+4(b^2-2bc+c^2))$

$(a-2b+2c)(a+2b-2c)(a^2+4b^2-8bc+4c^2)$

$(a-2b+2c)(a+2b-2c)(a^2+4(b-c)^2)$

12. a^2-b^2-a-b

$(a-b)(a+b)-a-b$

$(a-b)(a+b)-(a+b)$

$(a+b)(a-b-1)$

13. $x^2+8x+16$

$x^2+4x+4x+16$

$x(x+4)+4(x+4)$

$(x+4)(x+4)$

14. $4x^2-4x+1$

$4x^2-2x-2x+1$

$2x(2x-1)-1(2x-1)$

$(2x-1)(2x-1)$

15. $9x^2+12xy+4y^2$

$(3x)^2+2\times3x\times2y+(2y)^2$

$(3x)^2+(2y)^2+2\times3x\times2y$

Using $(a+b)^2=a^2+b^2+2ab$

$(3x+2y)^2$ or $(3x+2y)(3x+2y)$

16. $x^2y^2-6xyz+9z^2$

$(a-b)^2=a^2-2ab+b^2$

$a^2=x^2y^2,\qquad b^2=9z^2$

$a=xy,\qquad b=3z$

$-2ab=-2\times xy\times3z$

$=-6xyz$

$x^2y^2-6xyz+9z^2=(xy-3z)^2$

$(xy-3z)^2$ or $(xy-3z)(xy-3z)$

17. $x^2+2x+1-4y^2$

$(x^2+2x+1)-4y^2$

$a^2+2ab+b^2=(a+b)^2$

so, x^2+2x+1 can be written as $(x+1)^2$

$(x+1)^2-4y^2\qquad(x+1)^2-(2y)^2$

Using identity $a^2-b^2=(a-b)(a+b)$

$((x+1)-2y)((x+1)+2y)$

$(x+1-2y)(x+1+2y)$

18. $16-x^2-2xy-y^2$

$16-(x^2+2xy+y^2)$

$a^2 + 2ab + b^2 = (a+b)^2$

$16 - (x+y)^2$

$(4)^2 = (x+y)^2$

$a^2 - b^2 = (a-b)(a+b)$

$(4-(x+y))(4+(x+y))$

$(4-x-y)(4+x+y)$

19. $x^4 - 6x^2y^2 + 9y^4 - 81$

$(x^4 - 6x^2y^2 + 9y^4) - 81$

$a^2 - 2ab + b^2 = (a-b)^2$

$(x^2 - 3y^2)^2 - 81$

$(x^2 - 3y^2)^2 - (9)^2$

$a^2 - b^2 = (a-b)(a+b)$

$(x^2 - 3y^2 - 9)(x^2 - 3y^2 + 9)$

20. $9c^2 - a^2 + 4ab - 4b^2$

$9c^2 - (a^2 - 4ab + 4b^2)$

$(a-b)^2 = a^2 + b^2 - 2ab$

$9c^2 - (a-2b)^2$

$(3c)^2 - (a-2b)^2$

$a^2 - b^2 = (a-b)(a+b)$

$(3c - a + 2b)(3c + a - 2b)$

21. $x^2 + 8x + 15$

$x^2 + 5x + 3x + 15$

$x(x+5) + 3(x+5)$

$(x+3)(x+5)$

22. $x^2 - x - 6$

$x^2 - 3x + 2x - 6$

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

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

23. $2x^2-17x-30$

$2x^2+3x-20x-30$

$x(2x+3)-10(2x+3)$

$(x-10)(2x+3)$

24. x^2-x-30

$x^2+5x-6x-30$

$x(x+5)-6(x+5)$

$(x-6)(x+5)$

25. $6x^2+5x-6$

$6x^2+9x-4x-6$

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

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

26. $x^2-22x+120$

$x^2-10x-12x+120$

$x(x-10)-12(x-10)$

$(x-10)(x-12)$

27. $x^2-11x-42$

$x^2+3x-14x-42$

$x(x+3)-14(x+3)$

$(x+3)(x-14)$

28. $12x^2-23xy+10y^2$

$12x^2-8xy-15xy+10y^2$

$4x(3x-2y)-5y(3x-2y)$

$(3x-2y)(4x-5y)$

29. $(x-2y)^2-6(x-2y)+5$

Let $(x-2y)=a$

Then a^2-6a+5

$a^2-a-5a+5$

$a(a-1)-5(a-1)$

$(a-5)(a-1)$

Substitute the value of $a=x-2y$

$(x-2y-5)(x-2y-1)$

Exercis 6.3

❖ Divide :

1. $25x^2y^3$ by $5xy^2$

$$=\frac{5\times5\times x\times x\times y\times y\times y}{5\times x\times y\times y}$$

$=5\times x\times y \quad =5xy$

2. $-21x^2y^3z^2$ by $3xyz$

$$=\frac{-7\times3\times x\times x\times y\times y\times y\times z\times z}{3\times x\times y\times z}$$

$=-7\times x\times y\times y\times z=-7xy^2z$

3. $16x^3y^2$ by $-4x^2y$

$$=\frac{4\times4\times x\times x\times x\times x\times y\times y}{-4\times x\times x\times x\times y}$$

$=-4\times x\times y \qquad =-4xy$

4. $-72x^2y^3z$ by $-12xy^2z$

$$=\frac{-12\times6\times x\times x\times y\times y\times y\times z}{-12\times x\times y\times y\times z}$$

$=6\times x\times y=6xy$

5. $9x^5+12x^4-6x^2$ by $3x^2$

$$=\frac{3\times3\times x^5}{3x^2}+\frac{3\times4\times x^4}{3x^2}-\frac{2\times3\times x^2}{3x^2}-\frac{2\times3\times x^2}{3x^2}$$

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

6. $x^4 - 3x^3 + 2x^2$ by $3x$

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

$= \frac{x^3}{3} - x^2 + \frac{2x}{3}$

7. $2x^4 + 8x^3 + 7x^2 + 4x$ by $2x$

$= \frac{2x^4}{2x} + \frac{8x^3}{2x} + \frac{7x^2}{2x} + \frac{4x}{2x}$

$= x^2 + 4x^2 + \frac{7}{2}x + 2$

8. $-4x^3 + 4x^2 + x$ by $2x$

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

$= -2x^2 + 2x + \frac{1}{2}$

9. $x^2 - y^2$ by $(x + y)$

$a^2 - b^2 = (a - b)(a + b)$

$= \frac{(x - y)(x + y)}{x + y} = (x - y)$

10. $x^4 - y^4$ by $(x - y)$

$= \frac{(x^2)^2 - (y^2)^2}{x - y}$

$= \frac{(x^2 - y^2)(x^2 + y^2)}{(x - y)}$

$= \frac{(x + y)(x - y)(x^2 + y^2)}{x - y}$

$= (x + y)(x^2 + y^2)$

11. $x^2 - 5x + 6$ by $(x - 2)$

$$= \frac{x^2 - 2x - 3x + 6}{x - 2}$$

$$= \frac{x(x-2) - 3(x-2)}{(x-2)}$$

$$= \frac{(x-2)(x-3)}{(x-2)} = (x-3)$$

12. $40 + 3x - x^2$ by $(x + 5)$

$$= -x^2 + 3x + 40$$

$$= -x^2 + 8x - 5x + 40$$

$$= x(-x + 8) + 5(-x + 8)$$

$$= (-x + 8)(x + 5)$$

$$\frac{(-x+8)(x+5)}{(x+5)} = (-x + 8)$$

13. $x^2 - 23x + 132$ by $(x - 12)$

$$= x^2 - 11x - 12x + 132$$

$$= x(x - 11) - 12(x - 11)$$

$$= \frac{(x-11)(x-12)}{(x-12)} = (x - 11)$$

14. $(x + 7)(x - 10) + 16$ by $(x - 9)$

$$x^2 + 7x - 10x - 70 + 16$$

$$x^2 - 3x - 54$$

$$x^2 - 9x + 6x - 54$$

$$x(x - 9) + 6(x - 9)$$

$$(x - 9)(x + 6)$$

$$= \frac{(x-9)(x+6)}{(x-9)} = (x + 6)$$

15. $(x^2 - 5x)^2 - 36$ by $(x - 3)$

$x^4 + 25x^2 - 2 \times x^2 \times 5x - 36$

$x^4 + 25x^2 - 10x^3 - 36$

$x^4 - 10x^3 + 25x^2 - 36$

$$\frac{(x+1)(x-6)(x-2)(x-3)}{x-3}$$

$(x+1)(x-6)(x-2)$

16. $ax^2 + (b+ac)x + bc$ by $(x+c)$

$ax^2 + bx + acx + bc$

$x(ax+b) + c(ax+b)$

$(ax+b)(x+c)$

$$\frac{(ax+b)(x+c)}{(x+c)} = (ax+b)$$

MCQs

1.	(d)	2.	(a)	3.	(b)	4.	(a)	5.	(a)	6.	(b)
7.	(d)	8.	(c)	9.	(c)	10.	(a)	11.	(c)	12.	(b)

1. $2x^2 + 5x$

   $x(2x+5)$

2. $a^2 - b^2 = (a-b)(a+b)$

3. $x^4 - 1$

   $= (x^2)^2 - (1)^2$

   $= (x^2 - 1)(x^2 + 1)$

   $= (x-1)(x+1)(x^2+1)$

4. $(2x+5)(7+3)$

   $10(2x+5)$

5. $x(x+y) + 8(x+y)$

   $(x+8)(x+y)$

6. $16x^4 - 81$

   $(4x^2)^2 - (9)^2$

   $(4x^2 - 9)(4x^2 + 9)$

   $((2x)^2 - (3)^2)(4x^2 + 9)$

   $(2x - 3)(2x + 3)(4x^2 + 9)$

7. $x^3 - x$

   $x(x^2 - 1)$

   $x(x - 1)(x + 1)$

8. $4x^2 - 4x + 1$

   $= (2x - 1)^2$

   $= (2x - 1)(2x - 1)$

9. $x^2 + 4x - 21$

   $x^2 + 7x - 3x - 21$

   $x(x + 7) - 3(x + 7)$

   $(x - 3)(x + 7)$

10. $2x^2 + 5x + 3$

    $2x^2 + 3x + 2x + 3$

    $2x(x + 1) + 3(x + 1)$

    $(2x + 3)(x + 1)$

11. $(2x + 3y)^2 - 5(2x + 3y) - 14$

    $2x + 3y = a$

    $a^2 - 5a - 14$

    $a^2 - 7a + 2a - 14$

    $a(a - 7) + 2(a - 7)$

$(a-7)(a+2)$

$(2x+3y-7)(2x+3y+2)$

12. $3x^2+24x+36$

Divide by 3

$3(x^2+8x+12)$

$3(x^2+6x+2x+12)$

$3(x(x+6)+2(x+6))$

$3((x+2)(x+6))$

Fill in the blanks

1. $5(m+5)$
2. factorization
3. $2y-1$
4. $(a+b)^2$
5. $(a-b)^2$
6. $(a+b), ab$
7. $3x+10$
8. $8mn^2p$
9. $x^2-4x-12$
10. $(a^2+x^2),(a+x),(a-x)$
11. $x^3,(x-4),(x+4)$
12. $12x^2+10xy-2$

7. $\frac{3x^2+4x-20}{x-2}$

$\frac{3x^2+10x-6x-20}{x-2}$

$\frac{3x(x-2)+10(x-2)}{(x-2)}$

$\frac{(3x-10)(x-2)}{(x-2)}$

$3x+10$

7 Linear Equations in One Variable

Exercise 7.1

❖ Solve each of the following equations :

1. $5x - 30 = 3x - 19$

$5x - 3x = -19 + 30$

$2x = 11$

$x = \frac{11}{2}$

2. $2x - 7 = 5 - 7x$

$2x + 7x = 5 + 7$

$9x = 12$

$x = \frac{12}{9} = \frac{4}{3}$

3. $\frac{x}{5} + 11 = \frac{1}{15}$

$\frac{x}{5} = \frac{1}{15} - 11$

$\frac{x}{5} = \frac{1 - 165}{15}$

$\frac{x}{5} = \frac{-164}{15}$

$x = \frac{-164}{15} \times 5$

$x = \frac{-164}{3}$

4. $\frac{x}{3} - \frac{5}{2} = 6$

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

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

$$\frac{x}{3} = \frac{17}{2}$$

$$x = \frac{17 \times 3}{2}$$

$$x = \frac{51}{2}$$

5. $3x + \frac{2}{3} = 2x + 1$

$$3x - 2x = 1 - \frac{2}{3}$$

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

$$x = \frac{1}{3}$$

6. $\frac{x-1}{3} - \frac{x-2}{4} = 1$

$$\frac{4(x-1) - 3(x-2)}{12} = 1$$

$$\frac{4x - 4 - 3x + 6}{12} = 1$$

$$\frac{x+2}{12} = 1 \qquad x + 2 = 12$$

$$x = 12 - 2$$

$$x = 10$$

7. $\frac{x-5}{2} - \frac{x-3}{5} = \frac{1}{2}$

$$\frac{5(x-5) - 2(x-3)}{10} = \frac{1}{2}$$

$$\frac{5x-25-2x+16}{10}=\frac{1}{2}$$

$$\frac{3x-19}{10}=\frac{1}{2}$$

$$2(3x-19)=10$$

$$6x-38=10$$

$$6x=10+38$$

$$6x=48$$

$$x=\frac{48}{6}=8$$

8. $\frac{7x+2}{5}=\frac{6x-5}{11}$

$$11(7x+2)=5(6x-5)$$

$$77x+22=30x-25$$

$$77x-30x=-25-22$$

$$47x=-47$$

$$x=\frac{-47}{47}=-1$$

9. $\frac{6x+1}{2}=\frac{7x-3}{3}-1$

$$\frac{6x+1}{2}=\frac{7x-3-3}{3}$$

$$3(6x+1)=2(7x-6)$$

$$18x+3=14x-12$$

$$18x-14x=-12-3$$

$$4x=-15$$

$$x=\frac{-15}{4}$$

10. $\frac{2x+7}{5}-\frac{3x+11}{2}=\frac{2x+8}{3}-5$

$$\frac{2(2x+7)-5(3x+11)}{10}=\frac{2x+8-15}{3}$$

$$\frac{4x+14-15x-55}{10}=\frac{2x-7}{3}$$

$$\frac{-11x-41}{10}=\frac{2x-7}{3}$$

$$3(-11x-41)=10(2x-7)$$

$$-33x-123=20x-70$$

$$-33x-20x=-70+123$$

$$-53x=53$$

$$x=\frac{53}{-53}=-1$$

11. $\frac{9x+7}{2}-\left(x-\frac{x-2}{7}\right)=36$

$$\frac{9x+7}{2}-\left(\frac{7x-(x-2)}{7}\right)=36$$

$$\frac{9x+7}{2}-\left(\frac{6x+2}{7}\right)=36$$

$$\frac{7(9x+7)-2(6x+2)}{14}=36$$

$$\frac{63x+49-12x-4}{14}=36$$

$$\frac{51x+45}{14}=36$$

$$51x+45=36\times14$$

$$51x=504-45$$

$$x=\frac{459}{51}$$

$$x=9$$

12. $\frac{2-x}{x+7}=\frac{3}{5}$

$$5(2-x)=3(x+7)$$
$$10-5x=3x+21$$
$$-5x-3x=21-10$$
$$-8x=11$$
$$x=\frac{-11}{8}$$

13. $\frac{2x+1}{3x-2}=\frac{5}{9}$

$$9(2x+1)=5(3x-2)$$
$$18x+9=15x-10$$
$$18x-15x=-10-9$$
$$3x=-19$$
$$x=\frac{-19}{3}$$

14. $\frac{\frac{2}{3}x+1}{x+\frac{1}{4}}=\frac{5}{3}$

$$\frac{\frac{2x+3}{3}}{\frac{4x+1}{4}}=\frac{5}{3}$$
$$\frac{2x+3}{3}\times\frac{4}{4x+1}=\frac{5}{3}$$
$$\frac{8x+12}{12x+3}=\frac{5}{3}$$
$$3(8x+12)=5(12x+3)$$
$$24x+36=60x+15$$
$$24x-60x=15-36$$
$$-36x=-21$$

$$x = \frac{-21}{-36} = \frac{7}{12}$$

15. $\frac{4+x}{7-x} = \frac{2+x}{5-x}$

$5 - x(4+x) = 2 + x(7-x)$

$20 + 5x - 4x - x^2 = 14 - 2x + 7x - x^2$

$20 + x - x^2 = 14 + 5x - x^2$

$20 - 14 = 5x - x$

$6 = 4x$

$x = \frac{6}{4} = \frac{3}{2}$

16. $\frac{9x-7}{3x+5} = \frac{3x-4}{x+6}$

$x + 6(9x-7) = 3x - 4(3x+5)$

$9x^2 - 7x + 54x - 42 = 9x^2 + 15x - 12x - 20$

$47x - 42 = 3x - 20$

$47x - 3x = -20 + 42$

$44x = 22$

$x = \frac{22}{44} = \frac{1}{2}$

17. $\frac{x+2}{x-2} - \frac{x-2}{x+2} = 1 - \frac{x^2}{x^2-4}$

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

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

$\frac{x^2 + 4x + 4 - x^2 + 2x + 2x - 4}{x^2 - 4} = \frac{x^2 - 4 - x^2}{x^2 - 4}$

$$\frac{8x}{x^2-4}=\frac{-4}{x^2-4} \qquad x=\frac{-4}{8}=\frac{-1}{2}$$

18. $\frac{1}{x+1}-\frac{2}{x+10}=\frac{-1}{x+2}$

$$\frac{(x+10)(1)-(2)(x+1)}{(x+1)(x+10)}=\frac{-1}{x+2}$$

$$\frac{x+10-2x-2}{x^2+10x+x+10}=\frac{-1}{x+2}$$

$$\frac{-x+8}{x^2+11x+10}=\frac{-1}{x+2}$$

$$x+2(-x+8)=-1(x^2+11x+10)$$

$$-x^2+8x-2x+16=-x^2-11x-10$$

$$-x^2+6x+16=-x^2-11x-10$$

$$6x+11x=-10-16$$

$$17x=-26$$

$$x=\frac{-26}{17}$$

19. $\frac{3}{2x-1}+\frac{4}{2x+1}=\frac{7}{2x}$

$$\frac{(2x+1)(3)+(2x-1)(4)}{(2x-1)(2x+1)}=\frac{7}{2x}$$

$$\frac{6x+3+8x-4}{4x^2+2x-2x-1}=\frac{7}{2x}$$

$$\frac{14x-1}{4x^2-1}=\frac{7}{2x}$$

$$2x(14x-1)=7(4x^2-1)$$

$$28x^2-2x=28x^2-7$$

$$x=\frac{-7}{-2}=\frac{7}{2}$$

20. $\frac{15(2-x)-5(x+6)}{1-3x}=10$

$15(2-x)-5(x+6)=10(1-3x)$

$30-15x-5x-30=-20x+30x=10$

$-20x=10-30x$

$-20x+30x=10$

$10x=10$

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

21. $\frac{x^2-(x+1)(x+2)}{5x+1}=6$

$x^2-(x+1)(x+2)=6(5x+1)$

$x^2-(x^2+2x+x+2)=30x+6$

$x^2-(x^2+3x+2)=30x+6$

$x^2-x^2-3x-2=30x+6$

$-3x-2=30x+6$

$-3x-30x=6+2$

$-33x=8$

$x=\frac{-8}{33}$

22. $\frac{6x^2+13x-4}{12x^2+5x-2}=\frac{2x+5}{4x+3}$

$4x+3(6x^2+13x-4)=2x+5(12x^2+5x-2)$

$24x^3+52x^2-16x+18x^2+39x-12=24x^3+10x^2-4x$
$+60x^2+25x-10$

$24x^3+70x^2+23x-12=24x^3+70x^2+21x-10$

$23x-12=21x-10$

$23x-21x=-10+12$

$2x = 2$ $\qquad$ $x = \frac{2}{2} = 1$

Exercise 7.2

1. Three consecutive multiples of 8 are

   $x, x+8, x+16$

   $x + x + 8 + x + 16 = 888$

   $3x + 24 = 888$ $\qquad$ $3x = 888 - 24$

   $3x = 864$ $\qquad$ $x = \frac{864}{3} = 288$

   $x = 288, \quad x + 8 = 288 + 8 = 296$

   $x + 16 = 288 + 16 = 304$

2. Three consecutive multiples of 9

   $x, x+9, x+18$

   $x + x + 9 + x + 18 = 999$

   $3x + 9 + 18 = 999$ $\qquad$ $3x + 27 = 999$

   $3x = 999 - 27$ $\qquad$ $3x = 972$ $\qquad$ $x = \frac{972}{3} = 324$

   $x = 324, \quad x + 9 = 324 + 9 = 333$

   $x + 18 = 324 + 18 = 342$

3. Let the numbers be $7x$ and $8x$

   $7x + 8x = 45$ $\qquad$ $15x = 45$ $\qquad$ $x = \frac{45}{15} = 3$

   Number $= 7 \times 3 = 21$

   $8 \times 3 = 24$

4. Let first part be $= x$

   second part $= \frac{x}{3} + 72$

   $x + \frac{x}{3} + 72 = 240$ $\qquad$ $x + \frac{x}{3} = 240 - 72$

$\frac{3x + x}{3} = 168$ $\frac{4x}{3} = 168$

$4x = 168 \times 3$ $4x = 504$

$x = \frac{504}{4} = 126$

$\frac{126}{3} + 72$ $\frac{126 + 216}{3} = \frac{342}{3} = 114$

126 and 114 are two numbers.

