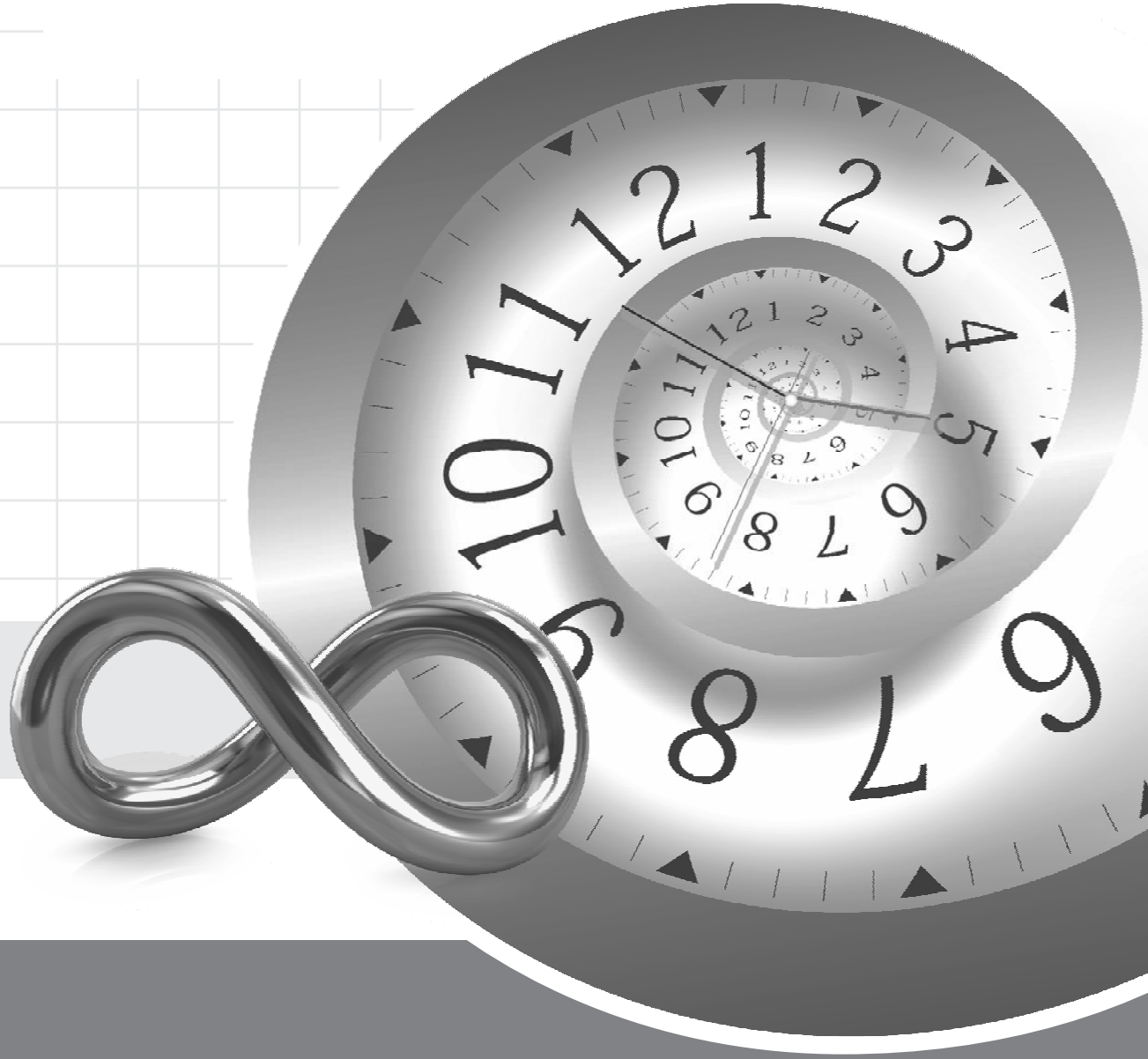
RAPID MATHS

Part 8

Teacher's Help Book (6-8)



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SOLUTIONS

1 Rational Numbers

➲ EXERCISE 1.1

1. (a) $\frac{-35}{98}=\frac{-35\div 7}{98\div 7}=\frac{-5}{14}$

(b) $\frac{-36}{64}=\frac{-36\div 4}{64\div 4}=\frac{-9}{16}$

(c) $\frac{27}{-84}=\frac{27\div(-3)}{-84\div(-3)}=\frac{-9}{28}$

(d) $\frac{-48}{72}=\frac{-48\div 24}{72\div 24}=\frac{-2}{3}$

(e) $\frac{46}{-94}=\frac{46\div(-2)}{-94\div(-2)}=\frac{-23}{47}$

(f) $\frac{-125}{340}=\frac{-125\div 5}{340\div 5}=\frac{-25}{68}$

(g) $\frac{-27}{108}=\frac{-27\div 27}{108\div 27}=\frac{-1}{4}$

(h) $\frac{26}{78}=\frac{26\div 26}{78\div 26}=\frac{1}{3}$

(i) $\frac{-125}{475}=\frac{-125\div 25}{475\div 25}=\frac{-5}{19}$

(j) $\frac{-63}{135}=\frac{-63\div 9}{135\div 9}=\frac{-7}{15}$

(k) $\frac{-42}{98}=\frac{-42\div 14}{98\div 14}=\frac{-3}{7}$

(l) $\frac{35}{165}=\frac{35\div 5}{165\div 5}=\frac{7}{33}$

2. (a) $-\frac{4}{5}$ or $\frac{6}{-7} \Rightarrow -\frac{4}{5}$ or $-\frac{6}{7}$

On cross-multiplication

$-4\times 7=-28$ and $-6\times 5=-30$

$-\frac{4}{5} > -\frac{6}{7}$ since $-28 > -30$

$\therefore -\frac{4}{5}$ is greater.

(b) $-\frac{5}{8}$ or $\frac{-3}{10}$

On cross-multiplication

$-5\times 10=-50$ and $-3\times 8=-24$

So, $\frac{-3}{10} > \frac{-5}{8}$ since $-24 > -50$

$\therefore \frac{-3}{10}$ is greater.

(c) $\frac{4}{11}$ or $\frac{-3}{8} \Rightarrow \frac{4}{11} > \frac{-3}{8}$

Since positive rational number is greater than negative rational number.

$\therefore \frac{4}{11}$ is greater.

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

On cross multiplication

$-3\times 11=-33$ and $-4\times 7=-28$

$\frac{-4}{11} > \frac{-3}{7}$ since $-28 > -33$

$\therefore \frac{-4}{11}$ is greater.

(e) $\frac{-12}{5}$ or $\frac{-3}{1}$

On cross-multiplication

$-12\times 1=-12$ and $-3\times 5=-15$

$\frac{-12}{5} > -3$ since $-12 > -15$

$\therefore \frac{-12}{5}$ is greater.

(f) $\frac{-3}{10}$ or $\frac{-5}{16}$

On cross-multiplication

$-3\times 16=-48$ and $-5\times 10=-50$

$\frac{-3}{10} > \frac{-5}{16}$ since $-48 > -50$

$\therefore \frac{-3}{10}$ is greater

3. (a) $\frac{-8}{19}$ or $\frac{-6}{13}$

On cross-multiplication

$-6\times 19=-114$ and $-8\times 13=-104$

$\frac{-6}{13} < \frac{-8}{19}$ since $-114 < -104$

$\therefore \frac{-6}{13}$ is smaller.

(b) $\frac{-6}{7}$ or $\frac{4}{7} \Rightarrow \frac{-6}{7} < \frac{4}{7}$

Since negative rational number is lesser than positive rational number.

$\therefore$ $\frac{-6}{7}$ is smaller.

(c) 0 or $\frac{-6}{13}$ $\Rightarrow$ $\frac{-6}{13} < 0$

Since negative numbers are smaller than 0.

$\therefore$ $\frac{-6}{13}$ is smaller.

(d) $\frac{7}{-9}$ or $\frac{-5}{8}$ $\Rightarrow$ $\frac{-7}{9}$ or $\frac{-5}{8}$

On cross-multiplication

$-7 \times 8 = -56$ and $-5 \times 9 = -45$

So, $\frac{-7}{9} < \frac{-5}{8}$ since $-56 < -45$

$\therefore$ $\frac{7}{-9}$ is smaller.

(e) $\frac{-3}{7}$ or $\frac{-5}{11}$

On cross-multiplication

$-3 \times 11 = -33$ and $-5 \times 7 = -35$

$\frac{-5}{11} < \frac{-7}{7}$ since $-35 < -33$

$\therefore$ $\frac{-5}{11}$ is smaller.

(f) $\frac{16}{25}$ or $\frac{-5}{16}$ $\Rightarrow$ $\frac{-5}{16} < \frac{16}{25}$

Since negative number is smaller than positive.

$\therefore$ $\frac{-5}{16}$ is smaller.