5. Let the first part be x

Then second part is $(184 - x)$

$\frac{1}{3}x = \frac{1}{7}(184 - x) + 8$

$\frac{1}{3}x + \frac{1}{7}x = \frac{184}{7} + 8$

$\frac{10x}{21} = \frac{184 + 56}{7}$

$\frac{10x}{21} = \frac{240}{7}$

$x = \frac{240}{7} \times \frac{21}{10} = 72,$

Other no. $(184 - x)$

$= 184 - 72 = 112$

Ans. 72, 112

6. Let denominator be x

Numerator = $x - 6$

By condition $\frac{x - 6 + 3}{x} = \frac{2}{3}$

$3(x - 3) = 2x$

$3x - 9 = 2x$

$3x - 2x = 9$

$x = 9$

denominator = 9

numerator = 9 − 6 = 3

fraction = $\frac{3}{9} = \frac{1}{3}$

7. Let the denominator be x

numerator = $x - 4$

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

$2(x - 3) = (x + 1)$ $\qquad 2x - 6 = x + 1$

$2x - x = 1 + 6$ $\qquad x = 7$

Numerator = 7 − 4 = 3

fraction $= \frac{3}{7}$

8. Five years ago let the age of son be x years

age of father was $7x$ years

present age of son = $(x + 5)$ years

present age of father = $(7x + 5)$ years

After five years :

Age of son = $(x + 5 + 5) = (x + 10)$ years

Age of father = $(7x + 5 + 5) = (7x + 10)$ years

$7x + 10 = 3(x + 10)$

$7x + 10 = 3x + 30$

$7x - 3x = 30 - 10$

$4x = 20$ $\qquad x = 5$

present age of son = $(5 + 5) = 10$ years

present age of father = $(7 \times 5 + 5) = 40$ years

9. Let age of father = x

and age of son be y

$x + y = 60$; $\qquad x = 60 - y$

10 years later, age of father = $x + 10$

$= 60 - y + 10$ $\qquad 70 - y$

Age of son $= y + 10$

$\frac{70 - y}{y + 10} = \frac{11}{5}$ $\qquad 5(70 - y) = 11(y + 10)$

$350 - 5y = 11y + 110$

$350 - 110 = 11y + 5y$

$240 = 16y$ $\qquad y = \frac{240}{16} = 15$ years

Father's age $= 60 - y = 60 - 15 = 45$ years

Son's age $= 15$ years

10. $3x + 4x + 5x = 60$

$12x = 60$; $\qquad x = \frac{60}{12} = 5$

$3x = 3 \times 5 = 15$ cm

$4x = 4 \times 5 = 20$ cm

$5x = 5 \times 5 = 25$ cm

11. Breadth $= b$, $\qquad$ Length $= b + 4$

New length $= l + 3$, $\qquad$ New breadth $= b + 3$

Area of new rectangle $= (l + 3)(b + 3)$

$l = (b + 4)$

$(b + 4 + 3)(b + 3)$

Area of new rectangle $= (b + 7)(b + 3)$

$= b^2 + 3b + 7b + 21$

$= b^2 + 10b + 21$

Area of old rectangle $= b(b + 4) = b^2 + 4b$

$b^2 + 10b + 21 = b^2 + 4b + 81$

$b^2 - b^2 + 10b - 4b = 81 - 21$

$6b = 60$; $\qquad b = \frac{60}{6} = 10$ cm

breadth = 10 cm,

length = 10 + 4 = 14 cm

12. Let breadth of rectangle be x and its length be $(x + 7)$ cm.

Area of rectangle = $l \times b = x(x + 7)$

If the length is decreased by 4 ie., $(x + 7 - 4)$

and breadth is increased by 3 i.e $(x + 3)$

$x(x + 7) = (x + 7 - 4)(x + 3)$

$x(x + 7) = (x + 3)(x + 3)$

$x^2 + 7x = x^2 + 3x + 3x + 9$

$7x - 6x = 9$, $x = 9$

breadth = 9 cm length = $(x + 7)$

$9 + 7 = 16$ cm

13. Distance travelled by both the trains in 3 hours $= 425 - 20 = 405$

$405 = (x + x + 5)3$

$3x + 3x + 15 = 405$

$6x + 15 = 405$

$6x = 405 - 15$ $6x = 390$

$x = \frac{390}{6} = 65$ km/hr

Speed of IInd train is $(65 + 5) = 70$ km/hr

14. Let the average speed of second car is x km/hr then the avg. speed of first car is $(x + 5)$ km/hr

Distance covered by first car in 5 hours = $5x$ km

Distance covered by second car in 5 hours = $5(x + 5)$ km

Total distance covered = Distance covered by first car + Distance covered by second car

$425 = 5x + 5(x + 5)$

$425 = 5x + 5x + 25$

$425 = 10x + 25$

$10x = 425 - 25$

$x = \frac{400}{10} = 40$ km/hr

$(x + 5) = 45$ km/hr

15. Number of 10 notes $= 2x$

Number of 50 notes $= 3x$

Number of 100 notes $= 4x$

The total amount is $10(2x) + 50(3x) + 100(4x) = 5700$

$= 20x + 150x + 400x = 5700$

$570x = 5700$

$x = \frac{5700}{570} = 10$

$2 \times x = 2 \times 10 = 20$, $3x = 3 \times 10 = 30$, $4x = 4 \times 10 = 40$

MCQs

1.	(a)	2.	(c)	3.	(b)	4.	(a)	5.	(c)	6.	(d)
7.	(c)	8.	(b)	9.	(d)	10.	(b)				

2. $5x - 4 = 11$

$5x = 11 + 4$

$5x = 15$

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

5. $\frac{x+1}{2x+3} = \frac{3}{8}$

$8(x + 1) = 3(2x + 3)$

$8x + 8 = 6x + 9$

$8x - 6x = 9 - 8$

$2x = 1$

$$x = \frac{1}{2}$$

7. Let the number be x

$$x + x = 24$$
$$2x = 24$$
$$x = \frac{24}{2} = 12$$

8. Let the number be x

$$x + 10 = 20$$

Fill in the blanks

1. transposition 2. only one 3. 1 4. sign 5. $x - 8 = -3$
6. 54 7. solution, equation 8. $\frac{3x}{4} + 5$

3. $3x + 2x = 1 + 4$

$$5x = 5$$
$$x = \frac{5}{5} = 1$$

6. $6x = 18$

$$x = \frac{18}{6} = 3$$
$$= 18 \times 3 = 54$$

8 Direct and Inverse Proportions

Exercise 8.1

1. Look at the following tables and point out in which cases do a and b vary directly?

(i) $\frac{a}{b}=\frac{3}{18}=\frac{1}{6}$; $\frac{5}{30}=\frac{1}{6}$; $\frac{7}{42}=\frac{1}{6}$

$\frac{8}{48}=\frac{1}{6}$, $\frac{12}{72}=\frac{1}{6}$, Yes

(ii) $\frac{a}{b}=\frac{1}{8},\frac{6}{48},\frac{7}{56},\frac{12}{96},\frac{20}{160},\frac{22}{176}=\frac{1}{8}$, Yes

(iii) $\frac{a}{b}=\frac{9}{18},\frac{10}{20},\frac{15}{30},\frac{30}{60},\frac{40}{80},\frac{80}{160},\frac{100}{200}=\frac{1}{2}$, Yes

(iv) No

2. If a and b vary directly in each of the following then complete the table—

(i) $\frac{a_1}{30}=\frac{12}{24}$; $\frac{a_1}{30}=\frac{1}{2}=a_1=\frac{30}{2}=15$

$\frac{16}{b_1}=\frac{1}{2}=b_1=16\times 2=32$

$\frac{a_2}{120}=\frac{1}{2}=a_2=\frac{120}{2}=60$

(ii) $\frac{a_1}{9}=\frac{8}{24}$; $\frac{a_1}{9}=\frac{1}{3}$ $a_1=\frac{9}{3}=3$

$\frac{5}{b_1}=\frac{1}{3}=b_1=5\times 3=15$

$\frac{12}{b_2}=\frac{1}{3}=b_2=12\times 3=36$

$\frac{24}{b_3}=\frac{1}{3}=b_3=24\times 3=72$

$\frac{a_2}{90}=\frac{1}{3}=a_2=\frac{90}{3}=30$

$\frac{a_3}{120}=\frac{1}{3}=a_3=\frac{120}{3}=40$

(iii) $\frac{a_1}{8}=\frac{2.5}{5}=\frac{2.5\times 8}{5}=\frac{20}{5}=4$

$$\frac{a_2}{12} = \frac{4}{8} = \frac{12 \times 4}{8} = 6$$

$$\frac{15}{b_1} = \frac{4}{8} = \frac{15 \times 8}{4} = 30$$

(iv) $\frac{9}{b_1} = \frac{4}{16}$ $\quad b_1 = \frac{16 \times 9}{4} = 36$

$$\frac{a_1}{48} = \frac{4}{16} = \frac{4 \times 48}{16} = 12$$

$$\frac{a_2}{36} = \frac{4}{16} = \frac{4 \times 36}{16} = 9$$

$$\frac{3}{b_2} = \frac{4}{16} = \frac{16 \times 3}{4} = 12$$

$$\frac{a_3}{4} = \frac{4}{16} = \frac{4 \times 4}{16} = 1$$

3. (i)

Distance covered	Time taken
126	3
x	7

$$\frac{126}{x} = \frac{3}{7}$$

$$x = \frac{126 \times 7}{3}$$

$$= 294 \text{ km}$$

(ii)

Distance covered	Time taken
126 km	3 hours
462 km	x

$$\frac{126}{462} = \frac{3}{x}$$

$$x = \frac{462 \times 3}{126} = 11 \text{ hours}$$

4.

Length of cloth	cost
8 m	`250
5.8 m	x

$$\frac{8}{5.8} = \frac{250}{x}$$

$$x = \frac{250 \times 5.8}{8}$$

$$= 181.25$$

5. $\frac{p}{q} = \frac{282}{5.1} = \frac{p}{5.8}$ $\qquad p = \frac{282 \times 6.8}{5.1} = 376$

6.

x	y
10	2
x	7

$$\frac{10}{x} = \frac{2}{7}$$

$$\frac{7 \times 10}{2} = x$$

$$35 = x$$

7.

No. of boxes	Shelf length
68	13.6 m
x	20.4 m

$$\frac{68}{x} = \frac{13.6}{20.4}$$

$$x = \frac{20.4 \times 68}{13.6} = 102 \text{ boxes}$$

8.

Income paid	No. of days
`210	6
`875	x

$$\frac{210}{875} \qquad \frac{6}{x}$$

$$x = \frac{875 \times 6}{210}$$

$$= 25 \text{ days}$$

9.

Weight	Extension
25 g	3.2 cm
x	24 cm

$$\frac{125}{x} = \frac{3.2}{24}$$

$$x = \frac{125 \times 24}{3.2}$$

$$= 937.5 \text{ gm}$$

10.

Height of pole	Length of shadow
11.5 m	3 m
34.5 m	x

$$\frac{11.5}{34.5} = \frac{3}{x}$$

$$x = \frac{3 \times 34.5}{11.5}$$

$$= 9\,\text{m}$$

Exercise 8.2

1. In which of the following cases do the two quantities a and b vary inversely?
   (i) Yes
   (ii) No
   (iii) No
   (iv) Yes
   (v) No
2. If a and b vary inversely, then complete the table :
   (i) $\frac{a}{b} = \frac{50}{2} = \frac{25}{b_1}$ $\quad 50 \times 2 = 25 \times b_1 = \frac{100}{25} = 4$

   $\frac{25}{4} = \frac{a_1}{10}$ $\quad 25 \times 4 = a_1 \times 10$ $\quad \frac{100}{10} = 10$

   $\frac{25}{4} = \frac{20}{b_2} = 25 \times 4 = 20 \times b_2$ $\quad \frac{100}{20} = 5$

   $\frac{a_2}{100} = \frac{20}{b_2} = 25 \times 4 = 20 \times b_2$ $\quad \frac{100}{100} = 1$

   (ii) $\frac{a_1}{18} = \frac{3}{12}$ $\quad a_1 \times 18 = 3 \times 12$ $\quad \frac{36}{18} = 2; a = 2$

   $\frac{4}{b_1} = \frac{3}{12}$ $\quad 4 \times b_1 = 3 \times 12 = \frac{36}{4} = 9$

   $\frac{a_2}{6} = \frac{3}{12}$ $\quad a_2 \times 6 = 3 \times 12$ $\quad \frac{36}{6} = a_2 = 6$

   (iii) $\frac{16}{4} = \frac{32}{b_1}$ $\quad 16 \times 4 = 32 \times b_1$ $\quad \frac{64}{32} = 2; b_1 = 2$

$$\frac{16}{4}=\frac{8}{b_2}=16\times4=8\times b_2 \qquad \frac{64}{8}=8;\ b_2=8$$

(iv) $\frac{9}{27}=\frac{a_1}{9}$ $\quad 9\times27=a_1\times9$ $\quad \frac{9\times27}{9}$ $\quad a_1=27$

$\frac{81}{b_1}=\frac{9}{27}$ $\quad 81\times b_1=9\times27$ $\quad \frac{9\times27}{81}$ $\quad b_1=3$

3. $\frac{x}{y}=\frac{10}{6}=\frac{15}{y}$ $\quad 10\times6=15\times y$ $\quad 60=15y$

$$y=\frac{60}{15}=4$$

4.

No. of persons	300	350
No. of days food cost	42	y

$$300\times42=350\times y$$

$$y=\frac{300\times42}{350}=36$$

$$=36 \text{ days}$$

5.

Men	15	9
Days	24	y

$$15\times24=9y$$

$$=40 \text{ days}$$

6.

Men	800	500
Weeks	10	y

$$800\times10=500\times y$$

$$y = \frac{800 \times 10}{500} = 16 \text{ weeks}$$

7.

Cows	33	x
Days	12	9

$33 \times 12 = x \times 9$

$$x = \frac{33 \times 12}{9} = 44 \text{ cows}$$

8.

Men	420	x
Months	9	7

$420 \times 9 = 7x$ $\qquad \frac{420 \times 9}{7}$

$x = 60 \times 9 = 540$

$540 - 420 = 120$ men

9. If x and y vary inversely as each other and

(i) $\frac{3}{8} = \frac{4}{y}$ $\quad 3 \times 8 = 4y = y = \frac{3 \times 8}{4} = 6$

(ii) $\frac{5}{15} = \frac{x}{12}$ $\quad 5 \times 15 = x \times 12; x = \frac{5 \times 15}{12} = \frac{25}{4}$

(iii) $\frac{30}{y} = 900$ $\quad 30y = 900$ $\quad y = \frac{900}{30} = 30$

(iv) $\frac{x}{35} = 7, x \times 35 = 7$ $\quad x = \frac{7}{35} = \frac{1}{5}$

10.

No. of machines	3	5
Minutes	60	y

$3 \times 60 = 5 \times y$

$180 = 5y$

$$y = \frac{180}{5} = 36 \text{ minutes}$$

11.

speed	48 km/hr	x
Distance	8 hours	6

$48 \times 8 = x \times 6$ $\qquad x = \frac{48 \times 8}{6} = 64 \text{ km/hr}$

$64 - 48 = 16 \text{ km/hr}$

12.

Soldiers	105	$(105 - 42) = 63$
Days	21	y

$105 \times 21 = 63 \times y = \frac{105 \times 21}{63} = 35 \text{ days}$

13.

speed	40 km/h	x
minutes	45 min	25

$40 \times 45 = x \times 25$

$x = \frac{40 \times 45}{25} = 72 \text{ kmph}$

14.

Men	52	28
Days	35	y

$52 \times 35 = 28 \times y$

$y = \frac{52 \times 35}{28} = 65 \text{ days}$

MCQs

1.	(a)	2.	(a)	3.	(b)	4.	(d)	5.	(c)	6.	(c)
7.	(d)	8.	(b)	9.	(a)	10.	(b)				

5.

Diesel required	Distance covered
54 *l*	297 km
x	550 km

$$\frac{54}{x} = \frac{297}{550}$$

$$x = \frac{54 \times 550}{297} = 100l$$

6.

No of men	8	20
No of days	20	*y*

$$8 \times 20 = 20 \times y$$

$$\frac{8 \times 20}{20} = y$$

$$= 8 \text{ days}$$

7.

No. of lambs	3	2
No. of days	8	*y*

$$3 \times 8 = 2 \times y$$

$$\frac{3 \times 8}{2} = y$$

$$12 = y$$

$$= 12 \text{ days}$$

8. $x = ky$

$8 = k \times 4$

$\frac{8}{4} = k$

$2 = k$

9. $\frac{x_1}{y_1} = \frac{x_2}{y_2}$

$\frac{5}{210} = \frac{2}{y_2}$

$\frac{2 \times 210}{5} = y_2$

$= 84$

10.

No. of pipes	6	5
Time taken	80 mins	y

$6 \times 80 = 5 \times y$

$\frac{6 \times 80}{5} = y$

$96 = y$

96 mins

Fill in the blanks

1. directly 2. indirectly (inversely) 3. direct; directly
4. indirect; indirectly 5. 300 6. 24
7. directly 8. directly 9. = 10. $\frac{a_2}{a_1} = \frac{b_1}{b_2}$

5. $x \times 2 = 60 \times 10$

$x = \frac{60 \times 10}{2}$

$= 300$

6. $\frac{12}{48}$ $\frac{6}{y}$

$$\frac{48\times 6}{12} = y$$

$$= 24$$

True or False

1. False 2. False 3. False 4. True 5. False 6. False 7. True
8. False

9 Comparing Quantities

Exercise 9.1

1. Convert each of the following fraction into a percentage :

(i) $\frac{37}{100} = 37\%$

(ii) $\frac{3}{8} = \frac{3}{8}\times 100 = \frac{300}{8} = 37.5\%$

(iii) $\frac{7}{20} = \frac{7\times 100}{20} = 7\times 5 = 35\%$

(iv) $1\frac{3}{5} = \frac{8}{5}\times 100 = 8\times 20 = 160\%$

2. Simplify the following ratios :

(i) $2\frac{1}{3} : 4\frac{1}{3} \quad \frac{7}{3} : \frac{13}{3} = 7 : 13$

(ii) $5\frac{1}{3} : 3\frac{1}{4} \quad \frac{16}{3} : \frac{13}{4}$ LCM of 3 and 4 is 12

$$= \frac{16}{3}\times 12 : \frac{13}{4}\times 12$$

$$= \frac{16\times 4}{13\times 3} = \frac{64}{39} = 64 : 39$$

(iii) $\frac{1}{6} : \frac{1}{8} : \frac{5}{12}$ LCM of 6, 8 and 12 is 24

$\frac{1}{6} \times 24 : \frac{1}{8} \times 24 : \frac{5}{12} \times 24$ $4 : 3 : 10$

(iv) $1\frac{1}{4} : 1\frac{1}{3} : \frac{7}{8}$; LCM of 4, 3, 8 = 24

$\frac{5}{4} \times 24 : \frac{4}{3} \times 24 : \frac{7}{8} \times 24$ $5 \times 6 : 4 \times 8 : 7 \times 3$

$= 30 : 32 : 21$

3. Arrange the following ratios in ascending order :

(i) $17 : 28, 8 : 21, 11 : 14, 3 : 7$

$\frac{17}{28}, \frac{8}{21}, \frac{11}{14}, \frac{3}{7}$; LCM of 28, 21, 14, 7 is 84

$\frac{17}{28} \times 84; \frac{8}{21} \times 84; \frac{11}{14} \times 84, \frac{3}{7} \times 84$

$17 \times 3, 8 \times 4, 11 \times 6, 3 \times 12$

$51,\ 32,\ 66,\ 36$ $\frac{8}{21} < \frac{3}{7} < \frac{17}{28} < \frac{11}{14}$

(ii) $11 : 14, 5 : 7, 17 : 21, 2 : 3$; LCM of 14, 7, 21, 3 = 42

$\frac{11}{14} \times 42, \frac{5}{7} \times 42, \frac{17}{21} \times 42, \frac{2}{3} \times 42$

$11 \times 3, 30, 17 \times 2, 2 \times 14$ $33, 30, 34, 28$

$\frac{2}{3} < \frac{5}{7} < \frac{11}{14} < \frac{17}{21}$

4. Arrange the following ratios in descending order :

(i) $4 : 5, 6 : 7, 7 : 10, 11 : 24$; LCM of 5, 7, 10, 24 = 840

$\frac{4}{5} \times 840; \frac{6}{7} \times 840; \frac{7}{10} \times 840; \frac{11}{24} \times 840$

$672;\ 720;\ 588;\ 385$

$\frac{6}{7} > \frac{4}{5} > \frac{7}{10} > \frac{11}{24}$

(ii) 16 : 11, 13 : 9, 25 : 23, 20 : 17

LCM of 11, 9, 23, 17 = 38709

$$\frac{16}{11}\times\frac{3519}{3519}=\frac{56304}{38709}$$

$$\frac{13}{9}\times\frac{4301}{4301}=\frac{55913}{38709}$$

$$\frac{25}{23}\times\frac{1683}{1683}=\frac{42075}{38709}$$

$$\frac{20}{17}\times\frac{2277}{2277}=\frac{45540}{38709}$$

$$\frac{16}{11}>\frac{13}{9}>\frac{20}{17}>\frac{25}{23}$$

5. If 2A = 2B = 4C find A : B : C.

We can set them equal to k

$2A = k,\ 2B = k, 4C = k$

$A=\frac{k}{2}, B=\frac{k}{2}, C=\frac{k}{4}$ LCM = 4

$\frac{k}{2}\times 4, \frac{k}{2}\times 4, \frac{k}{4}\times 4$

$= 2k : 2k : k = A : B : C$

$A : B : C = 2 : 2 : 1$

6. If a : b = 6 : 11, find (6a − 3b) : (3a + 2b)

$\frac{a}{b}=\frac{6}{11}$ $a=\frac{6}{11}b$

$$\frac{6a-3b}{3a+2b}\qquad \frac{6\left(\frac{6}{11}b\right)-3b}{3\left(\frac{6}{11}b\right)+2b}$$

$$\frac{6a-3b}{3a+2b}=\frac{\frac{36}{11}b-3b}{\frac{18}{11}b+2b}$$

$$\frac{6a-3b}{3a+2b}=\frac{\frac{36b-33b}{11}}{\frac{18b+22b}{11}}$$

$$\frac{6a-3b}{3a+2b}=\frac{\frac{3b}{11}}{\frac{40b}{11}}$$

$$\frac{6a-3b}{3a+2b}=\frac{3b}{11}\times\frac{11}{40b}$$

$$\frac{6a-3b}{3a+2b}=\frac{3}{40}$$

$3 : 40$

7. Let two numbers be $7x$ and $11x$

   $7 : 11$ so we have $\frac{7x}{11x}$

   If 7 is added to each number, the new ratio is $2 : 3$ so we have $\frac{7x+7}{11x+7}=\frac{2}{3}$

$$3(7x+7)=2(11x+7)$$

$$21x+21=22x+14$$

$$21x-22x=14-21$$

$$-x=-7;\qquad x=7$$

$$7x=7\times7=49\ ;\ 11x=11\times7=77$$

8. Check whether the following numbers are in proportion or not :

   (i) 4.8, 2.7, 80, 45

$\frac{4.8}{2.7} = \frac{48}{27} = \frac{16}{9}$; $\frac{80}{45} = \frac{16}{9}$, Yes

(ii) 36, 49, 6, 7

$\frac{36}{49} = \frac{6}{7} = 36 \times 7 = 49 \times 6$

$252 \neq 294$, No

(iii) $7, 8\frac{1}{2}, 9\frac{1}{3}, 11\frac{1}{3}$

$7, \frac{17}{2}, \frac{28}{3}, \frac{34}{3}$

$7 : \frac{17}{12} : : \frac{28}{3} : \frac{34}{3}$ $\frac{14}{17} : : \frac{28}{34}$ Yes

(iv) 0.24, 1.2, 7.5, 3.75

$\frac{0.24 \times 100}{1.2 \times 100} = \frac{24}{120} = \frac{1}{5}$

$\frac{7.5 \times 100}{3.75 \times 100} = \frac{750}{375} = \frac{2}{1}$, No

9. Find the value of x if :

(i) $3\frac{1}{3} : x : : 2\frac{1}{2} : 1\frac{1}{4}$

$\frac{10}{3} : \frac{x}{1} : : \frac{5}{2} : \frac{5}{4}$ $\frac{10}{3} \times \frac{5}{4} = x \times \frac{5}{2}$

$\frac{50}{12} = \frac{5x}{2}$ $x = \frac{50}{12} \times \frac{2}{5} = \frac{100}{60} = \frac{10}{6}$

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

(ii) $8 : x : : 16 : 35$

$\frac{8}{x} = \frac{16}{35} = 8 \times 35 = 16 \times x$

$280 = 16x$

$$x = \frac{280}{16} = 17\frac{1}{2}$$

(iii) $0.16 : x :: 0.4 : 7$

$$\frac{0.16}{x} = \frac{0.4}{7} \qquad 0.16 \times 7 = 0.4 \times x$$

$$x = \frac{0.16 \times 7}{0.4} = 0.4 \times 7 = 2.8$$

(iv) $2 : 27 :: 3.5 : x$

$$\frac{2}{27} = \frac{3.5}{x} \qquad 2 \times x = 3.5 \times 27$$

$$x = \frac{3.5 \times 27}{2} = \frac{94.5}{2} = 47.25$$

10. Convert each of the following into a fraction:

(i) $24\% = \frac{24}{100} = \frac{12}{50} = \frac{6}{25}$

(ii) $6\frac{1}{4}\% = \frac{25}{4 \times 100} = \frac{25}{400} = \frac{1}{16}$

(iii) $150\% = \frac{150}{100} = \frac{30}{20} = \frac{3}{2}$

(iv) $0.06\% = \frac{6}{100 \times 100} = \frac{6}{10000} = \frac{3}{5000}$

11. Express each of the following decimal into the form of percent:

(i) $0.63 = \frac{63}{100} = 63\%$

(ii) $0.005 = \frac{5}{1000} \times 100 = \frac{5}{10} = 0.5\%$

(iii) $3.25 = \frac{325}{100} \times 100 = 325\%$

(v) $2.05 = \frac{205}{100} \times 100 = 205\%$

12. Express each of the following as a decimal:

(i) $35\% = \frac{35}{100} = 0.35$

(ii) $0.18\% = \frac{18}{100 \times 100} = 0.0018$

(iii) $3\frac{1}{8}\% = \frac{25}{8 \times 100} = 0.03125$

(iv) $144\% = \frac{144}{100} = 1.44$

13. Express each of the following ratios as a percent :

(i) $2 : 5 = \frac{2}{5} \times \frac{20}{20} = \frac{40}{100} = 40\%$

(ii) $8 : 25 = \frac{8}{25} \times \frac{4}{4} = \frac{32}{100} = 32\%$

(iii) $7 : 100 = 7\%$

(iv) $5 : 4 = \frac{5 \times 25}{4 \times 25} = \frac{125}{100} = 125\%$

14. Express each of the following as a ratio :

(i) $12\% = \frac{12}{100} = \frac{6}{50} = \frac{3}{25} = 3 : 25$

(ii) $7.5\% = \frac{75}{10 \times 100} = \frac{75}{1000} = \frac{15}{200} = \frac{3}{40} = 3 : 40$

(iii) $65\% = \frac{65}{100} = \frac{13}{20} = 13 : 20$

(iv) $180\% = \frac{180}{100} = \frac{36}{20} = \frac{18}{10} = \frac{9}{5} = 9 : 5$

15. Find the value of the following:

(i) $60\% \text{ of } 55 = \frac{60}{100} \times 55 = 33$

(ii) $30\% \text{ of } 300 \text{ m} = \frac{30}{100} \times 300 = 30 \times 3 = 90 \text{ m}$

(iii) 0.6% of 40 litres $= \frac{6}{10\times100}\times40$ $\frac{6}{100}\times4$

$= \frac{24}{100} = 0.24l$

(iv) $3\frac{1}{3}$% of 90 kg $= \frac{10}{3\times100}\times90 = \frac{900}{300} = 3$ kg

(v) 40% of $1\frac{1}{2}$ hours $\frac{40}{100}\times\frac{3}{2} = \frac{20\times3}{100} = 0.6$ hours

(vi) 250% of `18 $= \frac{250}{100}\times18 = \frac{250\times9}{50} = 5\times9 =$ `45

16. What percent of :

(i) 32 is 80 $= \frac{80}{32}\times100 = 2.5\times100 = 250\%$

(ii) `125 is `750 $= \frac{750}{125}\times100 = 6\times100 = 600\%$

(iii) 8 hours is 3 days = 8 hours in 24×3 hours

$= \frac{72}{8}\times100 = 900\%$

(iv) $3\frac{1}{2}$ kg is 25 kg $= 25\times\frac{2}{7}\times100$

$= \frac{5000}{7} = 714.2\%$

(v) 175 ml is 1 litre = 175 ml is 1000 *l*

$= \frac{1000}{175}\times100 = \frac{100000}{175} = 571.4\%$

17. What percent is

(i) 25 cm of 4 m = 25 cm of 400 cm

$\frac{25}{400}\times100 = 0.0625\times100 = 6.25\%$

(ii) 8 hours of 2 days = 8 hrs of 48 hours

$$\frac{8}{48}\times 100 = \frac{1}{6}\times 100 = 16.7\%$$

(iii) 75 paise of ` 6 = 75 paise of 600 paise

$$\frac{75}{600}\times 100 = 12.5\%$$

(iv) 700 ml of 3.5 litres = 700 ml of 3500 ml

$$\frac{700}{3500}\times 100 = 20\%$$

18. Find the number which is

(i) 20% less than 60

20% of $60 = 12 = 60 - 12 = 48$

(ii) 30% more than 90

30% of $90 = 27$ $\qquad 90 + 27 = 117$

(iii) 25% more than 180 $\qquad$ 25% of $180 = 45$

$180 + 45 = 225$

(iv) $6\frac{1}{4}\%$ less than 200

$$\frac{25}{4}\% \text{ of } 200 = \frac{25}{4\times 100}\times 200 = 12.5$$

$200 - 12.5 = 187.5$

19. Find the percentage increase in the following cases:

(i) From 5.4 kg to 6 kg

$$\frac{6-5.4}{5.4}\times 100 = \frac{0.6}{5.4}\times 100 = \frac{60}{54} = 11.11\%$$

(ii) From ` 320 to ` 400

$$\frac{400-320}{320} = \frac{80}{320}\times 100 = 25\%$$

(iii) From 60 kg to 80 kg

$$\frac{80-60}{60}\times 100 = \frac{20}{60}\times 100 = 33.33\%$$

(iv) From 8 hours to 10 hours

$$\frac{10-8}{8}\times 100 = \frac{2}{8}\times 100 = 25\%$$

20. Find the percentage reduction in the following cases :

(i) From ` 500 to ` 300

$$\frac{500-300}{500}\times 100 = \frac{200\times 100}{500} = 40\%$$

(ii) From 81 marks to 72 marks

$$\frac{81-72}{81}\times 100 = \frac{9}{81}\times 100 = \frac{900}{81} = 11.11\%$$

(iii) From ` 12 hours to 10 hours

$$\frac{12-10}{12}\times 100 = \frac{2}{10}\times 100 = \frac{200}{12} = 16.66\%$$

(iv) From 1 year to 10 months

$$\frac{12-10}{12}\times 100 = \frac{2}{12}\times 100 = \frac{200}{12} = 16.66\%$$

21. Let the number be x

13 % of $x = 78$

$$\frac{13}{100}\times x = 78 \qquad 0.13x = 78$$

$$x = \frac{78}{0.13} = 600$$

22. Let the number be x

$6\frac{1}{4}\%$ of $x = 3$

$$\frac{25}{4\times 100}\times x = 3 \qquad 25x = 3\times 400$$

$$x = \frac{1200}{25} = 48$$

23. Let the number be x

12.5% of $x = 6$

$\frac{12.5}{100} \times x = 6$ $\qquad\qquad$ $x = \frac{600}{12.5} = 48$

24. Population of village = 24000

No. of men = 40% of 24000 = $\frac{40}{100} \times 24000$

$= 9600$ men

No. of women = $\frac{35}{100} \times 24000 = 8400$

No. of children = Total population – (No. of men + No of women)

$= 24000 - (9600 + 8400)$

$= 24000 - 18000 = 6000$ children

25. Marks of Suhani = $\frac{630}{900} \times 100 = 70\%$

Marks of Preeti = $\frac{650}{1300} \times 100 = 50\%$

Ans. Suhani performs better.

26. Amount of Nitrogen = 75% of 8 kg

$\frac{75}{100} \times 8000 = 6000$ gm or 6 kg

Amount of sulphur = 10% of 8 kg

$\frac{10}{100} \times 8000 = 800$ gm

Amount of charcoal = $(8000 - (6000 + 800)$

$= 8000 - 6800$

$= 1200$ gm or 1 kg 200 gm

27. Percentage of students passed in sec A

$\frac{45}{60} \times 100 = 75\%$

% of students passed in sec B $= \frac{12}{50} \times 100 = 24\%$

Sec A performance is better.

Exercise 9.2

1. Calculate the simple interest and amount when:

(i) $P = ` 3500, R = 5\%$ p.a., $T = 3$ years

$$SI = \frac{P \times R \times T}{100} = \frac{3500 \times 5 \times 3}{100} = \frac{52500}{100}$$

$SI = ` 525$

(ii) $$SI = \frac{10000 \times 7\frac{1}{2} \times 2\frac{1}{2}}{100}$$

$$= \frac{10000 \times 15 \times 5}{2 \times 100 \times 2} = \frac{750000}{400} = ` 1875$$

(iii) $$\frac{P \times R \times T}{100}$$

$$\frac{5000 \times 8 \times 39}{100 \times 2} = \frac{1560000}{1200} = 1300$$

(iv) $$\frac{600 \times 9 \times 146}{100 \times 365} = \frac{788400}{36500} = ` 21.6$$

2. In how many days will the interest on:

(i) $P = 1500, \quad R = 5.5\%, \ T = ?, \ SI = 16.50$

$$16.50 = \frac{1500 \times 5.5 \times T}{100}$$

$$16.50 \times 100 = 1500 \times 5.5 \times T$$

$$T = \frac{16.50 \times 100}{1500 \times 5.5} = \frac{1650}{8250} = 0.2 \text{ years}$$

No. of days $= 0.2 \times 365 = 73$ days.

(ii) $P = 3800, \quad R = 4\%, T = ?; \ SI = 60.80$

$$60.80 = \frac{3800 \times 4 \times T}{100}$$

$$T = \frac{60.80 \times 100}{3800 \times 4} = \frac{6080}{15200} = 0.4 \text{ years}$$

No. of days $= 0.4 \times 365 = 146$ days

3. $P = ?$, $R = 10\%$, $T = 3$ years, SI = ` 5525

SI $= A - P$

$A = P + \frac{P \times R \times T}{100}$; $\quad A = P\left(1 + \frac{R \times T}{100}\right)$

$P = \frac{A}{1 + \frac{R \times T}{100}}$ $\quad \frac{5525}{1 + \frac{10 \times 3}{100}}$

$P = \frac{5525}{1 + \frac{30}{100}}$ $\quad \frac{5525}{1 + 0.3} = ` 4250$

4. $P =$ ` 4500, $\quad A =$ ` 5715

$R = 9\%$ p.a.

SI $= A - P = 5715 - 4500$

SI $= 1215$

$1215 = \frac{4500 \times 9 \times T}{100}$

$T = \frac{121500}{4500 \times 9}$

$T = \frac{121500}{40500} = 3$ years

5. $P =$ ` 3600, $A =$ ` 4320, $\quad T = 2.5$ years

SI $= A - P$; $\quad$ SI $= \frac{P \times R \times T}{100}$

SI $= 4320 - 3600 = 720$

$720 = \frac{3600 \times R \times 2.5}{100}$

$$R = \frac{720 \times 100}{3600 \times 2.5} = 8\%$$

6. $A = P(1 + rt)$

$P = 8000, \quad A = 9760, \quad R = 11\%$

$$\left(\frac{11}{100} = (0.11)\right) \quad t = \frac{A - P}{Pr} = \frac{9760 - 8000}{8000 \times 0.11} = \frac{1760}{880} = 2 \text{ years}$$

Now rate is decreased by 2%

$11 - 2 = 9\%$

$= 8000(1 + 0.09 \times 2) = 8000(1 + 0.18)$

$8000 \times 1.18 = ` 9440$

7. Let the principal amount be $P = x$

The amount of A after 5 years is

$$A = \frac{8}{5} \times P = \frac{8}{5} \times x$$

$A = P + SI$

$$\frac{8}{5}x = x + \frac{x \times r \times 5}{100} \qquad \frac{8}{5}x - x = \frac{x \times r \times 5}{100}$$

$$\frac{8}{5}x - x = \frac{x \times r \times 5}{100}$$

$$\left(\frac{8}{5} - 1\right)x = \frac{x \times r \times 5}{100} \qquad \frac{8}{5} - 1$$

$$\frac{8}{5} - \frac{5}{5} = \frac{3}{5} \qquad \frac{3}{5}x = \frac{x \times r \times 5}{100}$$

$$\frac{3}{5} = \frac{r \times 5}{100} \qquad 3 \times 100 = 5 \times r \times 5$$

$$300 = 25r$$

$$r = \frac{300}{25} = 12\%$$

8. $A = SI + P$; 2 years = 783

3 years = ` 837; $837 - 783 = ` 54$

$P = A - SI$ $\quad 783 - (54 \times 2)$

$= 783 - 108;\ P = 675$

$108 = \dfrac{675 \times R \times 2}{100}$ $\quad 108 \times 100 = 675 \times R \times 2$

$R = \dfrac{108 \times 100}{675 \times 2} = 8\%$

9. $P = ` 25000,\quad R = 10\%,\quad T = 3.5$ years

Cash paid = ` 18750

$SI = \dfrac{25000 \times 10 \times 3.5}{100} = 250 \times 10 \times 3.5 = ` 8750$

$A = P + SI \quad 25000 + 8750 = ` 33750$

Value of two cows = Total amount due – cash paid

$33750 - 18750 = ` 15000$

10. Time = 2 years

Diff. of 1% in interest rates, SI increases by ` 24

$24 = \dfrac{(P \times 2 \times 1)}{100}$

$P = 1200$

11. No. of days from Jan 5^{th} to Jan 31^{st}

$= 31 - 5 = 26$ days

Total No. of days = 27 (Jan) + 28 (Feb) + 31 (Mar) + 30 (Apr) + 31 (May) = 146

Days into years = $T = \dfrac{147}{365}$

$SI = \dfrac{6000 \times 6 \times \frac{147}{365}}{100} = \dfrac{6000 \times 6 \times 146}{100 \times 365}$

$= \dfrac{5292000}{36500} = 144$

$A = P + SI;\quad A = 6000 + 144 = ` 6144$

12. $P = 30000,\ R = 8\%,\quad T = 3$ years

$SI_1 = \dfrac{30000 \times 8 \times 3}{100} = 7200$

$SI_2 = \dfrac{30000 \times 8 \times 5}{100} = 12000$

Difference in interest paid $= 12000 - 7200$

$= ` 4800$

Exercise 9.3

1. Compound Interest $= \dfrac{P \times R \times T}{100}$; $A = P + I$

For I^{st} year $= \dfrac{1000 \times 4 \times 1}{100} = \dfrac{4000}{100} = ` 40$

$A = 1000 + 40 = 1040$

$I_2 = \dfrac{1040 \times 4 \times 1}{100} = 41.6$

$A = 1040 + 41.6 = 1081.6$

$CI = 40 + 41.6 = ` 81.6$

2. $P = 2500,\quad R = 12\%,\ T = 2$ years

$SI_1 = \dfrac{2500 \times 12 \times 1}{100} = ` 300$

$A = 2500 + 300 = 2800$

$SI_2 = \dfrac{2800 \times 12 \times 1}{100} = \dfrac{33600}{100} = 336$

Compound interest $= 300 + 336 = ` 636$

3. $P = ` 160000,\ R = 20\%, T = 1$ years (4 qtr)

$r = \dfrac{R}{n} = \dfrac{20\%}{4} = 5\% = \dfrac{5}{100}$

$A = P\left(1 + \dfrac{r}{n}\right)^{t}$

$A = 160000\left(1 + \frac{5}{100}\right)^4$

$160000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} = ₹\ 194481$

$CI = A - P = 194481 - 160000 = ₹\ 34481$

4. $P = 10000,\ R = 20\%,\ T = 1.5$ (half yearly)

$A = P\left(1 + \frac{r}{n}\right)^t;\quad r = \frac{20}{2}\% = 10\% = \frac{10}{100}$

$10000\left(1 + \frac{10}{100}\right)^3 = 10000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100}$

$= \frac{1331000}{100} = ₹\ 13310$

$CI = 13310 - 10000 = ₹\ 3310$

5. $A = P\left(1 + \frac{r}{100}\right)^t$

$54080 = P\left(1 + \frac{4}{100}\right)^2 \qquad 54080 = P(1 + 0.04)^2$

$54080 = P(1.04)^2$

$54080 = P(1.0816)$

$P = \frac{54080}{1.0816} = ₹\ 50000$

6. $P = ₹\ 64000,\quad T = 3$ Years, $\quad R = 7.5\ \%$

$A = P\left(1 + \frac{r}{100}\right)^t \qquad 64000\left(1 + \frac{7.5}{100}\right)^3$

$= 64000\left(\frac{107.5}{100}\right)^3 \qquad 64000 \times \frac{107.5}{100} \times \frac{107.5}{100} \times \frac{107.5}{100}$

$64000 \times 1.075 \times 1.075 \times 1.075 = 79507$

$= ₹\ 79507$

Exercise 9.4

1. Find the amount and the compound interest by using the formula in each of the following cases:

(i) $P = 8000, \quad R = 5\%, \quad T = 3$ years

$$A = P\left[1 + \frac{R}{100}\right]^n$$

$$8000\left[1 + \frac{5}{100}\right]^3 \qquad 8000\left[\frac{105}{100}\right]^3$$

$$8000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} \qquad 8000 \times 1.05 \times 1.05 \times 1.05$$

$A = ₹\ 9261 \qquad CI = 9261 - 8000 = ₹1261$

(ii) $P = ₹4800,\ R = 7\frac{1}{2}\%, T = 2$ years

$$4800\left[1 + \frac{15}{2 \times 100}\right]^2 \qquad 4800\left[1 + \frac{15}{200}\right]^2$$

$$= 4800\left[\frac{215}{200}\right]^2 \qquad 4800 \times \frac{215}{200} \times \frac{215}{200} = 5547$$

$CI = 5547 - 4800 = ₹747$

(iii) $P = ₹62500,\ R = 12\%,\ T = 2\frac{1}{2}$ years $= \frac{5}{2}$ years

$$A_1 = P\left(1 + \frac{R}{100}\right)^2$$

$$= 62500\left(1 + \frac{12}{100}\right)^2 \qquad 62500(1 + 0.12)^2$$

$$62500 \times (1.12)^2 = 62500 \times 1.2544$$

$$= 78400$$

$$SI = \frac{784000 \times 12 \times 1}{100 \times 2} = 784 \times 6 = 4704$$

$A = A_1 + SI = 78400 + 4704 = 83104$

$CI = A - P \quad 83104 - 62500 = ` 20604$

(iv) $P = 8000, R = 5$ paise per rupee p.a., $T = 2$ years

$R = \frac{5}{100} = 5\%$

$A = 8000\left(1 + \frac{5}{100}\right)^2 \quad 8000(1 + 0.05)^2$

$A = 8000(1.05)^2 \quad 8000 \times 1.1025$

$A = 8820$

$CI = 8820 - 8000 = 820$

(v) $P = 3000, \quad R = 10\%$ p.a. (half yearly), $T = 2$ years,

$R = 5\%$

$A = 3000\left(1 + \frac{5}{100}\right)^4 \quad 3000(1 + 0.05)^4$

$3000 \times (1.05)^4$

$A = 3000 \times 1.2156 = 3646.51$

$CI = 3646.51 - 3000 = ` 646.52$

(vi) $P = 20000, \ R = 20\%$, quarterly, $T = 1$ year

$R = \frac{20}{100}$ quarterly $= \frac{20}{4 \times 100} = \frac{5}{100}$

$20000\left(1 + \frac{5}{100}\right)^4 \quad 20000\left(\frac{105}{100}\right)^4$

$20000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} = 24310.12$

$CI = 24310.12 - 20000 = ` 4310.12$

2. Iyr $= P = 10000, \ R = 8\%, T = 2$ years

II yr $\quad R = 9\%$

$A_1 = 10000 + \left(1 + \frac{8}{100}\right)^1 = 10000\left(\frac{108}{100}\right)$

$100 \times 108 = 10800$

$A_2 = 10800 + \left(1 + \frac{9}{100}\right) = 10800\left(\frac{109}{100}\right)$

$A_2 = 11772$

$CI = 11772 - 10000 = ₹1772$

3. $Iyr = 25000\left(1 + \frac{10}{100}\right) \quad 25000 \times \frac{110}{100}$

$A_1 = 250 \times 110 = ₹27500$

$IIyr = 27500\left(1 + \frac{12}{100}\right) \quad 27500\left(\frac{112}{100}\right)$

$A_2 = 275 \times 112 = ₹30800$

$A_3 = 30800\left(1 + \frac{15}{100}\right) = 30800 \times \frac{115}{100}$

$A_3 = 308 \times 115 = ₹35420$

$CI = 35420 - 25000 = ₹10420$

4. $A = P\left(1 + \frac{R}{100}\right)^t \qquad A = 1323, P = 1200$

$1323 = 1200\left(1 + \frac{5}{100}\right)^t$

$1323 = 1200 \times \left(\frac{105}{100}\right)^t \qquad \frac{1323}{1200} = \left(\frac{105}{100}\right)^t$

$\frac{441}{400} = \left(\frac{21}{20}\right)^t$

$\left(\frac{21}{20}\right)^2 = \frac{21}{20} = t = 2 \text{ years}$

5. $A = ₹676, \quad R = 4\%, \quad T = 2 \text{ years}, P = ?$

$A = P\left(1 + \frac{R}{100}\right)^t \qquad 676 = P\left(1 + \frac{4}{100}\right)^2$

$676 = P \times \frac{104}{100} \times \frac{104}{100} \qquad \frac{676 \times 100 \times 100}{104 \times 104}$

$P = \frac{6760000}{10816} = ₹625$

6. $A = 9826, \quad T = 1\frac{1}{2}$ yr (3 half years) $R = 12.5\% = \frac{12.5}{2}$

$A = P\left(1 + \frac{r}{100}\right)^n \qquad 9826 = P\left(1 + \frac{12.5}{2 \times 100}\right)^3$

$9826 = P\left(1 + \frac{12.5}{200}\right)^3 \qquad 9826 = P\left(\frac{212.5}{200}\right)^3$

$P = \frac{9826 \times (200)^3}{(212.5)^3} = \frac{78608000000}{9595703.12} = ₹8192$

$P = ₹8192$

7. $SI = 2400, R = 5\%, \quad T = 3$ years, $P = ?$

$SI = \frac{P \times R \times T}{100} \qquad 2400 = \frac{P \times 5 \times 3}{100}$

$P = \frac{2400 \times 100}{15} = 16000$

$A = 16000\left(1 + \frac{5}{100}\right)^3 \qquad 16000 \times \left(\frac{105}{100}\right)^3$

$A = \frac{160 \times 105 \times 105 \times 105}{100 \times 100} = ₹18522$

$CI = 18522 - 16000 = ₹2522$

8. $P = ₹800, A = ₹926.10, \quad R = 10\%(5\%) T = ?(t)$

$A = P\left(1 + \frac{r}{100}\right)^t \qquad 926.10 = 800\left(1 + \frac{5}{100}\right)^{2t}$

$926.10 = 800\left(\frac{105}{100}\right)^t \qquad \frac{926.10}{800} = \left(\frac{105}{100}\right)^{2t}$

$\frac{9261}{8000} = \left(\frac{21}{20}\right)^{2t} = \frac{21\times21\times21}{20\times20\times20} = \left(\frac{21}{20}\right)^{2t}$

$\left(\frac{21}{20}\right)^3 = \left(\frac{21}{20}\right)^{2t} \quad 2t = 3$

$t = \frac{3}{2} = 1\frac{1}{2}$ years

9. $P = ₹57600, R = 12.5\%, T = 1.5$ yrs (Intt half yearly)

$R = \frac{12.5}{2} = 6.25\%$

$T = 1.5\times2 = 3$

$A = 57600\left(1+\frac{6.25}{100}\right)^3 \qquad 57600\left(\frac{106.25}{100}\right)^3$

$\frac{576\times106.25\times106.25\times106.25}{100\times100} = \frac{690890625}{10000}$

$A = ₹69089$

10. $P = ₹50000, T = 1\frac{1}{2}$ years, $R = 10\%$ (half yearly)

$R = \frac{10}{2} = 5\%$

$T = 1\frac{1}{2}yr = 1.5\times2 = 3$

$A = 50000\left(1+\frac{5}{100}\right)^3 \qquad 50000\left(\frac{105}{100}\right)^3$

$A = \frac{50000\times105\times105\times105}{100\times100\times100} = ₹57881.25$

Exercise 9.5

1. Population of town = 16000

Population increased per year = 5%

5% of 16000 = 800

Population increased in Ist year = 16000 + 800 = 16800

Population increased in IInd year = $16800 \times \frac{5}{100} = 840$

16800 + 840 = 17640

2. Present population = 28000

Increased by 5% Iyr = $28000 \times \frac{5}{100} = 1400$

= 28000 + 1400 = 29400

Population increased in IInd year = $29400 \times \frac{5}{100} = 1470$

= 29400 + 1470 = 30870

3. Population of city = 125000

Annual birth rate = $125000 \times \frac{5.5}{100} = 6875$

Annual death rate = $125000 \times \frac{3.5}{100} = 4375$

Population is I year = 125000 + 6875 − 4375

= 127500

Birth rate in IIyr = $127500 \times \frac{5.5}{100} = 7012.5$

Death rate is IIyr = $127500 \times \frac{3.5}{100} = 4462.5$

Population is IIyr = 127500 + 7012.5 − 4462.5

= 130050

Birth rate is III yr = $130050 \times \frac{5.5}{100} = 7152.75$

Death rate is IIIyr = $130050 \times \frac{3.5}{100} = 4551.75$

Population is IIIyr = 132651.