4. Given in answersheet.

5. (a) $\frac{-3}{5}, \frac{-13}{15}, \frac{-9}{10}, \frac{-17}{20}$

5	5, 15, 10, 20
3	1, 3, 2, 4
2	1, 1, 2, 4
2	1, 1, 1, 2
	1, 1, 1, 1

LCM $= 5 \times 3 \times 2 \times 2 = 60$

$\frac{-3}{5} = \frac{-3 \times 12}{5 \times 12} = \frac{-36}{60}$

$\frac{-13}{15} = \frac{-13 \times 4}{15 \times 4} = \frac{-52}{60}$

$\frac{-9}{10} = \frac{-9 \times 6}{10 \times 6} = \frac{-54}{60}$

$\frac{-17}{20} = \frac{-17 \times 3}{20 \times 3} = \frac{-51}{60}$

So, ascending order is

$\frac{-54}{60}, \frac{-52}{60}, \frac{-51}{60}, \frac{-36}{60}$

Since, $-54 < -52 < -51 < -36$

or $\frac{-9}{10}, \frac{-13}{15}, \frac{-17}{20}, \frac{-3}{5}$

(b) $\frac{-7}{10}, \frac{-5}{8}, \frac{-9}{20}, \frac{-4}{5}$

5	10, 8, 20, 5
2	2, 8, 4, 1
2	1, 4, 2, 1
2	1, 2, 1, 1
	1, 1, 1, 1

LCM $= 5 \times 2 \times 2 \times 2 = 40$

$\frac{-7}{10} = \frac{-7 \times 4}{10 \times 4} = \frac{-28}{40}$

$\frac{-5}{8} = \frac{-5 \times 5}{8 \times 5} = \frac{-25}{40}$

$\frac{-9}{20} = \frac{-9 \times 2}{20 \times 2} = \frac{-18}{40}$

$\frac{-4}{5} = \frac{-4 \times 8}{5 \times 8} = \frac{-32}{40}$

So, ascending order is

$\frac{-32}{40}, \frac{-28}{40}, \frac{-25}{40}, \frac{-18}{40}$

Since, $-32 < -28 < -25 < -18$

or $\frac{-4}{5}, \frac{-7}{10}, \frac{-5}{8}, \frac{-9}{20}$

(c) $\frac{-6}{11}, \frac{-7}{22}, \frac{-19}{33}, \frac{-4}{1}$

11	11, 22, 33, 1
2	1, 2, 3
3	1, 1, 3
	1, 1, 1

LCM $= 11 \times 2 \times 3 = 66$

$\frac{-6}{11} = \frac{-6 \times 6}{11 \times 6} = \frac{-36}{66}$

$\frac{-7}{22} = \frac{-7 \times 3}{22 \times 3} = \frac{-21}{66}$

$\frac{-19}{33} = \frac{-19 \times 2}{33 \times 2} = \frac{-38}{66}$

$\frac{-4}{1} = \frac{-4 \times 66}{1 \times 66} = \frac{-264}{66}$

So, ascending order is

$$\frac{-264}{66}, \frac{-38}{66}, \frac{-36}{66}, \frac{-21}{66}$$

Since, $-264 < -38 < -36 < -21$

or $\quad -4, \frac{-19}{33}, \frac{-6}{11}, \frac{-7}{22}$

(d) $\frac{-5}{6}, \frac{-13}{18}, \frac{-17}{24}, \frac{-7}{12}$

2	6, 18, 24, 12
2	3, 9, 12, 6
3	3, 9, 6, 3
3	1, 3, 2, 1
2	1, 1, 2, 1
	1, 1, 1, 1

$$\text{LCM} = 2 \times 2 \times 3 \times 3 \times 2 = 72$$

$$\frac{-5}{6} = \frac{-5 \times 12}{6 \times 12} = \frac{-60}{72}$$

$$\frac{-13}{18} = \frac{-13 \times 4}{18 \times 4} = \frac{-52}{72}$$

$$\frac{-17}{24} = \frac{-17 \times 3}{24 \times 3} = \frac{-51}{72}$$

$$\frac{-7}{12} = \frac{-7 \times 6}{12 \times 6} = \frac{-42}{72}$$

So, ascending order is

$$\frac{-60}{72}, \frac{-52}{72}, \frac{-51}{72}, \frac{-42}{72}$$

Since $-60 < -52 < -51 < -42$

or $\quad \frac{-5}{6}, \frac{-13}{18}, \frac{-17}{24}, \frac{-7}{12}$

6. (a) $\frac{-10}{11}, \frac{-11}{22}, \frac{-35}{44}, \frac{-17}{33}$

11	11, 22, 44, 33
2	1, 2, 4, 3
2	1, 1, 2, 3
3	1, 1, 1, 3
	1, 1, 1, 1

$$\text{LCM} = 11 \times 2 \times 2 \times 3 = 132$$

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

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

$$\frac{-35}{44} = \frac{-35 \times 3}{44 \times 3} = \frac{-105}{132}$$

$$\frac{-17}{33} = \frac{-17 \times 4}{33 \times 4} = \frac{-68}{132}$$

So, descending order is

$$\frac{-66}{132}, \frac{-68}{132}, \frac{-105}{132}, \frac{-120}{132}$$

Since, $-66 > -68 > -105 > -120$

or $\quad \frac{-11}{22}, \frac{-17}{33}, \frac{-35}{44}, \frac{-10}{11}$

(b) $\frac{-4}{9}, \frac{-11}{18}, \frac{-2}{3}, \frac{-5}{12}$

3	9, 18, 3, 12
3	3, 6, 1, 4
2	1, 2, 1, 4
2	1, 1, 1, 2
	1, 1, 1, 1

$$\text{LCM} = 3 \times 3 \times 2 \times 2 = 36$$

$$\frac{-4}{9} = \frac{-4 \times 4}{9 \times 4} = \frac{-16}{36}$$

$$\frac{-11}{18} = \frac{-11 \times 2}{18 \times 2} = \frac{-22}{36}$$

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

$$\frac{-5}{12} = \frac{-5 \times 3}{12 \times 3} = \frac{-15}{36}$$

So, descending order is

$$\frac{-15}{36}, \frac{-16}{36}, \frac{-22}{36}, \frac{-24}{36}$$

Since, $-15 > -16 > -22 > -24$

or $\quad \frac{-5}{12}, \frac{-4}{9}, \frac{-11}{18}, \frac{-2}{3}$

(c) $\frac{-3}{10}, \frac{-19}{30}, \frac{-8}{15}, \frac{-11}{20}$

5	10, 30, 15, 20
2	2, 6, 3, 4
2	1, 3, 3, 2
3	1, 3, 3, 1
	1, 1, 1, 1

$$\text{LCM} = 5 \times 2 \times 2 \times 3 = 60$$

$$\frac{-3}{10} = \frac{-3 \times 6}{10 \times 6} = \frac{-18}{60}$$

$$\frac{-19}{30} = \frac{-19 \times 2}{30 \times 2} = \frac{-38}{60}$$

$$\frac{-8}{15} = \frac{-8 \times 4}{15 \times 4} = \frac{-32}{60}$$

$$\frac{-11}{20} = \frac{-11 \times 3}{20 \times 3} = \frac{-33}{60}$$

So, descending order is

$$\frac{-18}{60}, \frac{-32}{60}, \frac{-33}{60}, \frac{-38}{60}$$

Since, $-18 > -32 > -33 > -38$

or $\frac{-3}{10}, \frac{-8}{15}, \frac{-11}{20}, \frac{-19}{30}$

(d) $\frac{-6}{7}, \frac{-4}{21}, \frac{-23}{42}, \frac{-9}{14}$

7	7, 21, 42, 14
2	1, 3, 6, 2
3	1, 3, 3, 1
	1, 1, 1, 1

$$\text{LCM} = 7 \times 2 \times 3 = 42$$

$$\frac{-6}{7} = \frac{-6 \times 6}{7 \times 6} = \frac{-36}{42}$$

$$\frac{-4}{21} = \frac{-4 \times 2}{21 \times 2} = \frac{-8}{42}$$

$$\frac{-23}{42} = \frac{-23 \times 1}{42 \times 1} = \frac{-23}{42}$$

$$\frac{-9}{14} = \frac{-9 \times 3}{14 \times 3} = \frac{-27}{42}$$

So, descending order is

$$\frac{-8}{42}, \frac{-23}{42}, \frac{-27}{42}, \frac{-36}{42}$$

Since, $-8 > -23 > -27 > -36$

or $\frac{-4}{21}, \frac{-23}{42}, \frac{-9}{14}, \frac{-6}{7}$

➲ EXERCISE 1.2

1. Do it yourself.

2. -2 and 0

$$-2 = \frac{-2 \times 10}{10} = \frac{-20}{10}$$

$$0 = \frac{0 \times 10}{10} = \frac{0}{10}$$

So, three rational numbers are

$$\frac{-19}{10}, \frac{-18}{10}, \frac{-17}{10}$$

3. 0 and 3

$$0 = \frac{0 \times 10}{10} = \frac{0}{10}$$

$$3 = \frac{3 \times 10}{10} = \frac{30}{10}$$

So, six rational numbers are

$$\frac{1}{10}, \frac{2}{10}, \frac{3}{10}, \frac{4}{10}, \frac{5}{10}, \frac{6}{10}$$

4. -5 and -2

$$-5 = \frac{-5 \times 10}{1 \times 10} = \frac{-50}{10}$$

$$-2 = \frac{-2 \times 10}{10} = \frac{-20}{10}$$

So, seven rational numbers are

$$\frac{-49}{10}, \frac{-48}{10}, \frac{-47}{10}, \frac{-46}{10}, \frac{-45}{10}, \frac{-44}{10}, \frac{-43}{10}$$

5. $\frac{2}{3}$ and $\frac{3}{4}$

$$\frac{2}{3} = \frac{2 \times 40}{3 \times 40} = \frac{80}{120}$$

$$\frac{3}{4} = \frac{3 \times 30}{4 \times 30} = \frac{90}{120}$$

So, eight rational numbers are

$$\frac{81}{120}, \frac{82}{120}, \frac{83}{120}, \frac{84}{120}, \frac{85}{120}, \frac{86}{120}, \frac{87}{120}, \frac{88}{120}$$

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

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

$$\frac{5}{3} = \frac{5 \times 2}{3 \times 2} = \frac{10}{6}$$

So, ten rational numbers are

$$\frac{-8}{6}, \frac{-7}{6}, \frac{-6}{6}, \frac{-5}{6}, \frac{-4}{6}, \frac{-3}{6}, \frac{-2}{6}, \frac{-1}{6}, \frac{0}{6}, \frac{1}{6}$$

7. $\frac{-6}{7}$ and $\frac{1}{2}$

$$\frac{-6}{7} = \frac{-6 \times 2}{7 \times 2} = \frac{-12}{14}$$

$$\frac{1}{2} = \frac{1 \times 7}{2 \times 7} = \frac{7}{14}$$

So, fourteen rational numbers are

$$\frac{-11}{14}, \frac{-10}{14}, \frac{-9}{14}, \frac{-8}{14}, \frac{-7}{14}, \frac{-6}{14}, \frac{-5}{14}, \frac{-4}{14}, \frac{-3}{14}, \frac{-2}{14}$$

$$\frac{-1}{14}, \frac{0}{14}, \frac{1}{14}, \frac{2}{14}$$

8. Given in answersheet.

➲ EXERCISE 1.3

1. Given in answersheet.

4. Given in answersheet.

5. (a) $\frac{-4}{23} + \frac{6}{23} = \frac{-4+6}{23} = \frac{2}{23}$

(b) $\frac{7}{18} + \frac{-5}{18} = \frac{7-5}{18} = \frac{2}{18} = \frac{1}{9}$

(c) $\frac{-5}{26}+\frac{-3}{26}=\frac{-5-3}{26}=\frac{-8}{26}=\frac{-4}{13}$

(d) $\frac{3}{20}+\frac{-41}{20}+\frac{7}{20}=\frac{3-41+7}{20}=\frac{-31}{20}$

(e) $\frac{1}{27}+\frac{-11}{27}+\frac{8}{27}=\frac{1-11+8}{27}=\frac{-2}{27}$

(f) $\frac{-5}{16}+\frac{3}{16}+\frac{7}{16}=\frac{-5+3+7}{16}=\frac{5}{16}$

(g) $\frac{-17}{41}+\frac{16}{41}+\frac{13}{41}=\frac{-17+16+13}{41}=\frac{12}{41}$