4. $P = 40000,\ A = 48400,\ T = 2$ years

$$A = P\left(1 + \frac{R}{100}\right)^t$$

$$48400 = 40000\left(1 + \frac{R}{100}\right)^2$$

$$\frac{48400}{40000} = \left(1 + \frac{R}{100}\right)^2 \qquad 1.21 = \left(1 + \frac{R}{100}\right)^2$$

$$\sqrt{1.21} = 1 + \frac{R}{100} \qquad \frac{R}{100} = 1.1 - 1$$

$$\frac{R}{100} = 0.1 \qquad R = 0.1 \times 100 = 10\%$$

5. The bacteria grow by 10% in the first hour.

Original count = 10000

$$\text{Increase} = 10\% \text{ of } 10000 = \frac{10}{100} \times 1000 = 1000$$

Count after 1 hour $= 10000 + 1000 = 11000$

In the second hour, the bacteria decrease by $10\% = 10\%$ of $11000 = \frac{10}{100} \times 11000 = 1100$ count after 2 hours $= 11000 - 1100 = 9900$ count after 3 hours $= 9900 + 990 = 10890$

6. $P = 1000000,\ R = 10\%,\ T = 3$ years

$$A = 1000000\left(1 - \frac{10}{100}\right)^3 \qquad 1000000\left(\frac{90}{100}\right)^3$$

$$= 1000000 \times \frac{90}{100} \times \frac{90}{100} \times \frac{90}{100} = ` 729000$$

7. $A = ` 411540,\ R = 5\%, T = 3$ years

$$A = P\left(1 + \frac{R}{100}\right)^3 \qquad 411540 = P\left(1 + \frac{5}{100}\right)^3$$

$$411540 = P \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100}$$

$$P = \frac{411540 \times 100 \times 100 \times 100}{105 \times 105 \times 105} = ₹355503.72$$

8. $P = 17000, \quad R_1 = 5\%, R_2 = 4\%$

$$\text{Cost of } TV = P\left(1 + \frac{R}{100}\right)\left(1 - \frac{r}{100}\right)$$

$$17000\left(1 + \frac{5}{100}\right)\left(1 - \frac{4}{100}\right)$$

$$\text{Cost of TV} = 17000 \times \frac{105}{100} \times \frac{96}{100}$$

$$= ₹17136$$

Exercise 9.6

1. Find the discount and discount percentage, when

   (i) $MP = ₹780, \quad SP = ₹\ 721.50$

   $$\text{Discount} = 780 - 721.50 = ₹58.50$$

   $$\text{Discount \%} = \left[\frac{MP - SP}{MP}\right] \times 100$$

   $$= \frac{780 - 721.50}{780} \times 100$$

   $$= \frac{58.5 \times 100}{780} = 7.5\%$$

   (ii) Advertised price = ₹28500, SP = ₹24510

   $$\text{Discount} = 28500 - 24510 = ₹3990$$

   $$\text{Discount\%} = \frac{28500 - 24510}{28500} \times 100 = 14\%$$

2. Find the SP if

   (i) MP = ₹1300 and Discount =10%

   $$\text{Discount \%} = \frac{\text{Discount}}{\text{MP}} \times 100$$

$$10 = \frac{\text{Discount}}{1300} \times 100 \qquad 10 \times 1300 = D \times 100$$

$$D = \frac{13000}{100} = \text{`}130$$

$$\text{SP} = \text{MP} - \text{Discount} = 1300 - 130 = \text{`}1170$$

(ii) $\text{MP} = \text{`}5450$ and $\text{Discount} = 5\%$

$$5 = \frac{D}{5450} \times 100 \qquad 5450 \times 5 = D \times 100$$

$$D = \frac{5450 \times 5}{100} = \text{`}272.5$$

$$\text{SP} = 5450 - 272.5 = \text{`}5177.50$$

3. Find the MP if

(i) $\text{SP} = \text{`}9250$ and discount $= 7\frac{1}{2}\%$

$$\text{Discount } \% = \frac{\text{Discount}}{\text{MP}} \times 100$$

$$\frac{15}{2} = \frac{D}{MP} \times 100 \qquad (D = MP - SP)$$

$$\frac{15}{2} = \left(\frac{MP - 9250}{MP}\right) \times 100$$

$$\frac{15}{2}\,\text{MP} = (100MP - 925000)$$

$$200\,\text{MP} - 1850000 = 15\,\text{MP}$$

$$200MP - 15MP = 1850000$$

$$185MP = 1850000$$

$$MP = \frac{1850000}{185} = \text{`}10000$$

(ii) $\text{SP} = \text{`}1222$ and Discount $= 6\%$

$$6 = \left(\frac{MP - 1222}{MP}\right) \times 100$$

$$6MP = 100MP - 122200$$

$$100MP - 6MP = 122200$$

$$94MP = 122200$$

$$MP = \frac{122200}{94} = \text{`}1300$$

4. MP = ` 4650, Discount = 18%

SP = MP – Discount

$$\text{Discount} = 4650 \times \frac{18}{100} = \text{`}837$$

$$\text{SP} = 4650 - 837 = \text{`}3813$$

5. MP = 1120, Discount % = 10%, Profit = 26%

SP = MP – Discount

Profit = SP – CP

$$\text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100$$

$$\text{Discount} = \frac{10}{100} \times 1120 = \text{`}112$$

$$\text{SP} = 1120 - 112 = \text{`}1008$$

$$\text{Profit \%} = \frac{SP - CP}{CP} \times 100$$

$$26 = \frac{1008 - CP}{CP} \times 100$$

$$26\ \text{CP} = 100800 - 100CP$$

$$100800 = 100CP + 26CP$$

$$CP = \frac{100800}{126} = \text{`}800$$

6. CP = 7660, Discount = 12%, Profit = 10%

SP = CP + Gain ;

$$\text{Gain} = \frac{\text{Gain\%} \times \text{CP}}{100}$$

$$\text{Profit/Gain} = \frac{10}{100} \times 7660 = \text{`}766$$

$$SP = 7660 + 766 = \text{`}8426$$

$$\text{SP} = \text{MP} - \text{Discount}$$

$$\text{Discount} = \frac{12}{100} \times \text{MP} \qquad 0.12 \times \text{MP}$$

$$8426 = \text{MP} - 0.12 \times \text{MP}$$

$$8426 = 0.88 \times \text{MP}$$

$$\text{MP} = \frac{8426}{0.88} = \text{`}9575$$

7. Discount on MP = 25%

Profit = 50%

SP = MP – Discount

Profit = SP – CP

$$\text{Discount} = \frac{25}{100} \times \text{MP} = \frac{1}{4}\text{MP}$$

$$\text{SP} = \text{MP} - \frac{1}{4}\text{MP}$$

$$\frac{4MP - 1MP}{4} = \frac{3MP}{4}$$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100$$

$$50 = \frac{SP - CP}{CP} \times 100$$

$$\frac{50}{100} = \frac{SP}{CP} - 1$$

$$\frac{1}{2} = \frac{SP}{CP} - 1$$

$$\frac{SP}{CP} = \frac{3}{2} \qquad CP = \frac{2}{3}SP$$

$$CP = \frac{2}{3}SP \text{ and } SP = \frac{3}{4}MP$$

$$CP = \frac{2}{3} \times \frac{3}{4}MP$$

$$CP = \frac{1}{2}MP$$

$$\frac{CP}{MP} = \frac{1}{2} \quad 1:2$$

8. Let the CP be CP

MP be x

$$\text{MP} = \text{CP} + \frac{x}{100} \times CP = CP\left(1 + \frac{x}{100}\right)$$

$$SP = MP - 10\% \text{ of } MP = MP \times \left(1 - \frac{10}{100}\right)$$

$$= MP \times 0.90$$

$$SP = CP\left(1 + \frac{x}{100}\right) \times 0.90$$

$$SP = CP + 8\% \text{ of } CP = CP \times \left(1 + \frac{8}{100}\right) = CP \times 1.08$$

$$CP\left(1 + \frac{x}{100}\right) \times 0.90 = CP \times 1.08$$

$$\left(1 + \frac{x}{100}\right) \times 0.90 = 1.08$$

$$1 + \frac{x}{100} = \frac{1.08}{0.90} \qquad 1 + \frac{x}{100} = 1.2$$

$$100 + x = 1.2 \times 100$$

$$100 + x = 120 = x = 120 - 100 = 20\%$$

9. Let the CP be `100

MP = CP + 25% of CP

$MP = 100 + 25 = 125$

$\text{Discount} = 30\% \times MP = \frac{30}{100} \times 125 = 37.5$

SP = MP – discount $= 125 - 37.5 = 87.5$

Loss = CP – SP $= 100 - 87.5 = 12.5$

$\text{Loss \%} = \frac{\text{Loss}}{CP} \times 100 = \frac{12.5}{100} \times 100 = 12.5\%$

10. CP = ` 1200, profit % = 12%

SP = CP (1+ Profit%)

$= 1200 \times \left(1 + \frac{12}{100}\right) = 1200 \times (1 + 0.12)$

$SP = 1200 \times 1.12 = 1344$

$\text{Discount} = 16\% \text{ of } MP = \frac{16}{100} \times MP$

$0.16 \times 100x = 16x$

Discount = MP – SP

$16x = 100x - 1344$

$100x - 16x = 1344$

$84x = 1344$

$x = \frac{1344}{84} = 16$

$MP = 100x = 100 \times 16 = ` 1600$

Exercise 9.7

1. Let the price of mixer is x

$\text{VAT} = 10\% \text{ of base price} = \frac{10}{100} \times x = \frac{` x}{10}$

Purchase price = base price + VAT

$3300 = x + \frac{x}{10}$ $\qquad$ $3300 = \frac{11x}{10}$

$x = \frac{3300 \times 10}{11} = ` 3000$

2. Let the price of saree is x

   VAT = 8% of $x = \frac{8}{100} \times x = \frac{8x}{100}$

   Purchase price = Base price + VAT

   $5400 = x + \frac{8x}{100} \qquad 5400 = \frac{100x + 8x}{100}$

   $5400 = \frac{108x}{100} \qquad x = \frac{5400 \times 100}{108} = ` 5000$

3. Base price of refrigerator = ` 9700

   VAT = 6% on 9700 = 582

   Price to be paid = 9700 + 582

   = ` 10282

4. Discount = Discount % × MP

   $= \frac{25}{100} \times 4000 = ` 1000$

   Price of coat after discount = 4000 – 1000 = ` 3000

   Sales tax = Final cost – Price after discount

   = 3240 – 3000

   Sales tax = ` 240

   Rate of sales tax = $\frac{\text{Sales tax amt.}}{\text{Price after discount}} \times 100$

   $= \frac{240}{3000} \times 100 = 8\%$

5. Let the original price be x

   Listed price = x + 10% of x = 35640

   $x + \frac{10}{100} x = 35640 \qquad \frac{110x}{100} = 35640$

   $x = 32400$

Actual price = 32400 + 7% × 32400

= 32400 + 2268 = 34668

Extra profit = Listed price – Actual price

35640 – 34668 = ` 972

6. 1 kg of sugar = ` 40

12 kg of sugar = 12 × 40 = ` 480

9% GST on 480 = ` 43.2

Buying price = 480 + 43.2

= ` 523.2

7. Profit = Profit % × 800

$= \frac{10}{100} \times 800 =$ ` 80

SP without GST = CP + Profit

= 800 + 80 = ` 880

Let MP be x

SP without GST = $x - 20\% \times x$

$880 = x - \frac{20}{100} \times x$

$880 = x - 0.2x$ $\qquad 880 = 0.8x$

$x = \frac{880}{0.8} =$ ` 1100

GST = 18% of 880 $= \frac{18}{100} \times 880 =$ ` 158.4

Final SP = SP without GST + GST

880 + 158.4 = ` 1038.4

8. (i) Biscuits and bakery products

= 500 + 5% × 500

= 500 + 25 = ` 525 ...(1)

(ii) Medicine = 250 + 12% on 250

= 250 + 30 = ` 280 ...(2)

(iii) Clothes = 1200 + 18% on 1200

= 1200 + 216 = ` 1416 ...(3)

(iv) Cosmetics = 1500 + 28% on 1500

= 1500 + 420 = 1920 ...(4)

Total amount paid by Mohita to store

525 + 280 + 1416 + 1920

= ` 4141

9. Discount amount = MP × Discount%

$$= 210000 \times \frac{5}{100} = ` 10500$$

Price after discount = MP – Discount amount

= 210000 – 10500 = ` 199500

$$GST = 199500 \times \frac{10}{100} = ` 19950$$

Final price = Price after discount + GST

= 199500 + 19950 = ` 219450

MCQs

1.	(b)	2.	(c)	3.	(d)	4.	(b)	5.	(a)	6.	(d)
7.	(b)	8.	(a)	9.	(b)	10.	(b)	11.	(b)	12.	(c)

1. $\frac{1}{4} \times 100 = 25\%$

2. $\frac{4}{25} \times 100 = 16\%$

3. Discount — MP × $\frac{DP}{100}$

$= 100 \times \frac{25}{100}$

$= 25$

$SP = MP - D$

$= 100 - 25$

$= ₹75$

4. Discount % $= \frac{\text{Discount}}{MP} \times 100$

$= \frac{40-32}{40} \times 100$

$= \frac{8}{40} \times 100$

$= 20\%$

5. $SP = ₹90$

Discount percentage $= 10$

MP be x

Discount $=$ MP $-$ SP

$= ₹(x - 90)$

Discount % $= \frac{\text{Discount}}{\text{MP}} \times 100$

$10 = \frac{x-90}{x} \times 100$

$10x = 100x - 9000$

$90x = 9000$

$x = \frac{9000}{90}$

$x = ₹100$

6. SI $= \frac{P \times R \times T}{100} = \frac{1000 \times 8 \times 2}{100} = ₹160$

7. Value $= P\left(1 - \frac{R}{100}\right)^1$

$= 100000\left(1 - \frac{10}{100}\right)$

$= 100000(1 - 0.1)$

$= 90000$

10. $A = P\left(1 + \frac{R}{100}\right)^2$

$= 50000\left(1 + \frac{R}{100}\right)^2$

$= 50000\left(1 + \frac{4}{100}\right)^2$

$= 50000(1 + 0.04)^2$

$= 50000(1.04)^2$

$= 5000\,(1.0816)$

$A = 54080$

$CI = A - P$

$= 54080 - 50000$

$= ` 4080$

11. Sales tax amount $= \frac{9}{100} \times 36450$

$= 3280.5$

Total amount $= 36450 + 3280.5$

$= 39730.50$

12. Let original price be x

8% of $x + x = 13500$

$\frac{8}{100}x + x = 13500$

$\frac{8x + 100x}{100} = 13500$

$\frac{108x}{100} = 13500$

$$x = \frac{13500 \times 100}{108}$$

$= ` 12500$

Fill in the blanks

1. marked price 2. selling price 3. discount 4. ` 1750
5. selling price 6. relative 7. discount
8. compound, interest 9. ` 1600 10. amount

4. $x - 20\%$ of $x = 1400$

$$x - \frac{20}{100}x = 1400$$

$$\frac{100x - 20x}{100} = 1400$$

$$\frac{80x}{100} = 1400$$

$$x = \frac{1400 \times 100}{80} = ` 1750$$

9. $A = P\left(1 + \frac{r}{100}\right)^t$

$A = 1\left(1 + \frac{5}{100}\right)^2$

$A = P(1 + 0.05)^2$

$A = P(1.05)^2$

$A = 1.1025\,P$

$CI = A - P$

$164 = 1.1025P - P$

$164 = 0.1025P$

$$P = \frac{164}{0.1025}$$

$= ` 1600$

True or False

1. T 2. F 3. F 4. T 5. F 6. T 7. F 8. T

10 Understanding Quadrilaterals

1. Classify the following curves as open or closed:
   (i) (iii) (vi) Open
   (ii) (iv) (v) Closed
2. Classify the following figures on the basis of the following:
   (i) Simple closed curve and a concave polygon
   (ii) Simple closed curve and a convex polygon
   (iii) Not a curve, not a polygon.
   (iv) Not a curve, not a polygon.
   (v) Simple closed curve, but not a polygon
   (vi) Simple closed curve, but not a polygon
   (vii) Simple closed curve, but not a polygon
   (viii) Simple closed curve, but not a polygon
3. Find the measure of each interior angle of :
   (i) Quadrilateral = 4 sides = $\frac{360°}{4} = 90°$
   (ii) Hexagon = 6 sides
   $(n-2) * 180 / n = (6-2) \times 180 / 6$
   $4 \times 30 = 120°$
   (iii) Octagon = 8 sides
   $(8-2) * 180 / 8 = 6 \times 22.5 = 135°$
   (iv) Polygon of 18 sides = $(18-2) * \frac{180}{18}$
   $16 \times 10 = 160°$

4. Find the measure of each exterior angle of a regular polygon of :

(i) $\frac{360}{n} = \frac{360}{6} = 60°$

(ii) $\frac{360}{10} = 36°$

(iii) $\frac{360}{16} = 22.5 \text{ or } 21\frac{1°}{2}$

(iv) $\frac{360}{18} = 20°$

5. Find the number of sides of a regular polygon, whose each interior angle measures:

(i) Let the number of sides = n

Interior angle $= \frac{1}{n}(2n-4) \times 90°$

$120° = \frac{1}{n}(2n-4) \times 90°$

$120 \times n = (2n-4) \times 90°$

$120n = 180n - 360°$

$180n - 120n = 360°$

$60n = 360°$

$n = \frac{360°}{60°} = 6 \text{ sides}$

(ii) $178° = \frac{1}{n}(2n-4) \times 90°$

$178 \times n = 180n - 360°$

$180n - 178n = 360°$

$n = \frac{360°}{2} = 180 \text{ sides.}$

(iii) $162° = \frac{1}{n}(2n-4) \times 90°$

$162° \times n = 180n - 360°$

$180n - 162n = 360°$

$n = \frac{360}{18} = 20$ sides

(iv) $140° = \frac{1}{n}(2n - 4) \times 90°$

$140° n = 180n - 360°$

$180n - 140n = 360°$

$n = \frac{360}{40} = 9$ sides

6. Find the number of sides of a regular polygon which has each exterior angle measuring

(i) $\frac{360°}{\text{measure of angle}} = \text{number of sides}$

$\frac{360°}{30°} = 12$ sides

(ii) $\frac{360°}{36°} = 10$ sides

(iii) $\frac{360°}{40°} = 9$ sides

(iv) $\frac{360°}{72°} = 5$ sides

7. $(n - 2) \times 180° = 1080°$

$\frac{(n-2) \times 180°}{180°} = \frac{1080°}{180°} = n - 2 = 6$

$n = 8$ sides

$\frac{(n-2) \times 180}{n}$ $\frac{(8-2) \times 180}{8} = \frac{6 \times 180}{8}$

$= \frac{1080}{8} = 135°$

8. No. of sides = 6

$(n-2)\times 180 \qquad (6-2)\times 180$

$= 4\times 180 = 720$ degrees

Sixth angle $= 720 - 600 = 120°$.