(h) $\frac{-5}{17}+\frac{-3}{17}+\frac{-4}{17}=\frac{-5-3-4}{17}=\frac{-12}{17}$

6. (a) $\frac{-10}{57}+\frac{16}{19}$

19	57, 19
3	3, 1
	1, 1

$\text{LCM}=19\times3=57$

$\frac{-10}{57}+\frac{16}{19}=\frac{-10\times1+16\times3}{57}$

$=\frac{-10+48}{57}=\frac{38}{57}=\frac{2}{3}$

(b) $\frac{10}{51}+\frac{5}{17}$

17	51, 17
3	3, 1
	1, 1

$\text{LCM}=17\times3=51$

$\frac{10}{51}+\frac{5}{17}=\frac{10\times1+5\times3}{51}$

$=\frac{10+15}{51}=\frac{25}{51}$

(c) $\frac{-8}{21}+\frac{3}{14}$

7	21, 14
3	3, 2
2	1, 2
	1, 1

$\text{LCM}=7\times3\times2=42$

$\frac{-8}{21}+\frac{3}{14}=\frac{-8\times2+3\times3}{42}$

$=\frac{-16+9}{42}$

$=\frac{-7}{42}=-\frac{1}{6}$

(d) $\frac{5}{13}+\frac{15}{26}+\frac{-10}{39}$

13	13, 26, 39
2	1, 2, 3
3	1, 1, 3
	1, 1, 1

$\text{LCM}=13\times2\times3=78$

$\frac{5}{13}+\frac{15}{26}+\frac{-10}{39}=\frac{5\times6+15\times3-10\times2}{78}$

$=\frac{30+45-20}{78}=\frac{55}{78}$

(e) $\frac{-13}{20}+\frac{7}{10}+\frac{3}{5}$

5	20, 10, 5
2	4, 2, 1
2	2, 1, 1
	1, 1, 1

$\text{LCM}=5\times2\times2=20$

$\frac{-13}{20}+\frac{7}{10}+\frac{3}{5}=\frac{-13\times1+7\times2+3\times4}{20}$

$=\frac{-13+14+12}{20}=\frac{13}{20}$

(f) $\frac{5}{21}+\frac{-3}{14}+\frac{17}{42}$

7	21, 14, 42
2	3, 2, 6
3	3, 1, 3
	1, 1, 1

$\text{LCM}=7\times2\times3=42$

$\frac{5}{21}+\frac{-3}{14}+\frac{17}{42}=\frac{5\times2-3\times3+17\times1}{42}$

$=\frac{10-9+17}{42}=\frac{18}{42}=\frac{3}{7}$

(g) $\frac{3}{8}+\frac{-6}{25}+\frac{17}{50}$

5	8, 25, 50
5	8, 5, 10
2	8, 1, 2
4	4, 1, 1
	1, 1, 1

$\text{LCM}=5\times5\times2\times4=200$

$\frac{3}{8}+\frac{-6}{25}+\frac{17}{50}=\frac{3\times25-6\times8+17\times4}{200}$

$=\frac{75-48+68}{200}=\frac{95}{200}=\frac{19}{40}$

(h) $\frac{-8}{3}+\frac{-11}{12}+\frac{3}{16}$

3	3, 12, 16
4	1, 4, 16
4	1, 1, 4
	1, 1, 1

$\text{LCM} = 3\times4\times4 = 48$

$$\frac{-8}{3}+\frac{-11}{12}+\frac{3}{16} = \frac{-8\times16-11\times4+3\times3}{48}$$

$$= \frac{-128-44+9}{48} = \frac{-163}{48}$$

7. (a) $\frac{3}{8}-\frac{5}{8} = \frac{3-5}{8} = \frac{-2}{8} = \frac{-1}{4}$

(b) $\frac{-5}{18}-\frac{11}{18} = \frac{-5-11}{18} = \frac{-16}{18} = \frac{-8}{9}$

(c) $\frac{5}{19}-\frac{-13}{19} = \frac{5+13}{19} = \frac{18}{19}$

(d) $\frac{-1}{11}-\frac{9}{11} = \frac{-1-9}{11} = \frac{-10}{11}$

(e) $0-\frac{-21}{19} = \frac{21}{19}$

(f) $\frac{12}{25}-\frac{-13}{25} = \frac{12+13}{25} = \frac{25}{25} = 1$

(g) $\frac{-8}{19}-\frac{6}{19} = \frac{-8-6}{19} = \frac{-14}{19}$

(h) $\frac{-19}{26}-\frac{-5}{26} = \frac{-19+5}{26} = \frac{-14}{26} = \frac{-7}{13}$

8. (a) $\frac{1}{3}-\frac{-4}{5}$

3	3, 5
5	1, 5
	1, 1

$\text{LCM} = 3\times5 = 15$

$$\frac{1}{3}-\frac{-4}{5} = \frac{1}{3}+\frac{4}{5}$$

$$= \frac{1\times5+4\times3}{15} = \frac{5+12}{15} = \frac{17}{15}$$

(b) $0-\frac{-81}{16} = 0+\frac{81}{16} = \frac{81}{16}$

(c) $\frac{-6}{5}-\frac{-32}{13}$

5	5, 13
13	1, 13
	1, 1

$\text{LCM} = 5\times13 = 65$

$$\frac{-6}{5}-\frac{-32}{13} = \frac{-6}{5}+\frac{32}{13}$$

$$= \frac{-6\times13+32\times5}{65}$$

$$= \frac{-78+160}{65} = \frac{82}{65}$$

(d) $\frac{-4}{7}--17$

$$= \frac{-4}{7}+\frac{17}{1} = \frac{-4\times1+17\times7}{7} = \frac{-4+119}{7} = \frac{115}{7}$$

(e) $\frac{-4}{7}--7$

$$= \frac{-4}{7}+7 = \frac{-4+7\times7}{7} = \frac{-4+49}{7} = \frac{45}{7}$$

(f) $\frac{-3}{5}-\frac{-8}{9}$

5	5, 9
9	1, 9
	1, 1

$\text{LCM} = 5\times9 = 45$

$$\frac{-3}{5}-\frac{-8}{9} = \frac{-3\times9+8\times5}{45} = \frac{-27+40}{45} = \frac{13}{45}$$

(g) $\frac{6}{7}--8$

$$= \frac{6}{7}+\frac{8}{1} = \frac{6+8\times7}{7} = \frac{6+56}{7} = \frac{62}{7}$$

(h) $\frac{1}{6}-\frac{-13}{9}$

3	6, 9
2	2, 3
3	1, 3
	1, 1

$\text{LCM} = 3\times2\times3 = 18$

$$\frac{1}{6}-\frac{-13}{9} = \frac{1\times3+13\times2}{18}$$

$$= \frac{3+26}{18} = \frac{29}{18}$$

9. (a) $\frac{-1}{4}+\frac{-11}{6}+\frac{-3}{8}+\frac{9}{10}$

2	4, 6, 8, 10
2	2, 3, 4, 5
3	1, 3, 2, 5
2	1, 1, 2, 5
5	1, 1, 1, 5
	1, 1, 1, 1

$\text{LCM} = 2\times2\times3\times2\times5 = 120$

$$-\frac{1}{4}+\frac{-11}{6}+\frac{-3}{8}+\frac{9}{10}$$

$$=\frac{-1\times30-11\times20-3\times15+9\times12}{120}$$

$$=\frac{-30-220-45+108}{120}=\frac{-187}{120}$$

(b) $\frac{-5}{16}+\frac{7}{20}+\frac{-3}{10}+\frac{-7}{12}$

2	16, 20, 10, 12
2	8, 10, 5, 6
5	4, 5, 5, 3
	4, 1, 1, 3

$$\text{LCM}=2\times2\times5\times4\times3=240$$

$$\frac{-5}{16}+\frac{7}{20}+\frac{-3}{10}+\frac{-7}{12}$$

$$=\frac{-5\times15+7\times12-3\times24-7\times20}{240}$$

$$=\frac{-75+84-72-140}{240}=\frac{-203}{240}$$

(c) $\frac{3}{11}+\frac{5}{22}-\frac{4}{33}+\frac{5}{44}$

11	11, 22, 33, 44
2	1, 2, 3, 4
	1, 1, 3, 2

$$\text{LCM}=11\times2\times3\times2=132$$

$$\frac{3}{11}+\frac{5}{22}-\frac{4}{33}+\frac{5}{44}=\frac{3\times12+5\times6-4\times4+5\times3}{132}$$

$$=\frac{36+30-16+15}{132}=\frac{65}{132}$$

(d) $\frac{3}{5}-\frac{2}{15}+\frac{1}{6}+\frac{4}{3}$

3	5, 15, 6, 3
5	5, 5, 2, 1
	1, 1, 2, 1

$$\text{LCM}=3\times5\times2=30$$

$$\frac{3}{5}-\frac{2}{15}+\frac{1}{6}+\frac{4}{3}=\frac{3\times6-2\times2+1\times5+4\times10}{30}$$

$$=\frac{18-4+5+40}{30}=\frac{59}{30}$$

(e) $\frac{3}{14}+\frac{-5}{7}-\frac{-8}{21}+\frac{5}{3}$

7	14, 7, 21, 3
3	2, 1, 3, 3
	2, 1, 1, 1

$$\text{LCM}=7\times3\times2=42$$

$$\frac{3}{14}+\frac{-5}{7}+\frac{8}{21}+\frac{5}{3}=\frac{3\times3-5\times6+8\times2+5\times14}{42}$$

$$=\frac{9-30+16+70}{42}=\frac{65}{42}$$

(f) $\frac{7}{8}-\frac{11}{16}+\frac{1}{4}+\frac{-3}{4}$

2	8, 16, 4, 4
2	4, 8, 2, 2
2	2, 4, 1, 1
	1, 2, 1, 1

$$\text{LCM}=2\times2\times2\times2=16$$

$$\frac{7}{8}-\frac{11}{16}+\frac{1}{4}+\frac{-3}{4}=\frac{7\times2-11\times1+1\times4-3\times4}{16}$$

$$=\frac{14-11+4-12}{16}=\frac{-5}{16}$$

10. Sum of two numbers = -8

One number $=\frac{5}{9}$

Other number $=-8-\frac{5}{9}$

$$=\frac{-8\times9-5}{9}=\frac{-72-5}{9}=\frac{-77}{9}$$

11. Sum of two numbers $=\frac{-2}{5}$

One number $=\frac{3}{10}$

Other number $=\frac{-2}{5}-\frac{3}{10}$

$$=\frac{-2\times2-3\times1}{10}=\frac{-4-3}{10}=\frac{-7}{10}$$

12. Required number $=\frac{5}{14}-\frac{-3}{7}$

$$=\frac{5}{14}+\frac{3}{7}=\frac{5\times1+3\times2}{14}$$

$$=\frac{5+6}{14}=\frac{11}{14}$$

13. Required number $=\frac{-3}{34}-\frac{-5}{17}$

$$=\frac{-3}{34}+\frac{5}{17}=\frac{-3\times1+5\times2}{34}$$

$$=-\frac{-3+10}{34}=\frac{7}{34}$$

14. Required number $=-2-\frac{3}{4}$

$$=\frac{-2\times4-3}{4}=\frac{-8-3}{4}=\frac{-11}{4}$$

15. Required number $= \frac{-3}{8} - \frac{-5}{16}$

$$= \frac{-3\times2+5\times1}{16} = \frac{-6+5}{16} = -\frac{1}{16}$$

➲ EXERCISE 1.4

1. Given in answersheet.

2–4. Do it yourself.

5. Given in answersheet.

6. (a) $\frac{5}{13}\times\frac{26}{35} = \frac{5\times26}{13\times35} = \frac{2}{7}$

(b) $\frac{4}{11}\times\frac{22}{33} = \frac{4\times22}{11\times33} = \frac{8}{33}$

(c) $\frac{14}{19}\times\frac{-38}{35} = -\left(\frac{14\times38}{19\times35}\right) = -\frac{4}{5}$

(d) $\frac{-7}{10}\times\frac{15}{28} = -\left(\frac{7\times15}{10\times28}\right) = \frac{-3}{8}$

(e) $\frac{25}{46}\times\frac{-23}{35} = -\left(\frac{25}{46}\times\frac{23}{35}\right) = \frac{-5}{14}$

(f) $\frac{5}{16}\times\frac{32}{45} = \frac{5\times32}{16\times45} = \frac{2}{9}$

(g) $\frac{-25}{39}\times\frac{13}{10} = -\left(\frac{25\times13}{39\times10}\right) = \frac{-5}{6}$

(h) $\frac{15}{13}\times\frac{-26}{35} = -\left(\frac{15\times26}{13\times35}\right) = \frac{-6}{7}$

(i) $\frac{-6}{11}\times\frac{22}{15} = -\left(\frac{6\times22}{11\times15}\right) = \frac{-4}{5}$

7. (a) $\frac{8}{15}\times\frac{33}{40}\times\frac{-6}{11} = -\left(\frac{8\times33\times6}{15\times40\times11}\right) = \frac{-6}{25}$

(b) $\frac{-16}{25}\times\frac{5}{32}\times\frac{-8}{15} = +\left(\frac{16}{25}\times\frac{5}{32}\times\frac{8}{15}\right) = \frac{4}{75}$

(c) $\frac{4}{15}\times\frac{10}{11}\times\frac{-3}{8} = -\left(\frac{4}{15}\times\frac{10}{11}\times\frac{3}{8}\right) = \frac{-1}{11}$

(d) $\frac{9}{16}\times\frac{4}{-25}\times\frac{10}{27} = -\left(\frac{9\times4\times10}{16\times25\times27}\right) = \frac{-1}{30}$

(e) $\frac{34}{35}\times\frac{9}{17}\times\frac{-6}{7} = -\left(\frac{34\times9\times6}{35\times17\times7}\right) = \frac{-108}{245}$

(f) $\frac{-7}{12}\times\frac{24}{35}\times\frac{-1}{3} = +\left(\frac{7}{12}\times\frac{24}{35}\times\frac{1}{3}\right) = \frac{2}{15}$

(g) $\frac{3}{10}\times\frac{-5}{6}\times\frac{-18}{25} = +\left(\frac{3}{10}\times\frac{5}{6}\times\frac{18}{25}\right) = \frac{9}{50}$

(h) $\frac{-9}{34}\times\frac{17}{27}\times\frac{5}{6} = \left(\frac{9}{34}\times\frac{17}{27}\times\frac{5}{6}\right) = \frac{-5}{36}$

(i) $\frac{-3}{5}\times\frac{10}{19}\times\frac{38}{20} = -\left(\frac{3}{5}\times\frac{10}{19}\times\frac{38}{20}\right) = \frac{-3}{5}$

8. (a) $\frac{2}{5}\times\frac{-3}{7} - \frac{1}{14} - \frac{3}{7}\times\frac{3}{5} = \frac{2}{5}\times\frac{-3}{7} - \frac{3}{7}\times\frac{3}{5} - \frac{1}{14}$

$$= \frac{3}{7}\times\left(-\frac{2}{5} - \frac{3}{5}\right) - \frac{1}{14}$$

$$= \frac{3}{7}\times\left(\frac{-2-3}{5}\right) = \frac{1}{14}$$

$$= \frac{3}{7}\times\frac{-5}{5} - \frac{1}{14} = -\frac{3}{7} - \frac{1}{14}$$

$$= \frac{-3\times2-1\times1}{14} = \frac{-6-1}{14}$$

$$= \frac{-7}{14} = \frac{-1}{2}$$

(b) $\frac{2}{5}\times\frac{-3}{7} - \frac{1}{6}\times\frac{3}{2} + \frac{1}{14}\times\frac{3}{7}$

$$= \frac{2}{5}\times\frac{-3}{7} + \frac{1}{14}\times\frac{3}{7} - \frac{1}{6}\times\frac{3}{2}$$

$$= \frac{3}{7}\times\left(-\frac{2}{5} + \frac{1}{14}\right) - \frac{1}{4}$$

$$= \frac{3}{7}\times\left(\frac{-2\times14+1\times5}{70}\right) - \frac{1}{4}$$

$$= \frac{3}{7}\times\left(\frac{-28+5}{70}\right) - \frac{1}{4} = \frac{3}{7}\times\frac{-23}{70} - \frac{1}{4}$$

$$= \frac{-69\times2-1\times245}{980} = \frac{-138-245}{980} = \frac{-383}{980}$$

(c) $\frac{-5}{7}\times\frac{2}{3} + \frac{1}{15} - \frac{2}{3}\times\frac{1}{7} = \frac{-5}{7}\times\frac{2}{3} - \frac{2}{3}\times\frac{1}{7} + \frac{1}{15}$

$$= \frac{2}{3}\times\left(\frac{-5}{7} - \frac{1}{7}\right) + \frac{1}{15}$$

$$= \frac{2}{3}\times\left(\frac{-6}{7}\right) + \frac{1}{15}$$

$$= \frac{-4\times15+1\times7}{105}$$

$$= \frac{-60+7}{105}$$

$$= \frac{-53}{105}$$

(d) $\frac{3}{7}\times\frac{1}{5} - \frac{-1}{5}\times\frac{3}{7} + \frac{2}{7}\times\frac{1}{5} = \frac{1}{5}\times\left(\frac{3}{7} + \frac{3}{7} + \frac{2}{7}\right)$

$$= \frac{1}{5}\times\left(\frac{3+3+2}{7}\right)$$

$$= \frac{1}{5}\times\frac{8}{7} = \frac{8}{35}$$

(e) $\frac{6}{11}\times\frac{1}{5}-\frac{1}{15}\times\frac{3}{4}+\frac{1}{5}\times\frac{-6}{11}$

$=\frac{6}{11}\times\frac{1}{5}+\left(-\frac{1}{5}\times\frac{6}{11}\right)-\frac{1\times3}{15\times4}$

$=\frac{6-6}{55}-\frac{1}{20}=0-\frac{1}{20}=-\frac{1}{20}$

(f) $\frac{-3}{8}\times\frac{1}{5}+\frac{1}{14}-\frac{1}{5}\times\frac{4}{5}=\frac{1}{5}\times\left(\frac{-3}{8}-\frac{4}{5}\right)+\frac{1}{14}$

$=\frac{1}{5}\times\left(\frac{-15-32}{40}\right)+\frac{1}{14}$

$=\frac{1}{5}\times\frac{-47}{40}+\frac{1}{14}=\frac{-47}{200}+\frac{1}{14}$

$=\frac{-47\times7+1\times100}{1400}$

$=\frac{-329+100}{1400}=\frac{-229}{1400}$

9. Reciprocal of $-\frac{10}{39}$ is $-\frac{39}{10}$.

So, $\frac{5}{13}\times\frac{-39}{10}=-\left(\frac{5\times39}{13\times10}\right)=\frac{-3}{2}$

10. Reciprocal of $\frac{9}{44}$ is $\frac{44}{9}$.

So, $-\frac{3}{22}\times\frac{44}{9}=-\left(\frac{3\times44}{22\times9}\right)=\frac{-2}{3}$

11. Given in answersheet.

12. Given in answersheet.

➲ EXERCISE 1.5

1. (a) $\frac{-5}{18}\div\frac{10}{27}=\frac{-5}{18}\times\frac{27}{10}=-\left(\frac{5\times27}{18\times10}\right)=\frac{-3}{4}$

(b) $\frac{-8}{19}\div\frac{4}{57}=\frac{-8}{19}\times\frac{57}{4}=-\left(\frac{8\times57}{19\times4}\right)=-6$

(c) $\frac{-6}{25}\div\frac{9}{10}=-\left(\frac{6}{25}\times\frac{10}{9}\right)=\frac{-4}{15}$

(d) $\frac{13}{14}\div\frac{-65}{28}=\frac{13}{14}\times\frac{-28}{65}=-\left(\frac{13\times28}{14\times65}\right)=\frac{-2}{5}$

(e) $\frac{-12}{7}\div-16=\frac{-12}{7}\times\frac{-1}{16}=+\left(\frac{12}{7}\times\frac{1}{16}\right)=\frac{3}{28}$

(f) $\frac{-65}{21}\div\frac{13}{18}=-\left(\frac{65}{21}\times\frac{18}{13}\right)=\frac{-30}{7}$

(g) $\frac{-6}{17}\div\frac{9}{34}=-\left(\frac{6}{17}\times\frac{34}{9}\right)=\frac{-4}{3}$

(h) $\frac{4}{9}\div-\frac{12}{27}=\frac{4}{9}\times\frac{-27}{12}=-\left(\frac{4\times27}{9\times12}\right)=-1$

(i) $\frac{4}{9}\div\frac{-16}{27}=\frac{4}{9}\times\frac{-27}{16}=-\left(\frac{4}{9}\times\frac{27}{16}\right)=\frac{-3}{4}$

2. (a) $\frac{13}{18}\div\frac{5}{9}=\frac{13}{18}\times\frac{9}{5}=\frac{13}{10}$

and $\frac{5}{9}\div\frac{13}{18}=\frac{5}{9}\times\frac{18}{13}=\frac{10}{13}$

So, it is false.

(b) $\frac{-9}{11}\div\frac{5}{16}=\frac{-9}{11}\times\frac{16}{5}=\frac{-144}{55}$

and $\frac{5}{16}\div\frac{-9}{11}=\frac{-5}{16}\times\frac{11}{9}=\frac{-55}{144}$

So it is false.

(c) Similarly all are false.