9. $(5-2)\times 180° = 540°$

$1x + 2x + 3x + 4x + 5x = 540°$

$15x = 540° = x = \frac{540}{15} = 36°$

$1x = 1\times 36° = 36° \qquad 3x = 3\times 36° = 108°$

$2x = 2\times 36° = 72° \qquad 4x = 4\times 36° = 144°$

$5x = 5\times 36° = 180°$

largest angle is 5th = 180°

10. Find the value of 'x' in the following figures

(i) $110°+60°+120°+2x = 360°$

$290°+2x = 360°$

$2x = 360°-290°$

$x = \frac{70}{2} = 35°$

(ii) $90°+x = 180°$

$x = 180°-90° = 90°$

(iii) $70°+70°+110°+x° = 360°$

$x = 360°-250° = 110°$

(iv) $(x-15) + (x-25) + (x+25) + (x-35) = 360°$

$x-15+x-25+x+25+x-35 = 360°$

$4x-15-35 = 360°$

$4x-50 = 360°$

$4x = 360°+50°$

$4x = 410°$

$x = \frac{410}{4} = 102.5°$

(v) $x + 2x + x + 20°+(180°-120°) = 360°$

$4x + 20° + 60° = 360°$

$4x = 360° - 80°$

$4x = 280$

$x = \frac{280}{4} = 70°$

Exercise 10.2

1. The following figures are parallelograms. Find the degree values of the unknown x, y, z.

(i) Opposite angles of parallellogram are equal,

$y = 100°$

$100° + x = 180°$ $\quad x = 180° - 100° = 80°$

$z = x = 80°$ (opp. angles are equal)

$x = 80°$, $y = 100°$, $z = 80°$

(ii) $P = R$ (opp. angles)

$100° = x°$

$x + z° = 180°$ $\quad 100° + z = 180°$

$z° = 180° - 100 = 80°$

$y + z = 180° = y + 80° = 180°$

$y = 180° - 80° = 100°$

(iii) $x = 90°$ (opp. angles)

$x + 30° + y° = 180°$

$90° + 30° + y = 180°$

$y = 180° - 120° = 60°$

$z = 60°$ (alternate interior angles)

(iv) $\neq 112°$, $F = y°$ (opp. angles)

$112° = y°$

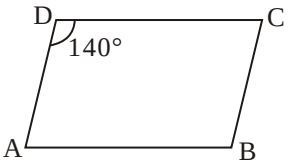
$= 112° + 40° + z° = 180°$

$z = 180° - 152° = 28°$

$z = x = 28°$ (alt. interior angles)

$x = 28°$, $z = 28°$, $y = 112°$

2. $B = D = 140°$



$A + D = 180°$

$A + 140° = 180°$

$A = 180° - 140° = 40°$

3. Let the angles be A, B, C and D

$A + C = 160°$

and $A = C$ (opp. angles)

$A + A = 160° = 2A = 160°$

$A = \frac{160°}{2} = 80°$; $A = C = 80°$

$A + B = 180°$ $80° + B = 180°$

$B = 180° - 80° = 100°$

$B = D = 100°$ (opp. angles)

4. Let $A = (3x - 2)°$ and $C = (50 - x)°$

$A = C$ (Opp. angles of || gm)

$(3x - 2)° = (50 - x)°$

$3x - 2 = 50 - x$ $3x + x = 50 + 2$

$4x = 52$ $x = \frac{52}{4} = 13°$

$A = (3x - 2)°$ $(3 \times 13 - 2)$

$A = 37°$

$C = (50 - x)° = 50 - 13 = 37°$

$A + B = 180°$

$37° + B = 180°$ $B = 180° - 37°$

$B = 143°$

$B = D = 143°$ (Opp. angles)

5. Let the equal angles be x and y

$x = y$

$x + y + 75° + 75° = 360°$

$x + x + 75° + 75° = 360°$ $(x = y)$

$2x = 360° - 150°$

$x = \frac{210}{2} = 105°$

$x = y = 105°$

6. $2x + 3x + 4x + 1x = 360°$

$10x = 360°$

$x = \frac{360°}{10°} = 36°$

$1 = 2x = 2 \times 36 = 72°$

$2 = 3x = 3 \times 36° = 108°$

$3 = 4x = 4 \times 36° = 144°$

$4 = 1x = 1 \times 36° = 36°$

7. $3x + 5x + 7x + 9x = 360°$

$24x = 360°$

$x = \frac{360°}{24°} = 15°$

$3x = 3 \times 15 = 45°$

$5x = 5 \times 15 = 75°$

$7x = 7 \times 15 = 105°$

$9x = 9 \times 15 = 135°$

8. $BCD = 60°$ ($BCO + OCD$)

$BCO = OCD$ (CO is bisector)

$OCD = 30°$

$180° = 30° + 30° + O$

$180° - 60° = O$

$DOC = 120°$

$A + B + C + D = 360°$

$100° + B + 60° + 60° = 360°$

$B = 360° - 220°$

$B = 140°$ or $ABC = 140°$

9. $C = A = 70°$ (opp angles of || gm $ABCD$)

$A = F = 70°$ (opp angles of || gm $AEFG$)

$F = 70°$

10. Let one side of ||gm be x

Then other side is $x + 25$

$P = x + x + (x + 25) + (x + 25)$

$150 = x + x + x + x + 50$

$150 = 4x + 50$

$4x = 150 - 50$

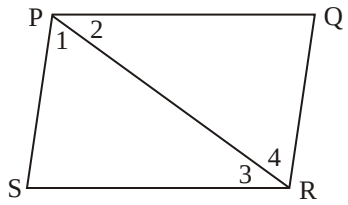
$4x = 100$

$x = \frac{100}{4} = 25\,\text{cm}$

$(x + 25) = (25 + 25) = 50\,\text{cm}$

Two sides of || gm is 25 cm each and other two sides is 50 cm each.

11. $PR = PQ$



$PQ = QR = RS = PS$

$PQR = PRS$

(equilateral triangle)

$1 = 2 = 3 = 4 = 60°$

$P = 1 + 2 = 60° + 60° = 120°$

$P = 120°$

$P = R = 120°$

$S = Q = 60°$

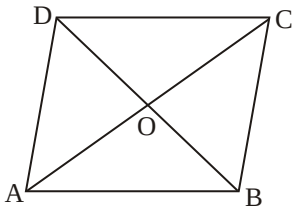
Angles of rhombus $P = R = 120°$ and $S = Q = 60°$

12. $AC = 16\,\text{cm}$

$BD = 12\,\text{cm}$

$AO = \frac{AC}{2} = \frac{16}{2} = 8\,\text{cm}$

$BO = \frac{BD}{2} = \frac{12}{2} = 6\,\text{cm}$



$AB^2 = AO^2 + BO^2$

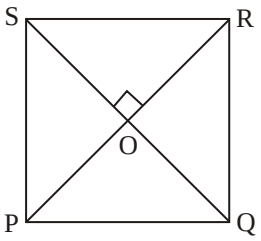
$= 8^2 + 6^2$

$= 64 + 36$

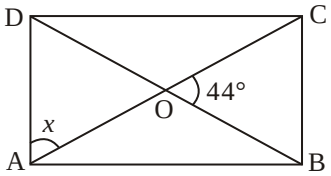
$AB^2 = 100 \qquad AB = 10\,\text{cm}$

13. Diagonals bisects each other at 90°.

$POQ = 90°$



14.



$BOC = OAD = 44°$ (vertically opp angles)

$OA = OD$ (Diagonals of rectangle are equal and bisect each other)

$OAD = ODA$

$OAD + ODA + OAD = 180°$

$OAD + ODA = 180° - 44°$

$OAD = 68°$

15. Trapezium $= PQRS$ $SP \parallel RQ$

$S = 90°$, $Q = 130°$

$P + Q = 180°$ (adjacent angles are supplement)

$P + 130° = 180°$

$P = 180° - 130° = 50°$

$S + R = 180°$

$90° + R = 180°$

$R = 180° - 90°$

$R = 90°$, $P = 50°$

16. $P = 2(l + b)$

Let length be $5x$ and breadth be $4x$

$90 = 2(5x + 4x)$

$90 = 10x + 8x$

$90 = 18x$ $\qquad x = \frac{90}{18} = 5$

length $= 5x = 5 \times 5 = 25$ cm

breadth $= 4x = 4 \times 5 = 20$ cm

17. $l = 12$ cm, $B = 5$ cm

According to pythagoras theorem.

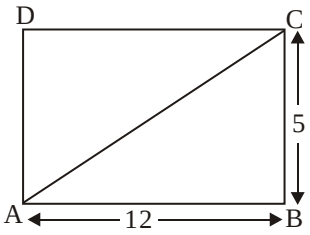
$AC^2 = AB^2 + BC^2$

$AC^2 = (12)^2 + (5)^2$

$AC^2 = 144 + 25$

$AC^2 = 169$

$AC = 13$ cm



18. In ||gm $ABFH$ = AHF = ABF

$120° = ABF$

In || gm $CDEG$ $EDC = CGE$

$70° = CGE$

In ||gm $ABFH$ $HAB + ABF = 180°$

$HAB + 120° = 180°$

$HAB = 180° - 120° = 60°$

$HAB = BFH = 60°$ (opp. angles)

In ΔOGF = $G = 70°$, $F = 60°$

$O = x°$

$O + F + G = 180°$ (Angle sum property)

$x + 60° + 70° = 180°$

$x = 180° - 130°$

$x = 50°$

19. (i) True, opposite angles of parallelogram.

(ii) True, AF is bisector of A

(iii) True CF is bisector of C

(iv) True, $CEB = DCE = FAB$

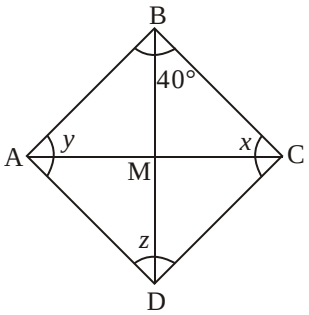
(v) True, corresponding angles are equal.

20. $B + M + C = 180°$

$B = 40°$, $M = 90°$

$C = x°$ (diagonals bisects at right angle)

$40° + 90° + x = 180°$



$x = 180° - 130°$

$x = 50°$

$\Delta DCB = DCM + MCB (x°)$

$\Delta DCB = DCM + 50°$

($DCM = MCB$)

(AC bisector)

$DCM = 50°$

$DCM = 50° + 50° = 100°$

$DCB = DAB$

$100° = y°$ (opp angles)

In ΔABC = ABM + MBC

= $ABM + 40°$

ABM = MBC (BD bisects B)

$\Delta ABC = 40° + 40° = 80°$

$\Delta ABC = \Delta ADC$ (opp. angles)

$80° = z$

$x = 50°$, $y = 100°$, $z = 80°$

21. Given $ABCD$ is a parallelogram

$AO = OC, BO = OD$

In ΔPOC and ΔAOQ

POC = AOQ (vertically opposite angles)

PCO = OAQ (alternate interior angles)

$AO = CO$ (diagonals bisect each other)

ΔPOC ΔAOQ

$OP = OQ$ (by CPCT)

Hence O is the mid point of PQ

22. In ΔEBC

$40° + x + 90° = 180°$

$x = 180° - 130°$

$x = 50°$

$z = 50°$ (opposite angles)

$90 + 50 + u$

$u = 180° - 140°$

$= 40°$

$y + 40 = 90°$ (alternate interior)

$y = 90° - 40°$

$= 50°$

23. Which of the following statements are True or False for rhombus?

(i) False (ii) True (iii) False (iv) True (v) False (vi) True

(vii) True

24. Which of the following statements are true or false for a rectangle and a square?

	Rectangle	Square
(i)	False	True
(ii)	False	True
(iii)	False	True
(iv)	False	True
(v)	True	True
(vi)	True	True

MCQs

1.	(a)	2.	(d)	3.	(b)	4.	(a)	5.	(b)	6.	(c)
7.	(c)	8.	(a)	9.	(b)	10.	(b)	11.	(d)	12.	(b)

11. $(2n-4)\times 90°$

$=(2\times 9-4)\times 90°$

$=14\times 90°$

$=1260°$

Fill in the blanks

1. $\left(\frac{360°}{n}\right)$ 2. 360° 3. pentagon 4. perpendicular bisector 5. isosceles 6. perpendicular 7. rhombus

8. convex polygon

True or False

1. True 2. False 3. False 4. True 5. False 6. False

7. False 8. True 9. False

11 Visualising Solid Shapes

Exercise 11.1

1. Fill in the blanks, the first one done for you.

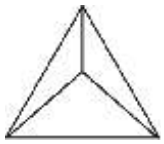
	V	E	F
(i)	0	0	1
(ii)	8	12	6
(iii)	6	9	5
(iv)	6	12	8
(v)	8	12	6
(vi)	0	2	3
(vii)	12	18	8
(viii)	4	6	4

2. Can a polyhedron have for its faces:

   (i) No

   (ii) Yes

   (iii) No



3. How many faces does each of the following solid figures have?

   (a) 2 (b) 6 (c) 9 (d) 3 (e) 8

4. How many vertices does each of the following solid figures have?

   (a) 6 (b) 4 (c) 6 (d) 12 (e) 6 (f) 9

5. How many edges does each of the following solid figures have?

(a) 12 (b) 6 (c) 12 (d) 18 (e) 12 (f) 8

6. How many edges the following solids have?

   (a) 12 (b) 9 (c) 0 (d) 8 (e) 6

7. $E = 30, \quad V = 20$

   Euler's formula $= V - E + F = 2$

   $= 20 - 30 + F = 2$

   $-10 + F = 2$

   $F = 2 + 10 = 12$

8. Using Euler's formula find the unknown:

   $V - E + F = 2$

   (i) $6 - 12 + F = 2$

   $-6 + F = 2$

   $F = 2 + 6 = 8$

   (ii) $V - 9 + 5 = 2$

   $V - 4 = 2$

   $V = 2 + 4 = 6$

   (iii) $12 - E + 20 = 2$

   $32 - E = 2$

   $-E = 2 - 32$

   $E = 30$

9. Do yourself.

10. Do yourself.

11.

		V	F	E	V + F − E
(a)	Triangular prism	6	5	9	6 + 5 − 9 = 2
(b)	Hexagonal prism	12	8	18	12 + 8 − 18 = 2

(c)	Hexagonal Pyramid	7	7	12	7 + 7 − 12 = 2
(d)	Pentagonal Pyramid	6	6	10	6 + 6 − 10 = 2
(e)	Cube	8	6	12	8 + 6 − 12 = 2
(f)	Rectangular Pyramid	5	5	8	5 + 5 − 8 = 2

MCQs

1.	(c)	2.	(a)	3.	(c)	4.	(a)	5.	(d)	6.	(a)
7.	(d)										

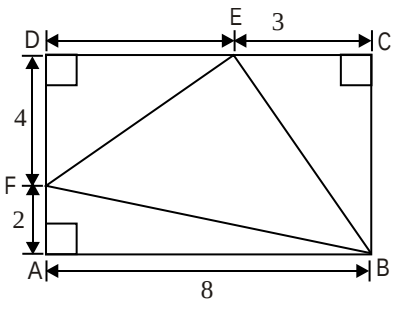
Fill in the blanks

1. 6 2. $F + V - E = 2$ 3. 3 4. 6, 6, 10 5. Vertex 6. 8,12, 6
7. Cuboid 8. Tetrahedron.

12 Area of a Trapezium and a Polygon

Exercise 12.1

1.



Area of rectangle = $l \times b$

$l = 8,\ b = 6\ (4+2)$

Area of rectangle $= 8 \times 6 = 48\ \text{cm}^2$

Area of $\Delta BEC = \frac{1}{2} \times b \times h$ (right angle at C)

$b = 3\,\text{cm}, \quad h = 6\,\text{cm}\ (4+2)$

$= \frac{1}{2} \times 3 \times 6 = 9\text{cm}^2$

Area of ΔFAB

$b = 8\,\text{cm}, \quad h = 2\,\text{cm}$ (right angle at A)

$\frac{1}{2} \times 8 \times 2 = 4 \times 2 = 8\text{cm}^2$

Area of ΔFDE (right angle at D)

$b = 5\,\text{cm}\ (8-3), \ h = 4\,\text{cm}$

$\frac{1}{2} \times 5 \times 4 = 10\text{cm}^2$

Area of shaded region = Area of rect– (Area of ΔBEC + Area of ΔFAB + Area of ΔFDE)

$= 48 - (9 + 8 + 10)$

$= 48 - 27 = 21\text{cm}^2$

2. Area of rhombus $= \frac{1}{2} \times$ product of diagonals

side $a = 13\,\text{cm}$

$d_1 = 24\,\text{cm}$

Phythagoras theorem $c^2 = a^2 + b^2$

Half of given diagonal $= \frac{d_1}{2} = \frac{24}{2} = 12$

and half of other diagonal be x

$x^2 + (12)^2 = (13)^2$

$x^2 + 144 = 169$

$x^2 = 169 - 144$

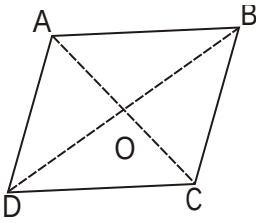
$x^2 = 25 \qquad x = 5$

Other diagonals $d_2 = 2x = 2 \times 5 = 10$ cm

Area of rhombus $= \frac{1}{2} \times 24 \times 10$

$= \frac{1}{2} \times 240 = 120$ cm^2

3. Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$



$24 = \frac{1}{2} \times 4 \times d_2$

$24 = 2d_2$

$d_2 = \frac{24}{2} = 12$ cm

$OA = \frac{d_1}{2} = \frac{4}{2} = 2$ cm $\qquad OB = \frac{d_2}{2} = \frac{12}{2} = 6$ cm

Using pythagoras theorem

$AB^2 = OA^2 + OB^2$

$AB^2 = (2)^2 + (6)^2 = 4 + 36 = 40$

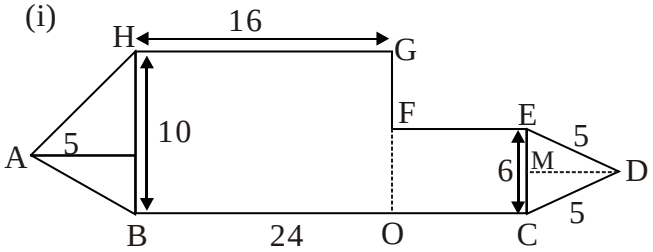
$AB = \sqrt{40} = 2\sqrt{10}$ cm

Perimeter of rhombus $= 4 \times$ side

$4 \times AB = 4 \times 2\sqrt{10} = 8\sqrt{10}$ cm

4. Find the area of shaded part in each of the following figures (2) and (3).

(i)



(I) Area of $\Delta ABH = \frac{1}{2} \times b \times h$

$b = 10, h = 5$ $\frac{1}{2} \times 10 \times 5 = 25 cm^2$

(II) Area of rectangle $BOGH = l \times b$

$l = 16$ cm, $b = 10$ cm

$= 16 \times 10 = 160$ cm^2

(III) Area of rectangle $OCEF = l \times b$

$b = 6$ cm

$l = 24 - 16 = 8$ cm

Area $= 8 \times 6 = 48 cm^2$

(IV) Area of $\Delta CDE = \frac{1}{2} \times b \times h$

$EH = 3$ cm, $h = ?$

$ED^2 = DM^2 + EM^2$

$(5)^2 = DM^2 + (3)^2$

$25 = DM^2 + 9$

$DM^2 = 16;$ $DM = 4$ cm

$h = DM = 4$ cm ; $b = 6$

$= \frac{1}{2} \times 6 \times 4 = 12 cm^2$

Add I + II + III + IV

$25 + 160 + 48 + 12 = 245 cm^2$

(ii) Area of rectangle $= l \times b$

$= 14 \times 14 = 196 cm^2$

Area of semi circle $= \frac{1}{2} \pi r^2$

$r = 7$ cm

$$= \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 = 11 \times 7 = 77 \text{cm}^2$$

Area of two semi circles $= 77 \times 2$

$= 154 \text{cm}^2$

Area of shaded region $= 196 - 154$

$= 42 \text{cm}^2$

5. $BC^2 = AB^2 + AC^2$

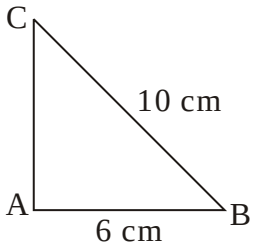
$(10)^2 = (6)^2 + AC^2$

$100 = 36 + AC^2$

$AC^2 = 100 - 36$

$AC^2 = 64$

$AC = 8 \text{ cm}$



Area $= \frac{1}{2} \times b \times h;$ $\quad b = 6, h = 8$

$= \frac{1}{2} \times 6 \times 8 = 3 \times 8 = 24 \text{cm}^2$

6. Area of ||gm $= b_1 h_1$ (longer side)

$= 10 \times 4 = 40 \text{m}^2$

$A = b_2 \times h_2$

$40 = 8 \times h_2$

$h_2 = \frac{40}{8} = 5 \text{ m}$

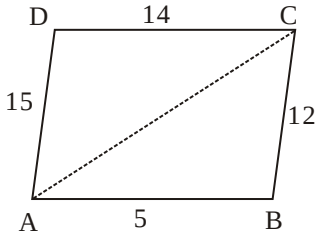
distance between shorter sides is 5 m.