3. Product of numbers $=-8$

One number $=\frac{-5}{12}$

Other number $=-8\div\left(\frac{-5}{12}\right)=-8\times\left(-\frac{12}{5}\right)=\frac{96}{5}$

4. Product of numbers $=-\frac{3}{8}$

One number $=-\frac{9}{16}$

Other number $=-\frac{3}{8}\div\left(-\frac{9}{16}\right)=-\frac{3}{8}\times\left(-\frac{16}{9}\right)$

$=+\left(\frac{3}{8}\times\frac{16}{9}\right)=\frac{2}{3}$

5. Required number $=\frac{10}{13}\div(-8)=\frac{10}{13}\times\left(-\frac{1}{8}\right)=\frac{-5}{52}$

6. Required number $=\frac{-10}{51}\div\left(\frac{-5}{17}\right)$

$=\frac{10}{51}\times\left(\frac{-17}{5}\right)=-\left(\frac{10\times17}{51\times5}\right)=\frac{-2}{3}$

7. Required number $=\frac{3}{13}\div\left(\frac{-9}{65}\right)$

$=\frac{3}{13}\times\left(\frac{-65}{9}\right)=-\left(\frac{3\times65}{13\times9}\right)=\frac{-5}{3}$

8. Sum $=\frac{25}{12}+\frac{4}{9}=\frac{25\times3+4\times4}{36}=\frac{75+16}{36}=\frac{91}{36}$

Difference $=\frac{25}{12}-\frac{4}{9}=\frac{25\times3-4\times4}{36}=\frac{75-16}{36}=\frac{59}{36}$

Now, $\frac{91}{36}\div\frac{59}{36}=\frac{91}{36}\times\frac{36}{59}=\frac{91}{59}$

9. Sum $=\frac{65}{12}+\frac{8}{3}=\frac{65+8\times4}{12}=\frac{65+32}{12}=\frac{97}{12}$

Product $= \frac{65}{12} \times \frac{8}{3} = \frac{130}{9}$

Now, $\frac{97}{12} \div \frac{130}{9} = \frac{97}{12} \times \frac{9}{130} = \frac{291}{520}$

10. Sum $= \frac{5}{14} + \frac{9}{28} = \frac{5 \times 2 + 9 \times 1}{28} = \frac{10 + 9}{28} = \frac{19}{28}$

Product $= \frac{3}{7} \times \frac{11}{35} = \frac{33}{245}$

Now, $\frac{19}{28} \div \frac{33}{245} = \frac{19}{28} \times \frac{245}{33} = \frac{665}{132}$

➲ EXERCISE 1.6

1. Weight of rice in a bag $= 48\frac{1}{4}$ kg

Weight of empty bag $= 1\frac{1}{5}$ kg

Weight of filled bag $= \left(48\frac{1}{4} + 1\frac{1}{5}\right)$ kg

$= \frac{193}{4} + \frac{6}{5} = \frac{193 \times 5 + 6 \times 4}{20}$

$= \frac{965 + 24}{20} = \frac{989}{20} = 49\frac{9}{20}$ kg

2. Weight of sugar in bag $= 90\frac{1}{4}$ kg

Weight of empty bag $= 2\frac{3}{5}$ kg

Weight of filled bag $= \left(90\frac{1}{4} + 2\frac{3}{5}\right)$ kg

$= \frac{361}{4} + \frac{13}{5} = \frac{361 \times 5 + 13 \times 4}{20}$

$= \frac{1805 + 52}{20} = 92\frac{17}{20}$ kg

3. Kerosene oil in drum $= 30\,l$

Oil is leaked $= 2\frac{1}{5}\,l$

Remaining quantity $= \left(30 - 2\frac{1}{5}\right)l$

$= \left(30 - \frac{11}{5}\right)l = \frac{150 - 11}{5}$

$= \frac{139}{5} = 27\frac{4}{5}\,l$

4. Cost of one toy car $= ₹\,80\frac{1}{2}$

Cost of 5 toy-cars $= ₹\left(80\frac{1}{2} \times 5\right)$

$= ₹\left(\frac{161}{2} \times 5\right) = ₹\left(\frac{805}{2}\right) = ₹\,402\frac{1}{2}$

5. Cost of 1 m cloth $= ₹\,10\frac{3}{5}$

Cost of $7\frac{1}{2}$ m cloth $= ₹\left(10\frac{3}{5} \times 7\frac{1}{2}\right)$

$= ₹\left(\frac{53}{5} \times \frac{15}{2}\right) = ₹\,\frac{159}{2} = ₹\,79\frac{1}{2}$

6. A car can cover in 1 $l = 18\frac{1}{4}$ km

So it can cover in $8\frac{1}{3}\,l = \left(18\frac{1}{4} \times 8\frac{1}{3}\right)$

$= \left(\frac{73}{4} \times \frac{25}{3}\right)$ km $= 152\frac{1}{12}$ km

7. Cost of $4\frac{1}{2}$ m cloth $= ₹\,81$

$\therefore$ Cost of 1 m cloth $= ₹\left(81 \div 4\frac{1}{2}\right)$

$= ₹\left(81 \div \frac{9}{2}\right) = ₹\left(81 \times \frac{2}{9}\right)$

$= ₹\,18$

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

So, cost of 1 m wire $= ₹\left(57\frac{3}{4} \div 3\frac{1}{2}\right)$

$= ₹\left(\frac{231}{4} \div \frac{7}{2}\right) = ₹\left(\frac{231}{4} \times \frac{2}{7}\right)$

$= ₹\,16\frac{1}{2}$

9. Total length of rope $= 45\frac{3}{4}$ m

It is divided into 15 pieces so length of each piece

$= \left(45\frac{3}{4} \div 15\right)$ m

$= \left(\frac{183}{4} \times \frac{1}{15}\right)$ m

$= \frac{61}{20} = 3\frac{1}{20}$ m

10. Cost of 1 m wire $= ₹\,10\frac{3}{5}$

Cost of $15\frac{1}{2}$ m wire $= ₹\left(10\frac{3}{5} \times 15\frac{1}{2}\right)$

$= ₹\left(\frac{53}{5} \times \frac{31}{2}\right) = ₹\,\frac{1643}{10}$

$= ₹\,164\frac{3}{10}$

➲ HOTS

1. Total piece of cake $=12$

Pieces taken by friends $=\frac{1}{3}+\frac{1}{4}+\frac{1}{6}+\frac{1}{6}$

$$=\frac{4+3+2+2}{12}=\frac{11}{12}$$

11 pieces taken out of 12 pieces

So, left pieces $=12-11=1$ piece

2. Total number of people $=x$

Number of adults $=\frac{3}{8}x$

Number of children $=x-\frac{3}{8}x=x\left(1-\frac{3}{8}\right)=\frac{5}{8}x$

Number of children more than adults

$$=\frac{5}{8}x-\frac{3}{8}x=100$$

$$\frac{2}{8}x=100$$

$$x=100\times\frac{8}{2}=400$$

Number of children $=\frac{3}{8}x=\frac{3}{8}\times400=150$

3. LHS $=x+(y+z)$

$$=\frac{2}{5}+\left(\frac{-4}{3}+\frac{8}{9}\right)=\frac{2}{5}+\left(\frac{-4\times3+8}{9}\right)$$

$$=\frac{2}{5}+\left(\frac{-12+8}{9}\right)=\frac{2}{5}+\left(\frac{-4}{9}\right)=\frac{2}{5}-\frac{4}{9}$$

$$=\frac{2\times9-4\times5}{45}=\frac{18-20}{45}=\frac{-2}{45}$$

RHS $=(x+y)+z=\left[\frac{2}{5}+\left(\frac{-4}{3}\right)\right]+\frac{8}{9}$

$$=\left(\frac{2}{5}-\frac{4}{3}\right)+\frac{8}{9}=\left(\frac{2\times3-4\times5}{15}\right)+\frac{8}{9}$$

$$=\left(\frac{6-20}{15}\right)+\frac{8}{9}=\frac{-14}{15}+\frac{8}{9}=\frac{14\times3+8\times5}{45}$$

$$=\frac{-42+40}{45}=\frac{-2}{45}$$

$\therefore$ LHS = RHS

4. Let a number $=x$

Its reciprocal $=\frac{1}{x}$

According to the question

$$\frac{7}{x}+\frac{2}{3}=3 \Rightarrow \frac{7}{x}=3-\frac{2}{3} \Rightarrow \frac{7}{x}=\frac{9-2}{3}$$

$$\frac{7}{x}=\frac{7}{3} \Rightarrow 7x=7\times3 \Rightarrow x=\frac{7\times3}{7}=3$$

5. Let a number $=x$

It additive inverse $=-x$

According to the question

$$\frac{-x}{12}=\frac{3}{x}-1$$

$$\frac{-x}{12}-\frac{3}{x}=-1 \quad \text{or} \quad \frac{x}{12}+\frac{3}{x}=1$$

$$\frac{x^2+36}{12x}=1$$

$$\Rightarrow \quad x^2+36=12x$$

$$\Rightarrow \quad x^2-12x+36=0$$

$$\Rightarrow \quad x^2+-6x-6x+36=0$$

$$\Rightarrow \quad x(x-6)-6(x-6)=0$$

$$\Rightarrow \quad (x-6)(x-6)=0$$

$$\Rightarrow \quad x=6$$

➲ NCERT CORNER

1. (i) LHS $=-(-x)=-\left(-\frac{11}{15}\right)=\frac{11}{15}=x=$ RHS

$\therefore\ -(-x)=x$ is verified for $x=\frac{11}{15}$

(ii) LHS $=-(-x)=-\left[-\left(-\frac{13}{17}\right)\right]=-\left(\frac{13}{17}\right)$

$$=-\frac{13}{17}=x=\text{RHS}$$

$\therefore\ -(-x)=x$ is verified for $x=-\frac{13}{17}$

2. Associativity property.

3. $0.3=\frac{3}{10}$ and $3\frac{1}{3}=\frac{10}{3}$

$\therefore$ 0.3 is the multiplicative inverse of $3\frac{1}{3}\left(=\frac{10}{3}\right)$

because $\frac{3}{10}\times\frac{10}{3}=\frac{3\times10}{10\times3}=\frac{30}{30}=1$.

4. (i) The rational number 0 does not have a reciprocal.

(ii) The rational numbers 1 and -1 are equal to their reciprocals respectively.

5. Converting the given rational numbers with the same denominator.

$$\frac{-2}{5}=\frac{-2\times4}{5\times4}=\frac{-8}{20} \text{ and } \frac{1}{2}=\frac{1\times10}{2\times10}=\frac{10}{20}$$

$\therefore$ The rational numbers between $\frac{-8}{20}$ and $\frac{10}{20}$ are

$\frac{-7}{20}, \frac{-6}{20}, \frac{-5}{20}, \frac{-4}{20}, \frac{-3}{20}, \frac{-2}{20}, \frac{-1}{20}, 0, \frac{1}{20}, \frac{2}{20}, \ldots\ldots$

(We can take any 10 numbers)

There can be many more such rational numbers.

6. Five rational numbers greater than –2 are

$$\frac{-3}{2}, -1, \frac{-1}{2}, 0, \frac{1}{2}.$$

There can be many more such rational numbers.

7. Converting the given rational numbers with the same denominator.

$$\frac{3}{5}=\frac{3\times4}{5\times4}=\frac{12}{20} \text{ and } \frac{3}{4}=\frac{3\times5}{4\times5}=\frac{15}{20}$$

Now, multiplying the numerator and denominator both by 8,

$$\frac{12}{20}=\frac{12\times8}{20\times8}=\frac{96}{160} \text{ and } \frac{15}{20}=\frac{15\times8}{20\times8}=\frac{120}{160}$$

$\therefore$ The ten rational numbers between $\frac{96}{160}$ and $\frac{120}{160}$ are

$$\frac{97}{160}, \frac{98}{160}, \frac{99}{160}, \frac{100}{160}, \frac{101}{160}, \frac{102}{160}, \frac{103}{160}, \frac{104}{160}, \frac{105}{160}, \frac{106}{160}$$

or the ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$ are

$$\frac{97}{160}, \frac{49}{80}, \frac{99}{160}, \frac{5}{8}, \frac{101}{160}, \frac{51}{80}, \frac{103}{160}, \frac{13}{20}, \frac{105}{160}, \frac{53}{80}$$

There can be many more such rational numbers.

2 Linear Equations in One Variable

➲ EXERCISE 2.1

1. $7x-9=12$

$\Rightarrow \quad 7x=12+9$

$\Rightarrow \quad 7x=21$

$\Rightarrow \quad x=\frac{21}{7}$

$\Rightarrow \quad x=3$

2. $17+6p=9$

$\Rightarrow \quad 6p=9-17$

$\Rightarrow \quad 6p=-8$

$\Rightarrow \quad p=\frac{-8}{6}$

$\therefore \quad p=\frac{-4}{3}$

3. $14y-8=13$

$\Rightarrow \quad 14y=13+8$

$\Rightarrow \quad 14y=21$

$\therefore \quad y=\frac{21}{14}=\frac{3}{2}$

4. $\frac{15}{4}-7x=9$

$\Rightarrow \quad -7x=9-\frac{15}{4}$

$\Rightarrow \quad -7x=\frac{36-15}{4}$

$\Rightarrow \quad -7x=\frac{21}{4}$

$\Rightarrow \quad x=\frac{-21}{4}\times\frac{1}{7}$

$\therefore \quad x=\frac{-3}{4}$

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

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

$\Rightarrow \quad \frac{x}{3}=-\frac{8}{2}$

$\Rightarrow \quad \frac{x}{3}=-4$

$\Rightarrow \quad x=-4\times3$

$\therefore \quad x=-12$

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

$\Rightarrow \quad 3x=-3\,(5x+2)$

$\Rightarrow \quad 3x=-15x-6$

$\Rightarrow \quad 3x+15x=-6$

$\Rightarrow \quad 18x=-6$

$\Rightarrow \quad x=\frac{-6}{18}$

$\therefore \quad x=\frac{-1}{3}$

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

$\Rightarrow \quad 2\,(2m+1)=3\,(3m-1)$

$\Rightarrow \quad 4m+2=9m-3$

$\Rightarrow \quad 4m-9m=-3-2$

$\Rightarrow \quad -5m=-5$

$\Rightarrow \quad m=\frac{-5}{-5}$

$\therefore \quad m=1$

8. $\frac{4y+5}{2y-3}=\frac{9}{13}$

$\Rightarrow \quad 13\,(4y+5)=9\,(2y-3)$

$\Rightarrow \quad 52y+65=18y-27$

$\Rightarrow \quad 52y-18y=-27-65$

$\Rightarrow \quad 34y = -92$

$\Rightarrow \quad y = \frac{-92}{34}$

$\Rightarrow \quad y = \frac{-46}{17}$

9. $\frac{3y+7}{5y-11} = -\frac{1}{2}$

$\Rightarrow \quad 2(3y+7) = -1(5y-11)$

$\Rightarrow \quad 6y+14 = -5y+11$

$\Rightarrow \quad 6y+14 = 11-14$

$\Rightarrow \quad 11y = -3$

$\therefore \quad y = \frac{-3}{11}$

10. $\frac{3p+5}{2p+1} = \frac{1}{3}$

$\Rightarrow \quad 3(3p+5) = 1(2p+1)$

$\Rightarrow \quad 9p+15 = 2p+1$

$\Rightarrow \quad 9p-2p = 1-15$

$\Rightarrow \quad 7p = -14$

$\Rightarrow \quad p = \frac{-14}{7}$

$\therefore \quad p = -2$

11. $\frac{7y+3}{5-y} = \frac{17}{3}$

$\Rightarrow \quad 3(7y+3) = 17(5-y)$

$\Rightarrow \quad 21y+9 = 85-17y$

$\Rightarrow \quad 21y+17y = 85-9$

$\Rightarrow \quad 38y = 76$

$y = \frac{76}{38}$

$\therefore \quad y = 2$

12. $\frac{9y-2}{y+6} = \frac{17}{5}$

$\Rightarrow \quad 5(9y-2) = 17(y+6)$

$\Rightarrow \quad 45y-10 = 17y+102$

$\Rightarrow \quad 45y-17y = 102+10$

$\Rightarrow \quad 28y = 112$

$\Rightarrow \quad y = \frac{112}{28}$

$\therefore \quad y = 4$

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

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

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

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

$-16n = -32$

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

$n = 2$

14. $\frac{4y+1}{8y-4} = 2$

$\Rightarrow \quad 4y+1 = 2(8y-4)$

$\Rightarrow \quad 4y+1 = 16y-8$

$\Rightarrow \quad 4y-16y = -8-1$

$\Rightarrow \quad -12y = -9$

$\Rightarrow \quad y = \frac{-9}{-12}$

$\therefore \quad y = \frac{3}{4}$

15. $\frac{(x+1)-(2x+4)}{(3-5x)} = \frac{1}{23}$

$\Rightarrow \quad \frac{x+1-2x-4}{3-5x} = \frac{1}{23}$

$\Rightarrow \quad 23(-x-3) = 3-5x$

$\Rightarrow \quad -23x-69 = 3-5x$

$\Rightarrow \quad -23x+5x = 3+69$

$\Rightarrow \quad -18x = 72$

$\Rightarrow \quad x = \frac{72}{-18}$

$\therefore \quad x = -4$

16. $\frac{5(x-4)-3(2x+4)}{1+2x} = \frac{3}{7}$

$\Rightarrow \quad \frac{5x-20-6x-12}{1+2x} = \frac{3}{7}$

$\Rightarrow \quad 7(-x-32) = 3(1+2x)$

$\Rightarrow \quad -7x-224 = 3+6x$

$\Rightarrow \quad -7x-6x = 3+224$

$\Rightarrow \quad -13x = 227$

$\therefore \quad x = \frac{227}{-13} = \frac{-227}{13}$

17. $\frac{2p-(7-5p)}{9p-(3+4p)} = \frac{7}{6}$

$\Rightarrow \quad \frac{2p-7+5p}{9p-3-4p} = \frac{7}{6}$

$\Rightarrow \quad 6(7p-7) = 7(5p-3)$

$\Rightarrow \quad 42p-42 = 35p-21$

$\Rightarrow \quad 42p-35p = -21+42$

$\Rightarrow \quad 7p = 21$

$\Rightarrow \quad p = \frac{21}{7}$

$\therefore \quad p = 3$

18. $\frac{(2x+3)-(5x-7)}{6x+11}=\frac{-8}{3}$

$\Rightarrow \quad \frac{2x+3-5x+7}{6x+11}=\frac{-8}{3}$

$\Rightarrow \quad 3(-3x+10)=-8(6x+11)$

$\Rightarrow \quad -9x+30=-48x-88$

$\Rightarrow \quad -9x+48x=-88-30$

$\Rightarrow \quad 39x=-118$

$\therefore \quad x=\frac{-118}{39}$

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

$\Rightarrow \quad \frac{8-10x+12+3x}{3-2x}=2$

$\Rightarrow \quad -7x+20=2(3-2x)$

$\Rightarrow \quad -7x+20=6-4x$

$\Rightarrow \quad -7x+4x=6-20$

$\Rightarrow \quad -3x=-14$

$\Rightarrow \quad x=\frac{-14}{-3}$

$\therefore \quad x=\frac{14}{3}$

20. $\frac{15(2-m)-5(m+6)}{1-3m}=10$

$\Rightarrow \quad \frac{30-15m-5m-30}{1-3m}=10$

$\Rightarrow \quad -20m=10(1-3m)$

$\Rightarrow \quad -20m=10-30m$

$\Rightarrow \quad -20m+30m=10$

$\Rightarrow \quad 10m=10$

$\therefore \quad m=\frac{10}{10}$

$m=1$

➲ EXERCISE 2.2

1. Let even consecutive numbers be $x, x+2$

$\therefore \quad x+x+2=46$

$\Rightarrow \quad 2x+2=46$

$\Rightarrow \quad 2x=46-2$

$2x=44$

$x=\frac{44}{2}$

$\therefore \quad x=22$

So, consecutive numbers are 22 and 24.

2. Let three consecutive odd natural numbers are x, $x+2$ and $x+4$

$\therefore \quad x+x+2+x+4=81$

$\Rightarrow \quad 3x+6=81$

$\Rightarrow \quad 3x=81-6$

$3x=75$

$x=\frac{75}{3}$

$\therefore \quad x=25$

So, numbers are 25, 27 and 29.

3. Let three consecutive multiples of 5 are x, $x+5$ and $x+10$

$\therefore \quad x+x+5+x+10=165$

$\Rightarrow \quad 3x+15=165$

$\Rightarrow \quad 3x=165-15$

$3x=150$

$\therefore \quad x=\frac{150}{3}=50$

So, numbers are 50, 55 and 60.

4. Let three consecutive multiples of 6 are x, $x+6$ and $x+12$

$\therefore \quad x+x+6+x+12=216$

$3x+18=216$

$\therefore \quad 3x=216-18$

$3x=198$

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

$x=66$

So, numbers are 66, 72 and 78.

5. Let numbers are $5x$ and $6x$

$\therefore \quad 5x+6x=154$

$11x=154$

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

$\therefore \quad x=14$

So, numbers are $5\times14=70$ and $6\times14=84$

6. Let numbers are $7x$ and $9x$

$\therefore \quad 9x-7x=22$

$2x=22$

$x=\frac{22}{2}$

$x=11$

So, numbers are 77 and 99

7. Let one number be x then other number will be $3x$

$\therefore \quad 2(x+15)=3x+15$

$2x+30=3x+15$

$2x-3x=15-30$

$-x=-15$

$$x = 15$$

So, numbers are 15 and 45.

8. Let age of Reeta be x years then age of Priya will be $(5x)$ years

5 years ago, $9(x-5) = 5x-5$

$\Rightarrow$ $9x-45 = 5x-5$

$\Rightarrow$ $9x-5x = -5+45$

$4x = 40$

$x = \frac{40}{4}$

$x = 10$

So, age of Reeta is 10 years and age of Priya is 50 years.