7. $ABCD$ = area of ΔABC + area of ΔADC

Area of $\Delta ABC = \frac{1}{2} \times 5 \times 12 = 30 \text{cm}^2$

$AC^2 = AB^2 + BC^2$

$AC^2 = (5)^2 + (12)^2$



$AC^2 = 25 + 144$

$AC^2 = 169$

$AC = 13$

In $\Delta ADC = 2s$ be the perimeter

$2s = AD + DC + AC$

$= 15 + 14 + 13$

$s = \frac{1}{2} \times 42 = 21\text{ m}$

Area of $\Delta ADC = \sqrt{s(s - AD)(s - DC)(s - AC)}$

$= \sqrt{21(21 - 15)(21 - 14)(21 - 13)}$

$= \sqrt{21 \times 6 \times 7 \times 8} = 84\text{m}^2$

Area of quadrilateral $= 30 + 84 = 114\text{m}^2$

8. Area of trapezium $= \frac{1}{2} \times$ height $\times$ sum of parallel sides.

(I) Parallel side be x

(II) Parallel side is $x + 6$

$= \frac{1}{2} \times 7 \times (x + x + 6)$

$105 = \frac{7}{2} \times 2x + 6$

$\frac{105 \times 2}{7} = 2x + 6$

$30 = 2x + 6$

$30 - 6 = 2x$

$24 = 2x$

$x = \frac{24}{2} = 12$

$x = 12\text{ cm}, x + 6 = 12 + 6 = 18\text{ cm}$

9. Length of the sides $= 13x, 14x$ and $15x$

$P = 13x + 14x + 15x$

$84 = 42x$

$x = \frac{84}{42} = 2$

Side $1 = 13x = 13 \times 2 = 26\,\text{cm}$

$2 = 14x = 14 \times 2 = 28\,\text{cm}$

$3 = 15x = 15 \times 2 = 30\,\text{cm}$

$s = \frac{84}{2} = 42\,\text{cm}$

$A = \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{42(42-26)(42-28)(42-30)}$

$= \sqrt{42 \times 16 \times 14 \times 12}$

$= \sqrt{112896}$

$= 336\,\text{cm}^2$

10. Area of trapezium $= \frac{1}{2}(a+b)h$

$a = 15,\ b = 9,\ h = 8$

$\frac{1}{2}(15+9) \times 8 = \frac{1}{2} \times 24 \times 8$

$= 12 \times 8 = 96\,\text{cm}^2$

11. $A = \frac{1}{2}(b_1 + b_2)h$

$A = 65, \quad b_1 = 13,\ b_2 = 26, h = ?$

$65 = \frac{1}{2}(13+26)h$

$65 = \frac{1}{2} \times 39h$

$65 \times 2 = 39h$

$h = \frac{65 \times 2}{39} = \frac{130}{39} = \frac{10}{3}\,\text{cm}$

12. Area of trapezium $= \frac{1}{2} \times$ (sum of parallel sides) $\times h$

$$180 = \left(\frac{x + 2x}{2}\right) \times 12$$

$$\frac{x + 2x}{2} = \frac{180}{12}$$

$$\frac{x + 2x}{2} = 15$$

$$x + 2x = 15 \times 2$$

$$3x = 30$$

$$x = 10 \text{ cm}$$

Other parallel side $= 2 \times 10 = 20$ cm

13. Let the lengths of parallel side be $3x$ and $5x$

$$A = \frac{1}{2}(a + b)h$$

$a = 3x, b = 5x, \ h = 12$

$$720 = \frac{1}{2}(3x + 5x)12$$

$$720 = \frac{1}{2} \times 8x \times 12$$

$$720 = 8x \times 6$$

$$720 = 48x$$

$$x = \frac{720}{48} = 15$$

Lengths $3x = 3 \times 15 = 45$ cm

$5x = 5 \times 15 = 75$ cm

14. Area of quadrilateral $ABCD$ = area of $AMCD$ + Area of ΔBMC

$DC = AM = 7$ cm

$AB = AM + MB$

$13 = 7 + MB$

$MB = 13 - 7 = 6\,\text{cm}$

Area of $\Delta BMC = \frac{1}{2} \times b \times h$

$BC^2 = (MB)^2 + (MC)^2$

$(10)^2 = (6)^2 + (MC)^2$

$100 = 36 + MC^2$

$MC^2 = 100 - 36 = 64$

$MC = 8\,\text{cm}$

Area of $\Delta BMC = \frac{1}{2} \times 6 \times 8 = 24\,\text{cm}$

Area of rectangle $AMCD = l \times b$

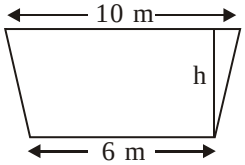
$= 7 \times 8 = 56\,\text{cm}^2$

Area of quadrilateral $ABCD = 56 + 24$

$= 80\,\text{cm}^2$

15. $A = 72$

$a = 10, b = 6$



$72 = \frac{1}{2}(10 + 6) \times h$

$72 = \frac{1}{2} \times 16 \times h$

$72 = 8h$

$h = \frac{72}{8} = 9\,\text{m}$

Exercise 12.2

1. Find the area enclosed by each of the following figures.

(i) Area of fig = Area of semicircle + Area of square – Area of Δ

Area of semi circle $= \frac{1}{2}\pi r^2 = r = \frac{17}{2} = 8.5$

$$= \frac{1}{2} \times \frac{22}{7} \times 8.5 \times 8.5 = 113.53 \text{cm}^2$$

Area of square $= 17 \times 17 = 289 \text{cm}^2$

Area of $\Delta = s\sqrt{s(s-a)(s-b)(s-c)}$

$$s = \frac{1}{2}(8 + 15 + 17)$$

$$s = \frac{1}{2} \times 40 = 20$$

$$= \sqrt{20(20-8)(20-15)(20-17)}$$

$$= \sqrt{20 \times 12 \times 5 \times 3}$$

$$= \sqrt{3600}$$

$$= 60 \text{cm}^2$$

Area of fig $= 113.53 + 289 - 60$

$$= 342.53 \text{cm}^2$$

(ii) Area of fig = Area of Δ + area of sq

Area of sq $= 14 \times 14 = 196 \text{cm}^2$

Area of $\Delta = \frac{1}{2} \times b \times h$

$b = 14, \quad h = (19 - 14) = 5$

$$= \frac{1}{2} \times 14 \times 5 = 7 \times 5 = 35 \text{ cm}^2$$

Area of fig $= 196 + 35 = 231 \text{cm}^2$

(iii) (I) Area of sq *ABCJ*

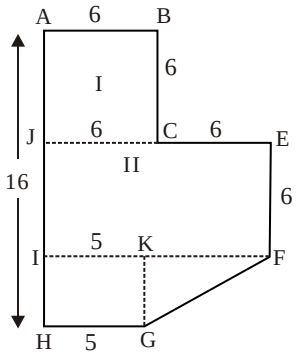
$= s^2 = 6 \times 6 = 36 \text{cm}^2$

(II) Area of rectangle

IFEJ $= l \times b$

$12 \times 6 = 72 \text{cm}^2$

(III) Area of rect *HGKI* $= l \times b$



$l = 5; b = 16 - (6 + 6)$

$= 16 - 12 = 4$

$5 \times 4 = 20\text{cm}^2$

(IV) Area of $\Delta KGF = \frac{1}{2} \times b \times h = \frac{1}{2} \times 6 \times 4$

$= 12\text{cm}^2$

Area of fig = I + II + III + IV

$= 36 + 72 + 20 + 12 = 140\text{cm}^2$

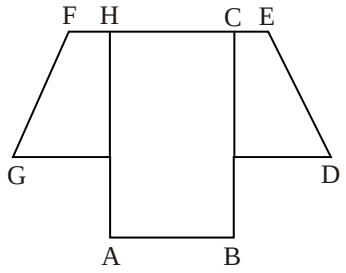
(iv) $5^2 = 4^2 + CE^2$

$CE^2 = 25 - 16 = 9, C = 3\text{ cm}$

and $GD = GH + HC + CD$

$= 4 + 6 + 4 = 14$

Area of fig = Area of rect *ABCH* + Area of trap. *GDEF*



$(AB \times BC) + \frac{1}{2} \times (GD + EF) \times CE$

$6 \times 4 + \frac{1}{2} \times (14 + 6) \times 3$

$24 + 30 = 54\text{cm}^2$

(v) $\frac{1}{2} \times 8 \times 3 + \frac{1}{2} \times 8 \times 4$

$12 + 16 = 28\text{cm}^2$

(vi) $\frac{1}{2} \times 10 \times 1 + \frac{1}{2} \times 10 \times 8$

$5 + 40 = 45\text{cm}^2$

2. Area of quad $PQRS$ = Area of ΔPQS + Area of QRS

$$h = \frac{15}{2} = 7.5$$

$$b = 18\,\text{cm}$$

$$= \frac{1}{2} \times 18 \times 7.5 = 9 \times 7.5 = 67.5$$

$$= 67.5 + 67.5 = 135\text{cm}^2$$

3. Area of Trapezium $= \frac{1}{2}$ (sum of parallel lines) $\times h$

$$112 = \frac{1}{2}(16 + 12) \times h$$

$$112 = \frac{1}{2} \times 28 \times h$$

$$112 \times 2 = 28h$$

$$224 = 28h$$

$$h = \frac{224}{28} = 8\,\text{m}$$

4. Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$$216 = \frac{1}{2} \times 18 \times d_2$$

$$216 = 9d_2 = \frac{216}{9} = 24\,\text{cm}$$

5. Area of rhombus $= \frac{1}{2} \times 18 \times 30$

$$= 9 \times 30 = 270\text{cm}^2$$

6. Area of trapezium $ABCD = \frac{1}{2} \times (AD + BC) \times h$

$$= \frac{1}{2}(7 + 12) \times 5$$

$$= \frac{1}{2}(19) \times 5$$

$$= 47.5 \text{ m}^2$$

Area of $EFGH = 47.5 \text{m}^2$

Area of rectangle $AHDE = l \times b$

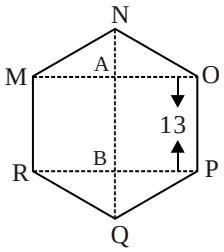
$$= 12 \times 7$$

$$= 84 \text{m}^2$$

Area $= (47.5 + 47.5 + 84) \text{m}^2$

$$= 179 \text{m}^2$$

7. Join QN



$AN = BQ$

$QN = QB + BA + AN$

$23 = AN + 13 + AN$

$2AN = 23 - 13 = 10$

$AN = \frac{10}{2} = 5 \text{ cm}$

In $\Delta MAN = MN^2 = AN^2 + AM^2$

$$13^2 = 5^2 + AM^2$$

$$AM^2 = 169 - 25 = 144$$

$$AM = 12 \text{ cm}$$

$OM = RP = 2 \times AM = 2 \times 12 = 24 \text{ cm}$

$$= \left(\frac{1}{2} \times OM \times AN\right) + (RP + PO) + \left(\frac{1}{2} \times RP \times BQ\right)$$

$$= \frac{1}{2} \times 24 \times 5 + (24 \times 13) + \frac{1}{2} \times 24 \times 5$$

$$= 60 + 312 + 60$$

$$= 432 \text{cm}^2$$

8. In ΔFPE

$FP = 10\,\text{cm}$

$EP = 40\,\text{cm}$

Area of $\Delta FPE = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 10 \times 40 = 200\,\text{cm}^2$

Area of trapezium $EPRD = \frac{1}{2} \times (\text{sum of parallel sides}) \times h$

$= \frac{1}{2} \times (40 + 60) \times 40$

$= \frac{1}{2} \times (100) \times 40$

$= 200\,\text{cm}^2$

Area of $\Delta RDC = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 50 \times 60$

$= 1500\,\text{cm}^2$

Area of $\Delta = \frac{1}{2} \times 20 \times 20$

$= 200\,\text{cm}^2$

Area of trapezium $= \frac{1}{2} \times (\text{sum of parallel sides}) \times h$

$= \frac{1}{2} \times (20 + 10) \times 40$

$= \frac{1}{2} \times 30 \times 40$

$= 600\ \text{cm}^2$

Area of $\Delta = \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times 40 \times 10$$

$$= 200\,cm^2$$

$$\text{Area} = (200 + 2000 + 1500 + 200 + 600 + 200)\,cm^2$$

$$= 4700\,cm^2$$

MCQs

1.	(b)	2.	(d)	3.	(a)	4.	(c)	5.	(d)	6.	(a)
7.	(c)	8.	(a)								

1. $\text{Area} = \frac{1}{2} \times d_1 \times d_2$

$$70 = \frac{1}{2} \times 14 \times d_2$$

$$\frac{70 \times 2}{14} = 10\,cm$$

2. $\text{Area} = \frac{1}{2} \times (\text{sum of parallel sides}) \times h$

$$40 = \frac{1}{2}(12 + 8) \times h$$

$$\frac{40 \times 2}{20} = h$$

$$4\,cm = h$$

4. Perimeter of square = 80 cm

$$\text{Side} = \frac{80}{4} = 20\,cm$$

$$\text{Area} = \text{side} \times \text{side}$$

$$= 20\,cm \times 20\,cm$$

$$= 400\,cm^2$$

5. Area of trapezium $= \frac{1}{2} \times (\text{sum of parallel sides}) \times h$

$$64 = \frac{1}{2} \times (\text{sum of parallel sides}) \times 8$$

$$\frac{64 \times 2}{8} = \text{sum of parallel sides}$$

$$16 \text{ cm} = \text{sum of parallel sides}$$

6. Area of $\Delta ABD = \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times 10 \times 4$$

$$= \frac{1}{2} \times 40$$

$$= 20 \text{ cm}^2$$

Area of $\Delta BCD = \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times 10 \times 6$$

$$= 30 \text{ cm}^2$$

$$\text{Area} = 20\text{cm}^2 + 30\text{cm}^2$$

$$= 50\text{cm}^2$$

7. Area of trapezium $= \frac{1}{2} \times (\text{sum of parallel sides}) \times h$

$$= \frac{1}{2} \times (5 + 3) \times 4.5$$

$$= \frac{1}{2} \times 8 \times 4.5$$

$$= 18\text{cm}^2$$

Area of trapezium $= \frac{1}{2} \times (5 + 3) \times 5$

$$= \frac{1}{2} \times 8 \times 5 = 20 \text{cm}^2$$

Area of triangle $= \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times 5 \times 2$$

$$= 5 \text{cm}^2$$

Area of triangle $= \frac{1}{2} \times 4.5 \times 2$

$$= 4.5 \text{cm}^2$$

Area $= 18 \text{ cm}^2 + 20 \text{ cm}^2 + 5 \text{ cm}^2 + 4.5 \text{ cm}^2$

$= 47.5 \text{ cm}^2$

Fill in the blanks

1. 1 2. diagonals 3. height 4. sum 5. two 6. 3, equal

True or False

1. False 2. False 3. True 4. True 5. True 6. True.

13 Volume and Surface Area

Exercise 13.1

1. Find the volume of a cuboid whose

(i) Volume of cuboid $= l \times b \times h$

$$= 10 \times 12 \times 14 = 1680 \text{cm}^3$$

(ii) Volume $= l \times b \times h$

$6 \text{ dm} \times 8 \text{ dm} \times 10 \text{ dm} = 480 \text{ dm}^3$

(iii) Volume $= l \times b \times h$

$30\,\text{cm} \times 15\,\text{cm} \times 12\,\text{cm} = 5400\,\text{cm}^3$

(iv) Volume $= l \times b \times h$

$12 \times 10 \times 7.5 = 900\,\text{cm}^3$

2. Find the volume, total surface area, lateral surface area and length of diagonal of a cuboid with dimensions

(i) Total surface area $= 2(lb + bh + hl)$

$l = 10\,\text{cm}, \quad b = 9\,\text{cm}, \quad h = 6\,\text{cm}$

$2(10 \times 9) + (9 \times 6) + (6 \times 10)$

$2(90 + 54 + 60)$

$2 \times 204 = 408\,\text{cm}^2$

Volume $= l \times b \times h$

Volume $= 10 \times 9 \times 6 = 540\,\text{cm}^3$

lateral surface area $= 2h(l + b)$

$2 \times 6(10 + 9)$

$2 \times 6 \times 19 = 228\,\text{cm}^2$

Diagional $= \sqrt{l^2 + b^2 + c^2}$

$= \sqrt{(10)^2 + (9)^2 + (6)^2}$

$= \sqrt{100 + 81 + 36} = \sqrt{217}$

$= 14.73\,\text{cm}$

(ii) Volume $= l \times b \times h$

Volume $= 50 \times 27 \times 15 = 20250\,\text{cm}^3$

TSA $= 2(50 \times 27) + (27 \times 15) + (15 \times 50)$

$= 2 \times (1350 + 405 + 750)$

$= 2 \times 2505 = 5010\,\text{cm}^3$

LSA $= 2h(l + b)$

$= 2 \times 15(50 + 27)$

$= 2 \times 15 \times 77 = 2310 \text{cm}^2$

Diagonal $= \sqrt{l^2 + b^2 + c^2}$

$= \sqrt{(50)^2 + (27)^2 + (15)^2}$

$= \sqrt{2500 + 729 + 225}$

$= \sqrt{3454} = 58.77$ cm

(iii) Volume $= l \times b \times h$

Volume $= 16.5 \times 8.3 \times 4.6 = 629.97$

TSA $= 2(16.5 \times 8.3 + 8.3 \times 4.6 + 4.6 \times 16.5)$

$= (2 \times 136.95 + 38.18 + 75.9)$

$= 502.06 \text{m}^2$

LSA $= 2h(l + b)$

$= 2 \times 4.6(16.5 + 8.3)$

$= 2 \times 4.6 \times 24.8 = 228.16 \text{ m}^2$

Diagonal $= \sqrt{(16.5)^2 \times (8.3)^2 \times (4.6)^2}$

$= \sqrt{272.25 + 68.89 + 21.16}$

$= \sqrt{362.27} = 19.03$ m

(iv) length $= \frac{1}{2}$ m, breadth $= \frac{7}{10}$ m $h = \frac{2}{5}$ m

Volume $= l \times b \times h$

volume $= \frac{1}{2} \times \frac{7}{10} \times \frac{2}{5} = \frac{7}{50} \text{m}^3$

TSA $= 2\left(\frac{1}{2} \times \frac{7}{10} + \frac{7}{10} \times \frac{2}{5} + \frac{2}{5} \times \frac{1}{2}\right)$

$= 2 \times \left(\frac{7}{20} + \frac{14}{50} + \frac{2}{10}\right)$

$= 2 \times \left(\frac{14 + 28 + 20}{100}\right)$

$$= \frac{124}{100} = \frac{31}{25} m^2$$

LSA $= 2h(l + b)$

$$= 2 \times \frac{2}{5}\left(\frac{1}{2} + \frac{7}{10}\right)$$

$$= 2 \times \frac{2}{5}\left(\frac{10 + 14}{20}\right)$$

$$= 2 \times \frac{2}{5} \times \frac{24}{20} = 0.96 \text{ m}^2$$

Diagonal $= \sqrt{l^2 + b^2 + c^2}$

$$= \sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{7}{10}\right)^2 + \left(\frac{2}{5}\right)^2}$$

$$= \sqrt{\frac{1}{4} + \frac{49}{100} + \frac{4}{25}}$$

$$= \sqrt{\frac{25 + 49 + 16}{100}} = \sqrt{\frac{90}{100}}$$

$$= 0.094 \text{ m}$$

3. Volume of gold biscuit $= (8 \times 5 \times 2)$ cm

$$= 80 \text{cm}^2$$

Volume of small lockets $= 2.5 \text{ cm}^3$

No. of lockets $= \frac{80}{2.5} = 32$ lockets

4. Volume of alarm clocks $= (5 \times 10 \times 10)$ cm

$$= 500 \text{cm}^3$$

Volume of box $= 1\text{m} \times \frac{1}{2}\text{m} \times \frac{3}{4}\text{m}$

Change into cm $= 100 \times \frac{1}{2} \times 100 \times \frac{3}{4} \times 100$

$$= 100 \times 50 \times (3 \times 25)$$

$= 375000\,cm^3$

No. of alarm clocks that can be packed

$= \frac{375000}{500} = 750$ clocks

5. Volume of brick $= (25 \times 10.5 \times 9)$ cm

$= 2362.5\,cm^3$

Volume of wall $= 18m \times 8m \times 21m$

Change into cm $= 1800 \times 800 \times 2100$

$= 3024000000\,cm^3$

No. of bricks needed $= \frac{3024000000}{2362.5}$

$= 1280000$ bricks

6. Surface area $= 2(lb + bh + hl)$

Let $l = 4x,\ b = 2x,\ h = x$

$2800 = 2(4x \times 2x) + (2x \times x) + (x \times 4x)$

$2800 = 2(8x^2 + 2x^2 + 4x^2)$

$2800 = 2(14x^2)$

$2800 = 28x^2$

$x^2 = \frac{2800}{28} = 100$

$x = \sqrt{100} = 10$

$l = 4 \times 10 = 40$ cm

$b = 2 \times 10 = 20$ cm

$h = 10$ cm

7. Subtract twice the thickness from external length, breadth and height

$40 - (2 \times 2.5) = 40 - 5 = 35$ cm

$35 - (2 \times 2.5) = 35 - 5 = 30$ cm

$20 - (2 \times 2.5) = 20 - 5 = 15$ cm

Multiply internal dimensions

$35 \times 30 \times 15 = 15750\,m^3$.

8. $b = l - 2,\ h = b - 1$

$h = (l - 2) - 1 = l - 3$

$SA = 2(lb + bh + hl)$

$188 = 2(l(l - 2) + (l - 2)(l - 3) + (l - 3)l)$

$94 = l^2 - 2l + l^2 - 3l - 2l + 6 + l^2 - 3l$

$94 = 3l^2 - 10l + 6$

$3l^2 - 10l + 6 - 94$

$3l^2 - 10l - 88$

$3l(l + 4) - 22(l + 4)$

$(l + 4)(3l - 22)$

$l = 4, l = \frac{22}{3}$

length $= \frac{22}{3}$ m

breadth $= (l - 2) = \left(\frac{22}{3} - 2\right) = \frac{22 - 6}{3} = \frac{16}{3}$ m

height $= b - 1 = \frac{16}{3} - 1 = \frac{16 - 3}{3} = \frac{13}{3}$ m

Volume of cuboid $= l \times b \times h$

$= \frac{22}{3} \times \frac{16}{3} \times \frac{13}{3}$

$= \frac{4576}{27} m^3 = 169\frac{13}{27} m^3$

9. (i) Let the height of cuboid be h

length $= 2l$

breadth $= \frac{1}{2}b$

Volume $= 2l \times b \times \frac{1}{2}h$

$l \times b \times h = 2l \times b \times \frac{1}{2}h$

$l \times b \times h = l \times b \times h$ same

(ii) length $= 2l$, breadth $= b$, height $= 2h$

$l \times b \times h = 2l \times b \times 2h = 4$ times

10. Volume of cuboid$_1$ $= (50 \times 45 \times 34)\text{cm} = 76500\text{cm}^3$

Volume of cuboid$_2$ $= (5 \times 3 \times 2)\text{cm} = 30\text{cm}^3$

No. of cuboids that can be obtained

$$= \frac{76500}{30} = 2550$$

Exercise 13.2

1. Find the volume of a cube of :

(i) Volume of cube $= (\text{side})^3$

$= 15 \times 15 \times 15 = 3375\text{cm}^3$

(ii) $9.5 \times 9.5 \times 9.5 = 857.375\text{m}^3$

(iii) $5 \times 5 \times 5 = 125\text{cm}^3$

(iv) $6 \times 6 \times 6 = 216\ \text{cm}^3$

(v) $1.2 \times 1.2 \times 1.2 = 1.728\ \text{cm}^3$

2. Find volume, total surface area, lateral surface area and length of diagonal of a cube with

(i) Volume $= a^3 = 10 \times 10 \times 10$

$= 1000\text{cm}^3$

TSA $= 6a^2 = 6 \times 10 \times 10 = 600\text{cm}^2$

LSA $= 4a^2 = 4 \times 10 \times 10 = 400\text{cm}^2$

Diagonal $= a\sqrt{3}$

$10\sqrt{3}$ or $10 \times 1.732 = 17.32$ cm

(ii) Volume $= (25)^3 = 15625 \text{cm}^3$

TSA $= 6 \times 25 \times 25 = 3750 \text{cm}^2$

LSA $= 4 \times 25 \times 25 = 2500 \text{cm}^2$

Diagonal $= a\sqrt{3} = 25\sqrt{3}$

$= 25 \times 1.732 = 43.3$ cm

(iii) Volume $= (32)^3 = 32 \times 32 \times 32 = 32768 \text{cm}^3$

TSA $= 6 \times 32 \times 32 = 6144 \text{cm}^2$

LSA $= 4 \times 32 \times 32 = 4096 \text{cm}^2$

Diagonal $= 32\sqrt{3} = 32 \times 1.732$

$= 55.424$ cm

(iv) Volume $= 50 \times 50 \times 50 = 125000 \text{cm}^3$

TSA $= 6 \times 50 \times 50 = 15000 \text{cm}^2$

LSA $= 4 \times 50 \times 50 = 10000 \text{cm}^2$

Diagonal $= a\sqrt{3} = 50 \times 1.732$

$= 86.6$ cm

(v) Volume $= 3.2 \times 3.2 \times 3.2 = 32.768 \text{cm}^3$

TSA $= 6 \times 3.2 \times 3.2 = 61.44 \text{cm}^2$

LSA $= 4 \times 3.2 \times 3.2 = 40.96 \text{cm}^2$

Diagonal $= a\sqrt{3} = 3.2 \times 1.732$

$= 5.5424$ cm

3. Let side of cube IInd is x

Then side length of cube Ist is $2x$

Volume of cube Ist $= (2x)^3 = 8x^3$

Volume of cube IInd $= x^3$

Ratio = $8x^3 : x^3$ 8 : 1

4. Volume of cube I 18 cm = $(18)^3$ = 5832 cm^3

   Volume of cube II 24 cm = $(24)^3$ = 13824 cm^3

   Volume of cube III 30 cm = $(30)^3$ = 27000 cm^3

   = 5832 + 13824 + 27000

   Total volume = 46656 cm^3

   $(V)^3$ = 46656

   $V = \sqrt[3]{46656} = \sqrt{36 \times 36 \times 36}$

   Edge/side of cube = 36 cm

5. Volume of one cube = $(6)^3$ = 216 cm^3

   Volume of 6 cubes = 6×216 = 1296 cm^3

   Volume of new solid = 1296 cm^3

6. Let the side of cube $B = x$

   Side of cube $A = 3x$

   Volume of cube $A = (3x)^3 = 27x^3$

   Volume of cube $B = (x)^3 = x^3$

   $27x^3 : x^3$

   Ratio 27 : 1

7. Let the edge of the cube be x

   The volume = x^3

   (i) Edge is halved

   Volume = $\left(\frac{1}{2}x\right)^3 = \frac{1}{8}x^3 = \frac{1}{8}$ times

   (ii) Edge = $3x$

   Volume = $(3x)^3 = 27x^3$

8. Volume of V_1 = $(2)^3$ = 8 cm^3

Volume of $V_2 = (4)^3 = 64\text{cm}^3$

V_2 is 8 times bigger than V_1

9. Let the edge length of each cube be A

$l = 3A, \quad B = A, \quad H = A$

$s = 2(LB + BH + HL)$

$s = 2((3A):A) + (A:A) + (A:3A)$

$s = 2(3A^2 + A^2 + 3A^2) = 2(7A^2) = 14A^2$

Surface area of cuboid $= 14A^2$

$s = 6A^2$

$3 \times s = 3 \times 6A^2 = 18A^2$

Surface area of cube $= 18A^2$

$$\text{Ratio} = \frac{\text{TSA of cuboid}}{\text{TSA of cube}} = \frac{14A^2}{18A^2}$$

$$\text{Ratio} = \frac{14}{18} = \frac{7}{9} = 7 : 9$$

10. Volume of $V_1 = (3)^3 = 27\text{cm}^3$

Volume of $V_2 = (4)^3 = 64\text{cm}^3$

Volume of $V_3 = (5)^3 = 125\text{cm}^3$

Total volume $= 27 + 64 + 125 = 216$

$a = \sqrt[3]{216}$

side $a = 6$ cm

surface area of new cube $= 6 \times (6)^2$

$= 6 \times 36 = 216\text{cm}^2$

Exercise 13.3

1. Find the volume of a cylinder with

(i) Volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 7 \times 7 \times 10 = 1540 \text{cm}^3$$