9. Present age of Nakul be x years

So, his mother's pesent age is $(3x)$ years.

After 5 years

$(x+5)+(3x+5) = 66$

$\Rightarrow$ $4x+10 = 66$

$4x = 66-10$

$4x = 56$

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

$x = 14$

So age of Nakul is 14 years and his mother's age is 42 years.

10. Let age of Manisha be x years

So age of her father is $4x$ years

After 5 years $3(x+5) = 4x+5$

$3x+15 = 4x+5$

$3x-4x = 5-15$

$-x = -10$

$\therefore$ $x = 10$

So age of Manisha is 10 years and her father's age is 40 years.

11. Let age of Shivani be $5x$ years and that of Shalini is $7x$ years

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

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

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

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

$-x = -4$

$x = 4$

So, age of Shivani is $5\times 4 = 20$ years and age of Shalini is $7\times 4 = 28$ years.

12. Let present age of Anu is $4x$ years and that of Renu is $5x$ years

After 8 years, $\frac{4x+8}{5x+8} = \frac{5}{6}$

$\Rightarrow$ $6(4x+8) = 5(5x+8)$

$\Rightarrow$ $24x+48 = 25x+40$

$\Rightarrow$ $24x-25x = 40-48$

$\Rightarrow$ $-x = -8$

or $x = 8$

So, age of Anu is 32 years and that of Renu is 40 years.

13. Let 5 rupees coin be x and 2-rupees coin is $3x$

$\therefore$ $5\times x+2\times 3x = 77$

$5x+6x = 77$

$11x = 77$

$\therefore$ $x = \frac{77}{11}$

$x = 7$

So, 5-rupees coins are 7 and 2-rupees coins are 21.

14. Let 50 rupees note be $3x$ and 20 rupees note be $5x$ so 10 rupees note will be $25-(3x+5x) = 25-8x$

$\therefore$ $50\times 3x+20\times 5x+10(25-8x) = 590$

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

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

$170x = 340$

$\therefore$ $x = \frac{340}{170}$

$x = 2$

So, 50-rupees notes are 6, 20-rupees notes are 10 and 10 rupees notes are 9.

15. Let numerator be x than denominator be $x+2$

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

$\Rightarrow$ $6(x+3) = 5(x+5)$

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

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

$\Rightarrow$ $x = 7$

$\therefore$ fraction is $\frac{7}{7+2} = \frac{7}{9}$

16. Let numerator be x so denominator will be $(x+5)$

So, fraction is $\frac{x}{x+5}$

Now, $\frac{x+2}{x+5-2}=\frac{5}{6}$

$\Rightarrow \quad 6(x+2)=5(x+3)$

$\Rightarrow \quad 6x+12=5x+15$

$\Rightarrow \quad 6x-5x=15-12$

$x=3$

So fraction is $\frac{3}{3+5}=\frac{3}{8}$.

17. Let digit at tens place be x

So digit at unit place is $7-x$

So, number is $10x+(7-x)=10x+7-x$

$=9x+7$

On interchanging the digits, new number is

$10(7-x)+x=70-10x+x=70-9x$

According to question,

$(70-9x)-(9x+7)=27$

$\Rightarrow \quad 70-9x-9x-7=27$

$-18x=27-63$

$-18x=-36$

$x=\frac{36}{18}$

$x=2$

So, number is $9\times 2+7=18+7=25$

18. Let tens place digit be x

So unit place digit is $5-x$

Number $=10x+5-x=9x+5$

On reversing the order of digits, new number is

$10(5-x)+x=50-10x+x$

$=50-9x$

According to question,

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

$\Rightarrow \quad 9x+5-50+9x=9$

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

$18x=54$

$\therefore \quad x=\frac{54}{18}$

$x=3$

So, number is $9\times 3+5=27+5=32$

19. Let unit place digit be x then tens place digit be $2x$

So, number is $10\times 2x+x=20x+x=21x$

On interchanging the digits, new number is $=12x$

According to question,

$21x-12x=36$

$9x=36$

$\therefore \quad x=\frac{36}{9}$

$x=4$

So, number is $21\times 4=84$

➲ HOTS

1. Given, rope length = 40 m

and one piece length = $\frac{10}{3}$ m

Number of pieces $=40\div\frac{10}{3}=40\times\frac{3}{10}=12$

Hence, there are 12 pieces.

2. (i) $\frac{3}{4}(7x-1)-\left(2x-\frac{1-x}{2}\right)=x+\frac{3}{2}$

$\Rightarrow \quad \frac{21x}{4}-\frac{3}{4}-\left(\frac{4x-1+x}{2}\right)=x+\frac{3}{2}$

$\Rightarrow \quad \frac{21x}{4}-\frac{3}{4}-\frac{5x}{2}+\frac{1}{2}=x+\frac{3}{2}$

$\Rightarrow \quad \frac{21x}{4}-\frac{5x}{2}-x=\frac{3}{2}-\frac{1}{2}+\frac{3}{4}$

$\Rightarrow \quad \frac{21x-10x-4x}{4}=\frac{6-2+3}{4}$

$\Rightarrow \quad \frac{7x}{4}=\frac{7}{4}$

$\Rightarrow \quad x=1$

(ii) $z+6.1=\frac{0.5(z-0.4)}{0.35}-\frac{0.6(z-2.71)}{0.42}$

$\Rightarrow \quad z+6.1=\frac{(z-0.4)}{0.7}-\frac{(z-2.71)}{0.7}$

$\Rightarrow \quad z+6.1=\frac{z-0.4-z+2.71}{0.7}$

$\Rightarrow \quad z+6.1=\frac{-2.31}{0.7}$

$\Rightarrow \quad z+6.1=-3.3$

$\Rightarrow \quad z=-3.3-6.1=-9.4$

(iii) $\frac{(2+x)(x-7)}{(x-5)(x+4)}=1$

$(2+x)(x-7)=(x-5)(x+4)$

$2x-14+x^2-7x=x^2+4x-5x-20$

$x^2-5x-14=x^2-x-20$

$-5x-14=-x-20$

$-5x+x=-20+14$

$-4x=-6$

$4x=6$

$x=\frac{6}{4}=\frac{3}{2}$

3. Let the number of coins of 50-paise $= x$

Let the number of coins of 25-paise $= y$

$$x + y = 52$$

$$y = 52 - x$$

Value of 50-paise coins $= 50 \times x$

Value of 25-paise cons $= 25 \times y$

$$\text{Total value} = 50x + 25y = 21 \times 100$$

$$50x + 25y = 2100$$

$$2x + y = 84$$

$$2x + 52 - x = 84$$

$$x = 84 - 52$$

$$x = 32$$

$$y = 52 - x = 52 - 32$$

$$y = 20$$

Hence, number of 50-paise coins are 32 and number of 25-paise coins are 20

➲ NCERT CORNER

1. (i) $\frac{3}{7} + x = \frac{17}{7}$

$\Rightarrow \quad x = \frac{17}{7} - \frac{3}{7}$ (Transposing $\frac{3}{7}$ to RHS)

$\therefore \quad x = \frac{17-3}{7} = \frac{14}{7} = 2$

(ii) $\frac{t}{5} = 10$

$\Rightarrow \quad t = 10 \times 5 = 50$

(Multiplying both sides by 5)

(iii) $\frac{x}{3} + 1 = \frac{7}{15}$

$\Rightarrow \quad \frac{x}{3} = \frac{7}{15} - 1$ (Transposing 1 to RHS)

$\therefore \quad \frac{x}{3} = \frac{7-15}{15} = \frac{-8}{15}$

Now, $\quad x = \left(-\frac{8}{15}\right) \times 3$

(Multiplying both sides by 3)

$\therefore \quad x = \frac{-8}{15} \times 3$

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

2. Let the smaller number be x.

$\therefore$ The larger number $= x + 15$

$\because$ Sum of two number is 95.

$\therefore \quad x + (x + 15) = 95$

$\Rightarrow \quad 2x + 15 = 95$

$\Rightarrow \quad 2x = 95 - 15$

(Transposing 15 to RHS)

$\Rightarrow \quad 2x = 80$

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

(Dividing both sides by 2)

$\Rightarrow \quad x + 15 = 40 + 15 = 55$

3. Let the Ravi's present age be x years.

Age of Ravi fifteen years from now $= (x + 15)$ years

According to the question, fifteen years from now Ravi's age will be four times his present age.

$\therefore \quad x + 15 = 4x$

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

(Transposing x to RHS)

$\Rightarrow \quad 15 = 3x$

or $\quad 3x = 15$

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

(Dividing both sides by 3)

Hence, Ravi's present age is 5 years.

4. The number of boys and girls in the ratio $= 7 : 5$.

Let, the number of boys and girls in a class $7x$ and $5x$ respectively.

According to the question, the number of boys is 8 more than the number of girls.

$\therefore \quad 7x = 5x + 8$

$\Rightarrow \quad 7x - 5x = 8$ (Transposing $5x$ to LHS)

$\Rightarrow \quad 2x = 8$

$\Rightarrow \quad x = \frac{8}{2} = 4$

(Dividing both sides by 2)

Now, $\quad 7x = 7 \times 4 = 28$

and $\quad 5x = 5 \times 4 = 20$

$\therefore$ Total class strength $= 28 + 20 = 48$

Hence, the total class strength is 48.

5. Let the units digit of the two-digit number be x.

$\therefore$ The tens digit of the two-digit number $= 9 - x$

$\therefore$ The original number $= 10(9 - x) + x$

$= 90 - 10x + x = 90 - 9x$

On interchanging the digits, the new number

$= 10x + (9 - x)$

$= 10x + 9 - x = 9x + 9$

According to the question,

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

$\Rightarrow \quad 9x + 9x = 90 + 27 - 9$

(Transposing $-9x$ to LHS and 9 to RHS)

$\therefore \quad 18x = 108$

$\Rightarrow \quad x = \frac{108}{18} = 6$ (Dividing both sides by 18)

Hence, the original number

$= 90 - (9 \times 6) = 90 - 54 = 36$

6. Let the length of cloth for trousers be $2x$ metres and the length of cloth for shirt $= 3x$ metres

$\therefore$ Cost of trouser's cloth $= 2x \times ₹\,90 = ₹180x$

Cost of shirt's cloth $= 3x \times ₹\,50 = ₹150x$

Hasan sells the trouser's cloth at 10% profit

$\therefore$ Selling price of trouser $= ₹\frac{110}{100} \times 180x$

$= ₹198x$

He sells the shirt's cloth at 12% profit

$\therefore$ Selling price of shirt $= ₹\frac{112}{100} \times 150x$

$= ₹168x$

$\therefore$ Total selling price $= ₹198x + ₹168x$

$= ₹366x$

According to the question, total selling price is ₹ 36,660.