(ii) $V = \frac{22}{7} \times 1.4 \times 1.4 \times 5$

$= 22 \times 0.2 \times 1.4 \times 5 = 30.8 \text{cm}^3$

(iii) $V = \frac{22}{7} \times 10 \times 10 \times 28 = 8800 \text{cm}^3$

(iv) $V = \frac{22}{7} \times \frac{15}{11} \times \frac{15}{11} \times \frac{14}{5}$

$= \frac{2 \times 3 \times 15 \times 2}{11} = \frac{180}{11} \text{cm}^3$

2. Find the volume, the curved surface area, and the total surface area of the cylinders whose dimensions are :

(i) $R = 7\text{m} = 700\,\text{cm}$

$H = 50\,\text{cm}$

$V = \pi r^2 h = \frac{22}{7} \times 700 \times 700 \times 50$

$22 \times 100 \times 700 \times 50 = 770,00,000 \text{cm}^3$

$\text{CSA} = 2\pi r h = 2 \times \frac{22}{7} \times 700 \times 50$

$= 2 \times 22 \times 100 \times 50 = 220000 \text{cm}^2$

$\text{TSA} = 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 700(50 + 700)$

$= 2 \times 22 \times 100(750) = 3300000 \text{cm}^2$

(ii) $V = \frac{22}{7} \times 5.6 \times 5.6 \times 1.25$

$= 22 \times 0.8 \times 5.6 \times 1.25 = 123.2 \text{m}^3$

$\text{CSA} = 2 \times \frac{22}{7} \times 5.6 \times 1.25$

$= 2 \times 22 \times 0.8 \times 1.25 = 44 m^2$

$TSA = 2 \times \frac{22}{7} \times 5.6(1.25 + 5.6)$

$= 2 \times 22 \times 0.8(6.85)$

$= 2 \times 22 \times 5.48 = 241.12 m^2$

(iii) $R = 14$ dm 1m = 10 dm

$14 \text{ dm} = \frac{14}{10} = 1.4 \text{ m}$

$V = \frac{22}{7} \times 1.4 \times 1.4 \times 15$

$= 22 \times 0.2 \times 1.4 \times 15 = 92.4 m^3$

$CSA = 2 \times \frac{22}{7} \times 1.4 \times 15$

$= 2 \times 22 \times 0.2 \times 15 = 132 m^2$

$TSA = 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 1.4(15 + 1.4)$

$= 2 \times 22 \times 0.2(16.4)$

$= 2 \times 22 \times 3.28$

$= 144.32 m^2$

(iv) $V = \frac{22}{7} \times 7 \times 7 \times 40$

$= 22 \times 7 \times 40 = 6160 cm^3$

$CSA = 2 \times \frac{22}{7} \times 7 \times 40$

$= 2 \times 22 \times 40 = 1760 cm^2$

$TSA = 2 \times \frac{22}{7} \times 7(40 + 7)$

$= 2 \times 22 \times (47) = 2068 cm^2$

(v) $V = \frac{22}{7} \times 2.8 \times 2.8 \times 1.5$

$= 22 \times 0.4 \times 2.8 \times 1.5 = 36.96 m^3$

$CSA = 2 \times \frac{22}{7} \times 2.8 \times 1.5$

$= 2 \times 22 \times 0.4 \times 1.5 = 26.4 m^2$

$TSA = 2 \times \frac{22}{7} \times 2.8(1.5 + 2.8)$

$= 2 \times 22 \times 0.4(4.3)$

$= 2 \times 22 \times 1.72 = 75.68 m^2$

3. Volume of well = $594 m^3$

Diameter = 6 m

$r = \frac{d}{2} = 3$ m

$h = ?$ Volume = $\pi r^2 h$

$594 = \frac{22}{7} \times 3 \times 3 \times h$

$h = \frac{594 \times 7}{22 \times 9} = \frac{4158}{198} = 21$

depth of well = 21 m

4. CSA = $4400 cm^2$

Circumference = 220 cm

$C = 2\pi r$ $220 = 2 \times \frac{22}{7} \times r$

$r = \frac{220 \times 7}{2 \times 22} = \frac{220 \times 7}{44} = 5 \times 7$

radius = 35 cm

$CSA = 2\pi rh$

$4400 = 2 \times \frac{22}{7} \times 35 \times h$

$$4400 = 2 \times 22 \times 5 \times h$$

$$h = \frac{4400}{44 \times 5} = \frac{100}{5} = 20\,\text{cm}$$

Volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 35 \times 35 \times 20$$

$$V = 22 \times 5 \times 35 \times 20 = 77000\,\text{cm}^3$$

5. Length of rectangular sheet = 44 cm

breadthof rectangular sheet = 22 cm

length = circumference of circle

$$44 = 2\pi r$$

$$44 = 2 \times \frac{22}{7} \times r$$

$$r = \frac{44 \times 7}{2 \times 22} = \frac{14}{2} = 7\,\text{cm}$$

$$\text{TSA} = 2\pi r(h + r)$$

$$= 2 \times \frac{22}{7} \times 7(22 + 7)$$

$$= 2 \times 22(29) = 1276\,\text{cm}^2$$

Volume $= \pi r^2 h$

$$= \frac{22}{7} \times 7 \times 7 \times 22 \qquad 22 \times 7 \times 22$$

$$= 3388\,\text{cm}^3$$

6. Volume of coin $= \pi r^2 h$

$r = 0.75$ cm, $h = 0.2$ cm

$$= \frac{22}{7} \times 0.75 \times 0.75 \times 0.2$$

$$= \frac{22}{7} \times 0.5625 \times 0.2 = \frac{22}{7} \times 0.1125$$

$= 0.356 \text{cm}^3$

Volume of right circular cylinder

$$r = \frac{d}{2} = \frac{6}{2} = 3 \text{ cm}$$

$$= \frac{22}{7} \times 3 \times 3 \times 8$$

$$= \frac{22}{7} \times 72$$

Coins to be melted $= \frac{22}{7} \times 72 \div \frac{22}{7} \times 0.1125$

$$= 72 \div 0.1125 = 640$$

7. Radius of first cylinder $= r_1$

radius of second cylinder $= r_2$

$r_1 : r_2 = 2 : 3 \quad 2x : 3x$

height of first cylinder $= h_1$

height of second cylinder $= h_2$

$h_1 : h_2 = 5 : 4 \quad 5y : 4y$

Volume of cylinder $= \pi r^2 h$

$$V_1 = \pi \times 2x \times 2x \times 5y = 20\pi x^2 y$$

$$V_2 = \pi \times 3x \times 3x \times 4y = 36\pi x^2 y$$

Ratio of volumes $= \frac{20\pi x^2 y}{36\pi x^2 y} = \frac{20}{36} = \frac{5}{9}$

Answer : 5 : 9

8. Internal radius = 3 cm $= r_1$

External radius $= 3.5 \text{cm} = r_2$

height $= 56$ cm $= h$

TSA $= 2\pi(r_2 - r_1)h + 2\pi(r_2 - r_1)$

CSA $= 2\pi r_2 h + 2\pi r_1 h$

or $= 2\pi h(r_2 + r_1)$

$= 2\pi \times 56 \times (3.5 + 3)$

$= 2 \times \pi \times 56 \times 6.5 = 728\pi$

Area of outer and inner circles

Outer circle = πr_2^2

Inner circle = πr_1^2

$2\pi(r_2^2 - r_1^2)$ $2\pi((3.5)^2 - (3)^2)$

$2\pi(12.25 - 9)$

$2\pi(3.25)$ 6.5π

TSA = CSA + Areas (Outer – inner circle)

$= 728\pi + 6.5\pi$

$= 734.5\pi$ $734.5 \times \frac{22}{7}$

TSA = 2306.35 cm^2

9. Volume of cylinder = $\pi r^2 h$

radius = $7x$, height = $2x$

$$8316 = \frac{22}{7} \times (7x)^2 \times (2x)$$

$$= \frac{8316 \times 7}{22} = 49x^2 \times 2x$$

$$= \frac{378 \times 7}{49 \times 2} = x^3$$

$27 = x^3$; $x = \sqrt[3]{27}$

$x = 3$ cm

radius = $7x = 7 \times 3 = 21$ cm

height = $2x = 2 \times 3 = 6$ cm

CSA = $2\pi rh$

$= 2 \times \frac{22}{7} \times 21 \times 6$

$= 2 \times 22 \times 3 \times 6 = 792 m^2$

10. Revolutions = 1000, r = 42 cm, h = 50 cm

$$\text{CSA} = 2\pi rh = 2 \times \frac{22}{7} \times 42 \times 50$$

$$= 2 \times 22 \times 6 \times 50$$

$$= 13200\,\text{cm}^2$$

Area of road $= 13200 \times 1000$

$$= 13200000\,\text{cm}^2$$

Change in metre

$$= 13200000 \frac{1}{100} \times \frac{1}{100} = 1320\,\text{m}^2$$

MCQs

1.	(d)	2.	(b)	3.	(b)	4.	(b)	5.	(c)	6.	(d)
7.	(a)	8.	(c)	9.	(d)	10.	(c)				

1. Volume $= a^3$

$$= (3x)^3$$

$$= 27x^3$$

2. Volume $= l \times b \times h$

$$= 5a \times 3b \times 2c$$

$$= 30abc$$

3. Lateral surface area of cuboid $= 2h(l + b)$

$$= 2 \times 5(11 + 8)$$

$$= 190\,\text{cm}^2$$

5. Volume of cube $= a^3$

$$2197 = a^3$$

$$\sqrt[3]{2197} = a$$

$$13 = a$$

Surface area of cube $= 6a^2$

$= 6 \times 13 \times 13$

$= 1014 \text{cm}^3$

6. Let edges be $1x, 2x$ and $3x$

TSA $= 88 \text{ cm}^2$

TSA $= 2(lb + bh + hl)$

$88 = 2(2x^2 + 6x^2 + 3x^2)$

$\frac{88}{2} = (11x^2)$

$\frac{88}{2 \times 11} = x^2$

$\sqrt{4} = x$

$x = 2$

Sides $= 1x = 1 \times 2 = 2 \text{ cm}$

$2x = 2 \times 2 = 4 \text{ cm}$

$3x = 3 \times 2 = 6 \text{ cm}$

Volume $= l \times b \times h$

$= (2 \times 4 \times 6) \text{ cm}$

$= 48 \text{cm}^3$

9. Area $= \pi r^2$

$88 = \frac{22}{7} \times r^2$

$\frac{88 \times 7}{22} = r^2$

$28 = r^2$

Volume $= \pi r^2 h$

$= \frac{22}{7} \times 28 \times 15$

$= 1320 \text{ cm}^3$

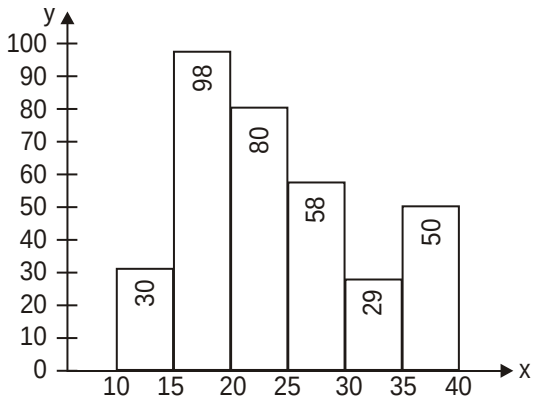
Fill in the blanks

1. 8 2. 8 times 3. $4\pi r^2$ 4. 414 π cm^3
5. $l \times b \times h$ 6. l 7. half 8. 1000, 1000000
9. 1 10. 1 11. 10^6 12. 50.

14 Data Handling

Exercise 14

1. Draw a histogram of the following data :



2. The following histogram shows the number of literate females in the age group of 10 to 40 years in a town.

(i) 15-20 1100

(ii) 5 $(15 - 10 = 5)$

(iii) 320

(iv) Class mark = $\frac{\text{upper limit + lower limit}}{2}$

$\frac{5+10}{2}, \frac{10+15}{2}, \frac{15+20}{2}, \frac{20+25}{2}, \frac{25+30}{2}$

7.5, 12.5, 17.5, 22.5, 27.5

(v) 10-15

3. Read the histogram and answer the following questions :

(i) No of employees = 6 + 4 + 2 + 10 + 8 = 30

(ii) (10 – 5 = 5)

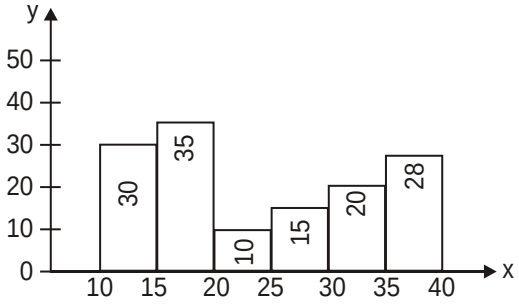
(iii) 20000 – 25000 (20-25)

(iv) 15-20

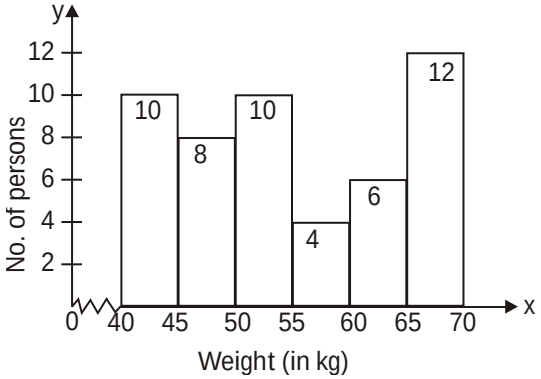
(v) 2

(vi) Number of employees and their salary.

4. Draw a histogram for the following table.



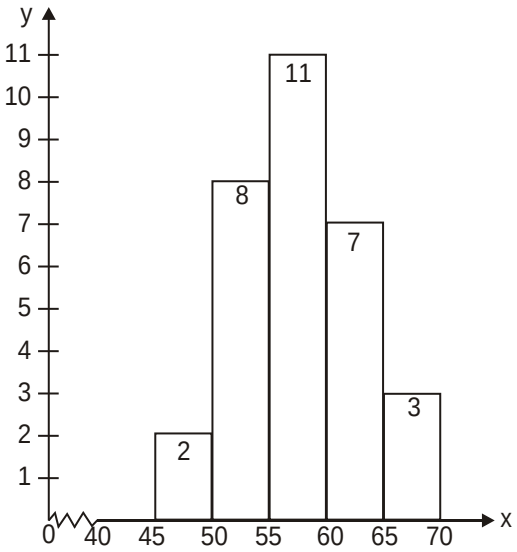
5. The following is the distribution of weight (in kg) of 50 persons.



(i) 65 -70 (ii) 45 – 40 = 5

(iii) 55-60

6. Draw a histogram to represent the following data:



7. The histogram given below shows marks obtained by 82 students of class VIII in a mathematics test.

   (i) $20 - 10 = 10$

   (ii) $4 + 8 + 6 + 12 + 8 = 38$

   (iii) $16 + 8 = 24$

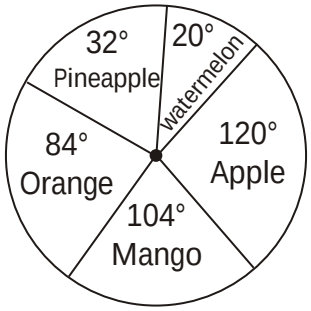
   (iv) $4 + 4 = 8$

   (v) $12 + 8 = 20$

   (vi) $4 + 8 + 6 + 12 = 30$

Exercise 14.2

1. The following table shows the number of fruits of different types kept in a gift hamper. Represent this data by a pie-chart.

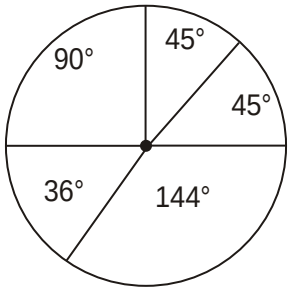


Fruit	No. of fruits	Fraction	Central angle
Mango	26	$\frac{26}{90}=\frac{13}{45}$	$\frac{13}{45}\times 360°=104°$
Apple	30	$\frac{30}{90}=\frac{1}{3}$	$\frac{1}{3}\times 360°=120°$
Watermelon	5	$\frac{5}{90}=\frac{1}{18}$	$\frac{1}{18}\times 360°=20°$
Pineapple	8	$\frac{8}{90}=\frac{4}{45}$	$\frac{4}{45}\times 360°=32°$
Orange	21	$\frac{21}{90}=\frac{7}{30}$	$\frac{7}{30}\times 360°=84°$
	90		

2. The percentage of various categories of workers in a state are given in the following table. Represent this data by a pie-chart.

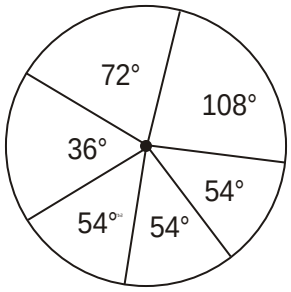
Cateogories	% of workers	Central Angle
Cultivators	40 = 40 % of 360	144
Agricultural	25 = 25 % of 360	90
Industrial	12.5 = 12.5 % of 360	45
Commerical	10 = 10 % of 360	36

Others	12.5 % of 360	45
		360°

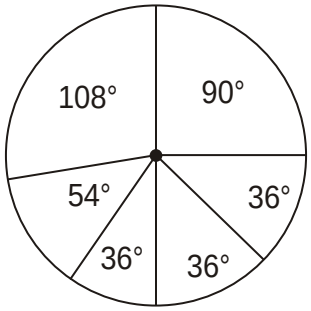


3. Following data gives the break up of the cost of production of a book

Printing	30 % of 360	108
Paper	15% of 360	54
Binding charges	15% of 360	54
Advertisement	20% of 360	72
Royalty	10% of 360	36
Miscellaneous	15% of 360	54



4. The following data relates to the cost of construction of a house in Delhi.



Cement	30 % of 360	108°
Steel	10 % of 360	36°
Bricks	10 % of 360	36°
Timber	15 % of 360	54°
Labour	25 % of 360	90°
Misc.	10 % of 360	36°

5. The adjoining pie-chart shows the instrument learnt by 300 students of a school. How many of these students learnt:

   (i) the tabla $= \frac{78}{360} \times 300 = 65$

   (ii) the violin $= \frac{90}{360} \times 300 = 75$

   (iii) the guitar $= \frac{90}{360} \times 300 = 75$

   (iv) the harmonium $= \frac{36}{360} \times 300 = 30$

6. The adjoining pie-chart shows the sports liked by 720 students of a school.

   (i) Cricket $= \frac{120}{360} \times 720 = 240$

(ii) Football $= \frac{45}{360} \times 720 = 90$

(iii) Pool $= \frac{60}{360} \times 720 = 120$

Hockey $= \frac{45}{360} \times 720 = 90$

$= 120 + 90 = 210$

(iv) $\frac{90}{360} \times 720 = 180$

% of students $= \frac{90}{360} \times 100 = 25\%$

(v) Basketball students = 180

Pool students = 120

$180 - 120 = 60$ students

7. Social science $= \frac{45°}{360} \times 440 = 55$

Mathematics $= \frac{108}{360} \times 440 = 132$

Science $= \frac{81}{360} \times 440 = 99$

English $= \frac{72}{360} \times 440 = 88$

Hindi $= \frac{54}{360} \times 440 = 66$

8. Hockey $= \frac{100}{360} \times 108000 =$ ` 30000

Tennis $= \frac{50}{360} \times 108000 =$ ` 15000

Football $= \frac{60}{360} \times 108000 =$ ` 18000

Cricket $= \frac{150}{360} \times 108000 =$ ` 45000

MCQs

1.	(b)	2.	(a)	3.	(d)	4.	(b)	5.	(c)	6.	(c)
7.	(a)	8.	(b)	9.	(b)	10.	(c)				

3. $\frac{90}{360} \times 108 = 27$

4. Votes of $A = \frac{60}{360} \times 540 = 90$

   Votes of $B = \frac{120}{360} \times 540 = 180$

   Votes of $E = \frac{50}{360} \times 540 = 75$

   Votes of $D = \frac{70}{360} \times 540 = 105$

   Votes of $C = \frac{60}{360} \times 540 = 90$

5. $180 - 105 = 75$

15 Probability

Exercise 15

1. Probability $= \frac{\text{No. of favourable outcomes}}{\text{Total no. of outcomes}}$

   Favourable outcomes = 24

   Total outcomes = 60

   $= \frac{24}{60} = \frac{2}{5}$

2. Favourable outcomes = 42

Total outcomes = 100

$$\text{Probability} = \frac{42}{100} = \frac{21}{50}$$

3. If a ` 5 coin and a ` 1 coin are tossed together,

(a)

Probable outcomes	` 5 coins	` 1 coin
HH	Heads	Heads
HT	Heads	Tails
TH	Tails	Heads
TT	Tails	Tails

(b) (i) $\frac{1}{4}$ (ii) $\frac{1}{4}$

4. If three identical coins are tossed,

(a) Favourable outcome = 1

Total coutcomes = 8

HHH, TTT, HHT, TTH, HTH, THT, HTT, THH

$$\text{Probability} = \frac{1}{8}$$

(b) Fav. outcome = 3, Total outcomes = 8

$$\text{Probability} = \frac{3}{8}$$

5. (a) Fav. outcome = 14, Total outcome = 14 + 22 = 36

$$\text{Probability} = \frac{14}{36} = \frac{7}{18}$$

(b) $\frac{22}{36} = \frac{11}{18}$

6. Fav. outcome = 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26 11

Total outcomes = 22

Probability = $\frac{11}{22} = \frac{1}{2}$

7. Fav. outcome = H H 1

Total outcomes = HH, TT, HT, TH 4

Probability = $\frac{1}{4}$

8 No. of Red balls = 5

No. of yellow balls = 7

No. of white balls = 9

Total no. of balls = 5 + 7 + 9 = 21

(a) $\frac{5}{21}$ (b) $\frac{7}{21} = \frac{1}{3}$ (c) $\frac{9}{21} = \frac{3}{7}$

9. Write the sample space for the following situations :

(i) Sample space for drawing a ball

S = (15, 8, 5, 3)

(ii) S = (2, 3, 5, 7, 11)

(iii) S = (E, V, A I, O)

10. A die is thrown. Find the probability of getting

(i) Possible outomes = (2, 3, 5) 3

Total outcomes = 6

Probability = $\frac{3}{6} = \frac{1}{2}$

(ii) Possible outcomes = 2, 3, 4, 6 4

Total outcomes = 6

Probability = $\frac{4}{6} = \frac{2}{3}$

(iii) Possible outcomes = (2, 4) 2

Total outcomes = 6

Probability $= \frac{2}{6} = \frac{1}{3}$

11. A die is thrown at random. Find the probability of getting :

(i) Possible outcomes = 1, 3, 5 3

Total outcomes = 6

Probability $= \frac{3}{6} = \frac{1}{2}$

(ii) Possible outcomes = 2, 4, 6 3

Probability $= \frac{3}{6} = \frac{1}{2}$

12. Three coins are tossed together. Find the probability of getting :

Outcomes HHH, TTT, HHT, TTH, HTH, THT, THH, HTT

Total outcomes = 8

(i) Possible outcomes $= \frac{3}{8}$

(ii) $\frac{4}{8} = \frac{1}{2}$

(iii) $\frac{6}{8} = \frac{3}{4}$

(iv) $\frac{1}{8}$

13. A box contains 5 white, 2 red, 3 blue and 5 yellow marbles. What is the probability of getting :

Total outcomes = 5 + 2 + 3 + 5 = 15

(i) Possible outcome = 2 Probability $= \frac{2}{15}$

(ii) Possible outcomes = 5, Probability $= \frac{5}{15} = \frac{1}{3}$

14. If two dice are tossed together, what is the probability of the sum of the numbers on the dice being:

Total outcomes = 1 + 1 = 2, 2 + 2 = 4,

3 + 3 = 6, 4 + 4 = 8, 5 + 5 = 10, 6 + 6 = 12

4 + 5 = 9, 4 + 6 = 10, 5 + 6 = 11

1 + 6 = 7, 2 + 3 = 5, 2 + 4 = 6, 2 + 5 = 7,

2 + 6 = 8, 3 + 4 = 7, 3 + 5 = 8, 3 + 6 = 9,

1 + 2 = 3, 1 + 3 = 4, 1 + 4 = 5, 1 + 5 = 6,

Total outcomes = 6 + 15 + 15 = 36

(i) an even number $= \frac{18}{36} = \frac{1}{2}$

(ii) an odd number $= \frac{18}{36} = \frac{1}{2}$

(iii) equal to 10 $= \frac{3}{36} = \frac{1}{12}$

(iv) a double-digit number $= \frac{6}{36} = \frac{1}{6}$

(v) a single-digit number $= \frac{30}{36} = \frac{5}{6}$

15. In 75% of the students of a class of 48 students are exceptionally good in Maths, what is the probability that a students, selected at random, is :

75% of total students 48

$\frac{75}{100} \times 48 = 36$ students

Students weak in Maths = 48 − 36 = 12

(i) $\frac{12}{48} = \frac{1}{4}$ (ii) $\frac{36}{48} = \frac{3}{4}$

MCQs

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

Fill in the blanks

1. $\frac{1}{2}$ 2. Negative 3. 0 and 1 4. 1 5. 0

True or False

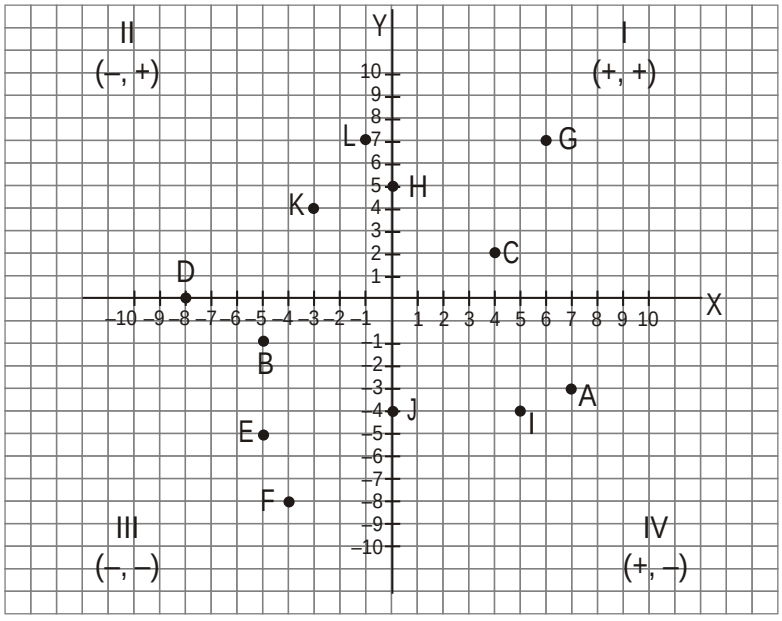
1. F 2. T 3. F 4. T 5. F.

16 Introduction to Graphs

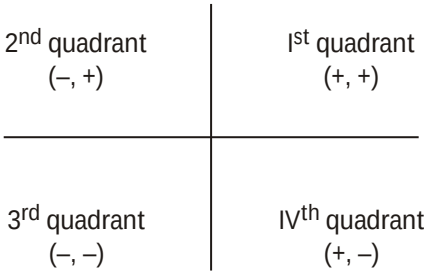
Exercise 16.1

1. Plot the following points on graph and name the quadrant/axis:

   For (i) to (xii)



2. Without plotting on the graph, name the quadrant/axis of the following points:



(i) IV quadrant (ii) III quadrant (iii) x-axis (iv) y-axis

(v) I quadrant (vi) II quadrant (vii) y-axis (viii) x-axis

3. $A(2,1), B(4,2), C(5,3), D(6,6), E(4,6), F(3,4), G(1,6), H(6,0), I(0,3)$

4. $A(4,5), B(7,5), C(6,3), D(3,3), P(7,4), Q(9,5), R(9,3)$
$X(0,2), Y(2,2), Z(2,0)$

Exercise 16.2

1. Radius of circle = r

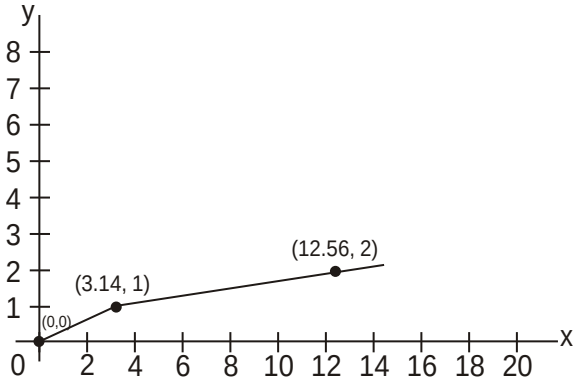
Area of circle = πr^2

$r = 0, \quad A = \pi \times 0^2 = 0$

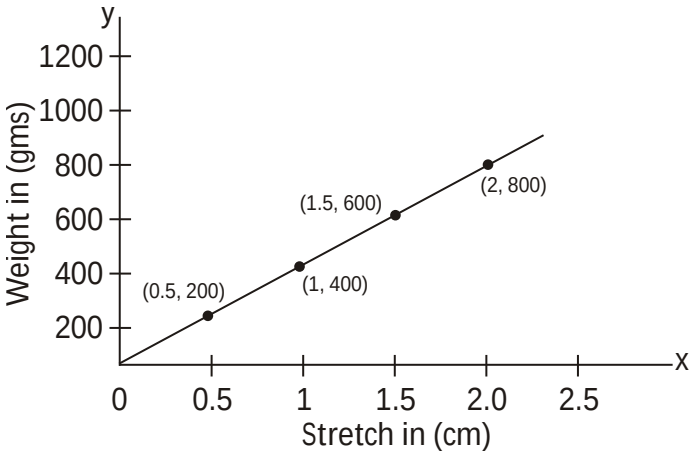
$r = 1, \quad A = \pi \times 1^2 = 3.14 \times 1 \times 1 = 3.14$

$r = 2, \quad A = \pi \times 2^2 = 3.14 \times 2 \times 2 = 12.56$

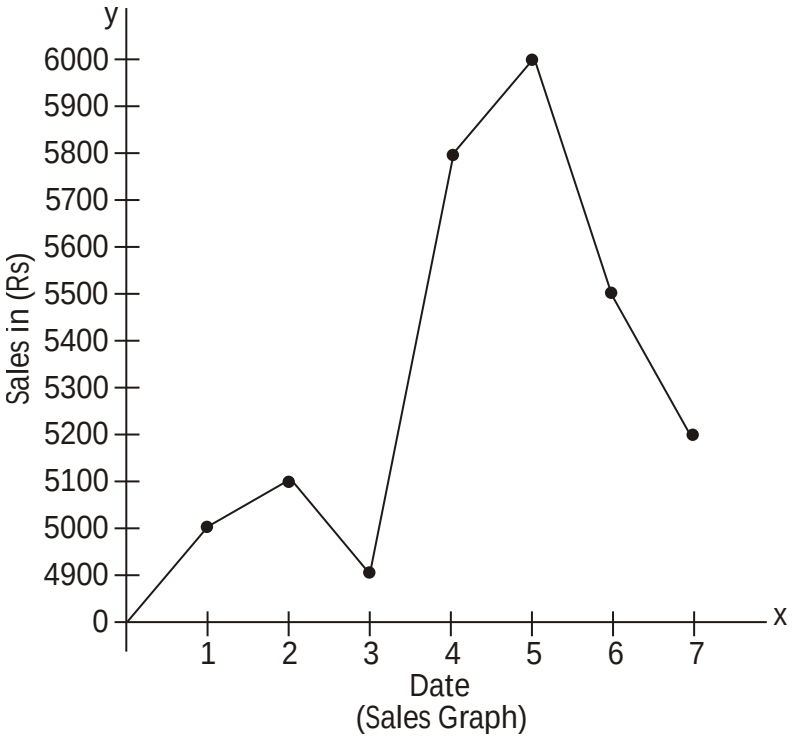
$r = 3, \quad A = \pi \times 3^2 = 3.14 \times 3 \times 3 = 28.26$



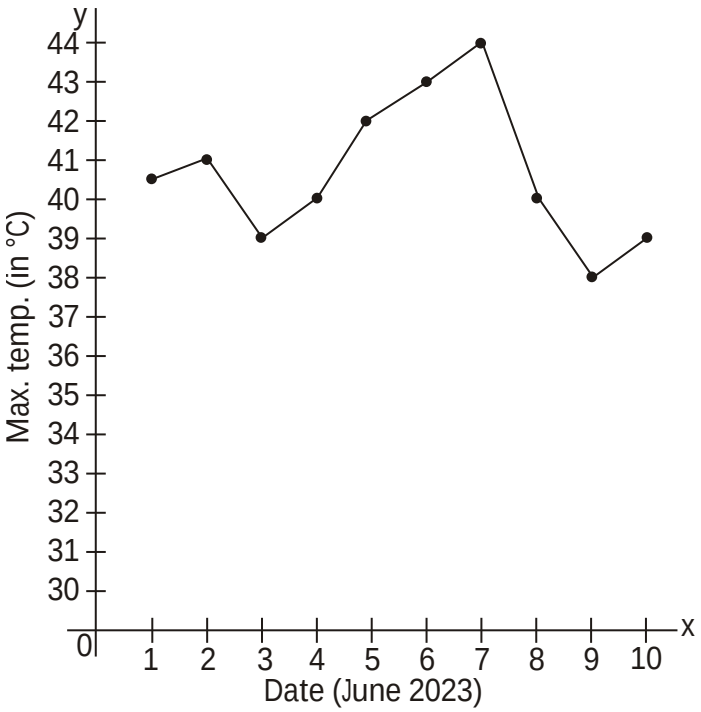
2.


y
1200
1000
800
600
400
200
Weight in (gms)
(0.5, 200)
(1, 400)
(1.5, 600)
(2, 800)
x
0
0.5
1
1.5
2.0
2.5
Stretch in (cm)

3.

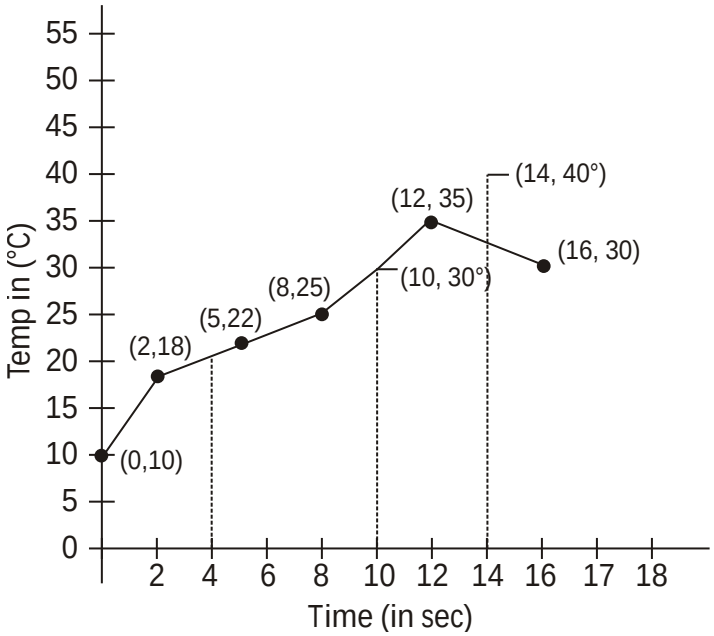

y
6000
5900
5800
5700
5600
5500
5400
5300
5200
5100
5000
4900
0
Sales in (Rs)
x
1
2
3
4
5
6
7
Date
(Sales Graph)

4.



Temperature Graph

5.



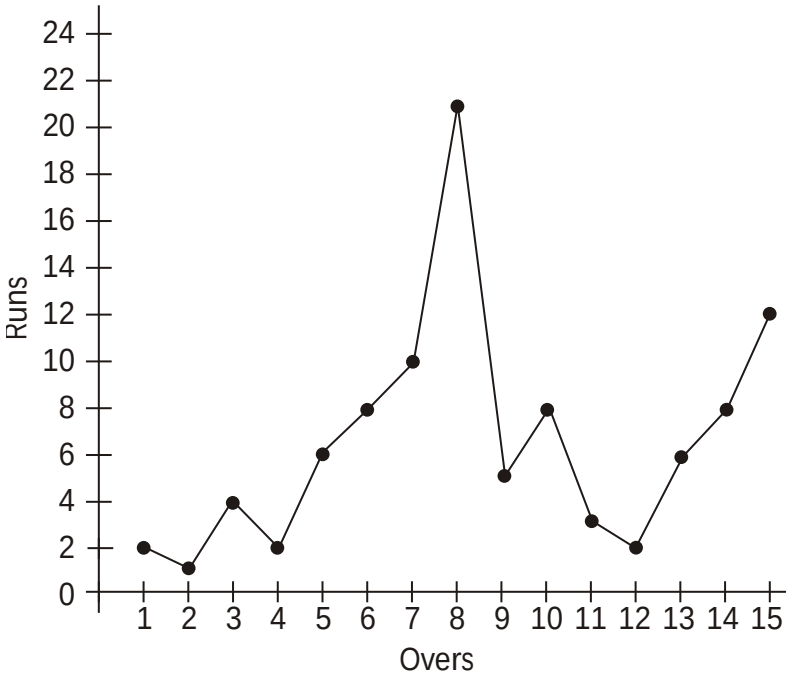
(i) Temperature of ball when $t = 45$ is 20°C

(ii) Temp. of ball when $t = 10s = 30$°C

(iii) Temp. of ball will be 40°C at 14 seconds

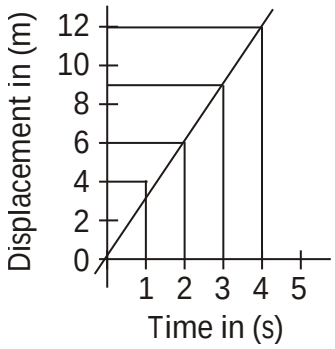
(iv) If we extend the graph beyound the given datapoints $T = 55$ on y axis corresponding time on the x axis will be approximately 23 seconds.

6.

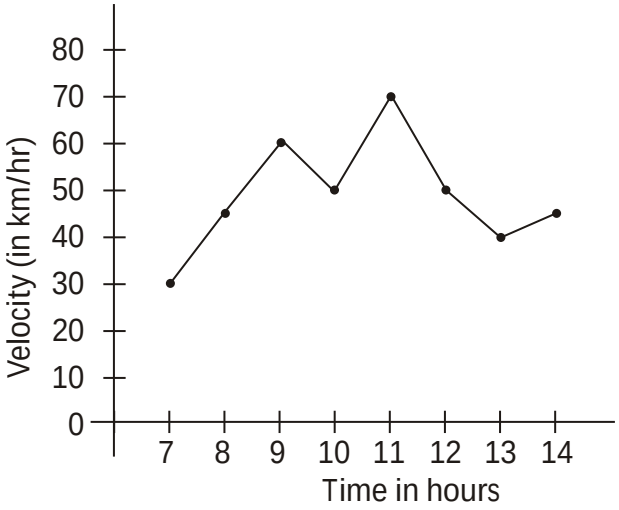


Graph showing runs scored by cricket team in 15 overs.

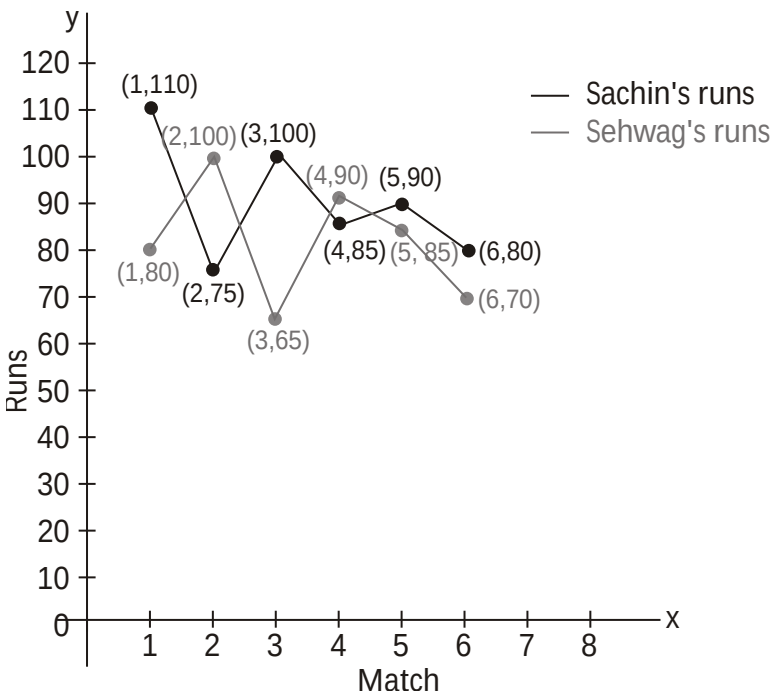
7.



8.



9.



10. $R = 10\%$, $P = 2500$, $T = x$, SI $= y$

$SI = \frac{P \times R \times T}{100}$ $\qquad y = 2500 \times \frac{10}{100} \times x$

or $y = 250x$

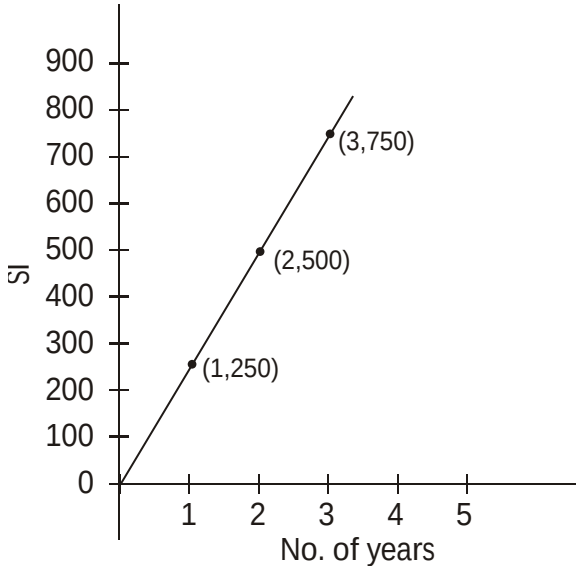
when $x = 2$

$$y = \frac{2500 \times 10 \times 2}{100}$$

$$y = 500$$

when $x = 3$; $\quad y = 2500 \times \frac{10}{100} \times 3$ $\quad$ ` 750

x	1	2	3
y	250	500	750
(x, y)	(1, 250)	(2, 500)	(3, 750)



(ii) $70 = \frac{P \times 10 \times 1}{100} = P = \frac{7000}{10}$

$= $ ` 700

11. (i) 40 m/s

(ii) at 2 seconds, distance = 40 m

at 4 seconds, distance = 80 m

$$\text{speed} = \frac{80-40}{4-2} = \frac{40}{2} = 20\ \text{m/s}$$

(iii) at 8 seconds = 100 m

at 4 seconds = 80 m

$$\text{speed} = \frac{100-80}{8-4} = \frac{20}{4} = 5\ \text{m/s}$$

(iv) at 0 seconds = 40 m

at 8 second = 100 m

$$\frac{100-40}{8-0} = \frac{60}{8} = 7.5\ \text{m/s}$$