$\therefore \quad 366x = 36{,}600$

$\Rightarrow \quad x = \frac{36{,}600}{366} = 100$

(Dividing both sides by 366)

$\therefore \quad 2x = 2 \times 100 = 200$ metres

Hence, he bought 200 metres of trouser material.

3 Understanding Quadrilaterals

➲ EXERCISE 3.1

1. (a) There are four pairs

(AD, DC), (DC, CB), (CB, BA) and (BA, AD)

(b) There are four pairs

$(\angle A, \angle B)$, $(\angle B, \angle C)$, $(\angle C, \angle D)$ and $(\angle D, \angle A)$

(c) There are two diagonals AC and BD.

2. Let fourth angle be x^0

Since, sum of angles of a quadrilateral is 360°

So, $65° + 83° + 104° + x° = 360°$

$252° + x° = 360°$

$\therefore \quad x° = 360° - 252°$

$= 108°$

3. Let measure of each equal angle be $x°$ then

$80° + 120° + x° + x° = 360°$

$200° + 2x = 360°$

$2x = 360 - 200$

$2x = 160$

$\therefore \quad x = \frac{160}{2}$

$x = 80°$

4. Let measure of each equal angle be $x°$ then,

$150° + x° + x° + x° = 360°$

$3x° = 360 - 150$

$3x° = 210°$

$x° = \frac{210}{3}$

$x° = 70°$

5. Let angles of quadrilateral are $3x$, $4x$, $5x$ and $6x$

$\therefore \quad 3x + 4x + 5x + 6x = 360°$

$18x = 360°$

$x = \frac{360°}{18}$

$x = 20°$

So, angles are $(3 \times 20°) = 60°$, $(4 \times 20°) = 80°$, $(5 \times 20°) = 100°$ and $(6 \times 20°) = 120°$

6. Let angles of quadrilateral are $4x$, $4x$, $5x$ and $5x$

$\therefore \quad 4x + 4x + 5x + 5x = 360°$

$18x = 360°$

$\therefore \quad x = \frac{360°}{18} = 20°$

So, angles are 80°, 80°, 100° and 100°

7. (a) Let measure of each exterior angle be $= \frac{360°}{x}$

$= \frac{360°}{6}$

$= 60°$

(b) Measure of each angle $= \frac{360°}{9}$

$= 40°$

(c) Measure of each angle $= \frac{360°}{10}$

$= 36°$

(d) Measure of each angle $= \frac{360°}{18}$

$= 20°$

8. Number of sides $= \frac{360°}{24°} = 15°$

9. Exterior angle $= 180° - 165° = 15°$

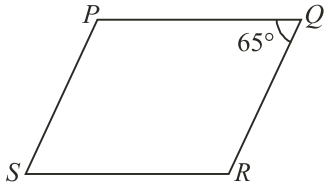
Number of sides $= \frac{360}{15} = 24$

10. Exterior angle $= 180° - 140° = 40°$

$\therefore$ Number of sides $= \dfrac{360°}{40} = 9$

➲ EXERCISE 3.2

1.



Opposite angles of a parallelogram are equal,

So, $\angle S = \angle Q = 65°$

$\angle P + \angle Q = 180°$ (co-int- angles)

$\angle P + 65° = 180°$

$\therefore \quad \angle P = 180° - 65° = 115°$

$\angle R = \angle P = 115°$

2. Let measure of adjacent angles be $2x$ and $3x$

$\therefore \quad 2x + 3x = 180°$

$5x = 180°$

$\therefore \quad x = \dfrac{180}{5}$

$x = 36°$

So, angles are 72°, 108°, 72°, and 108°.

Opposite angles of a rhombus are equal.

3. Let each equal angle be $x°$

$\therefore \quad x° + x° = 160°$

$2x = 160°$

$x = \dfrac{160}{2}$

$x = 80°$

Then other adjacent angle $= 180° - 80° = 100°$

So, angles are 80°, 100°, 80° and 100°.

4. Let one side be x cm then other will be $(x + 8)$ cm

Perimeter $= 40$

$2(x + 8 + x) = 40$

$2(2x + 8) = 40$

$4x + 16 = 40$

$4x = 40 - 16$

$4x = 24$

$\therefore \quad x = \dfrac{24}{4}$

$x = 6$

So, sides are 6 cm and 14 cm long

5. Let measure of each adjacent angle be $x°$

$\therefore \quad x° + x° = 180°$

$2x = 180$

$x = \dfrac{180}{2} = 90°$

So, each angle of the parallelogram is of 90°

6. Let adjacent sides are $3x$ and $5x$ cm

Perimeter $= 64$

$2(3x + 5x) = 64$

$2 \times 8x = 64$

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

So, sides are 12 cm and 20 cm

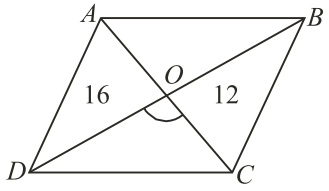
7. Perimeter of rhombus $= 36$

$4 \times$ side $= 36$

side $= \dfrac{36}{4}$

side $= 9$ cm

8.



Let $AC = 12$

$\therefore \quad OC = \dfrac{1}{2}AC = \dfrac{1}{2} \times 12 = 6$ cm

and $\quad OD = \dfrac{1}{2} \times BD = \dfrac{1}{2} \times 16 = 8$ cm

Diagonals of rhombus bisect each other at right angle.

So, in ΔODC by Pythagoras theorem,

$DC^2 = OD^2 + OC^2$

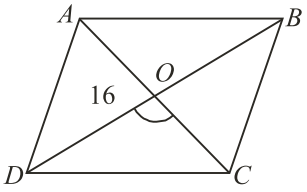
$= 8^2 + 6^2$

$= 64 + 36 = 100$

$\therefore \quad DC = \sqrt{100} = 10$ cm

So, perimeter of rhombus $= 4 \times 10 = 40$ cm

9.



$\therefore \quad OD = \dfrac{1}{2} \times 16 = 8$ cm

In ΔODC, $\quad DC^2 = OD^2 + OC^2$

$10^2 = 8^2 + OC^2$

$100 = 64 + OC^2$

$\therefore \quad OC^2 = 100 - 64 = 36$

or $\quad OC = \sqrt{36} = 6$

So, $AC = 2 \times OC = 2 \times 6 = 12$ cm

10. Diagonals of a parallelogram bisects each other at same point,

So, $\quad OA = OC$

$Y + S = 14$

$\therefore \quad y = 14 - 5 = 9$

and $\quad OD = OB$

$x + y = 12$

$x + 9 = 12$

$\therefore \quad x = 12 - 9 = 3$

11. $PS = QR$

$4x = 20$

$\therefore \quad x = \frac{20}{4} = 5$

$x = 5$

$SR = PQ$

$2y - 3 = 17$

$2y = 17 + 3$

$2y = 20$

$\therefore \quad y = \frac{20}{2} = 10$

12. $40° + x = 110°$ (co-int. angles)

$\therefore \quad x = 110° - 40°$

$x = 70°$

$x + y = 110°$

$70° + y = 110°$ (ext- angle property)

$y = 110° - 70° = 40°$

$(x + 40°) + z = 180°$

$(70° + 40°) + z = 180°$

$\therefore \quad z = 180° - 110°$

$z = 70°$

➲ HOTS

1. Interior angle $= \left(\frac{2x-4}{n} \times 90°\right) = 145°$

$\frac{2x-4}{n} = \frac{145}{90} = \frac{29}{18}$

$36n - 72 = 29n$

$7n = 72$

$n = \frac{72}{7}$

As n is not a natural number, so it is not possible to draw a polygon with an interior angle of 145°.

2. Measure of exterior angle $= \frac{360}{n}$

$\frac{360}{n} = 25$

$n = \frac{360}{25} = \frac{72}{5}$

$\therefore$ Not possible.

3. $\angle BCD = 90°$

$\angle BAD = \angle BCD = 90°$

$\therefore \quad \angle ADC = 90°$

4. $\angle PCB = \angle PCD = 30°$

$\angle PDA = \angle PDC = 25°$

Sum of angles of parallelogram $= 360°$

$\angle A + \angle B + \angle C + \angle D = 360°$

$100° + \angle B + 60° + 50° = 360°$

$\angle B + 210° = 360°$

$\angle B = 360° - 210°$

$\angle B = 150°$

➲ NCERT CORNER

1. The sum of the measures of the angles of a convex quadrilateral is 360°.

Yes, this property holds, even if the quadrilateral is not convex.

2. $x + 90° = 180°$ (Linear pair)

$\therefore \quad x = 180° - 90° = 90°$

$y = 30° + 90° = 120°$

(Sum of interior opposite angles = Exterior angle)

$z + 30° = 180°$ (Linear pair)

$\therefore \quad z = 180° - 30° = 150°$

$\Rightarrow \quad x + y + z = 90° + 120° + 150° = 360°$

3. A regular polygon have each of its interior angles = 165°

$\therefore$ Measure of each exterior angle = 180° – 165°

= 15°

$\therefore$ Number of sides

$= \frac{\text{Sum of all exterior angles}}{\text{Measure of each interior angle}} = \frac{360°}{15°} = 24$

4. A rectangle is a convex quadrilateral because both of its diagonals lie in its interior.

5. Let the two adjacent angles be $3x°$ and $2x°$.

$\therefore \quad 3x° + 2x° = 180°$

(Sum of the two adjacent angles of a parallelogram is 180°)

$\Rightarrow \quad 5x° = 180°$

$\Rightarrow \quad x° = \frac{180°}{5} = 36°$

Now, $3x° = 3 \times 36° = 108°$

and $2x° = 2 \times 36° = 72°$

Hence, the measures of the angles of the parallelogram are 72°, 108°, 72° and 108°.

6. (i) $y = 100°$

(Opposite angles of a parallelogram are equal)

$x + 100° = 180°$

(Adjacent angles in a parallelogram are supplementary)

$\Rightarrow \quad x = 180° - 100 = 80°$

$x = z = 80°$

(Opposite angles of a parallelogram are equal)

Thus, $x = 80°$, $y = 100°$ and $z = 80°$.

(ii) $x + 50° = 180°$

(Adjacent angles in a parallelogram are supplementary)

$\Rightarrow \quad x = 180° - 50° = 130°$

$y = x = 130°$

(The opposite angles of a parallelogram are equal)

$180° - z = 50°$ (Linear pair)

$\Rightarrow \quad z = 180° - 50° = 130°$

Thus, $x = 130°$, $y = 130°$ and $z = 130°$.

(iii) $x = 90°$ (Vertically opposite angles are equal)

$x + y + 30° = 180°$

(By angle sum property of a triangle)

$90° + y + 30° = 180°$

$\Rightarrow \quad 120° + y = 180°$

$\Rightarrow \quad y = 180° - 120° = 60°$

$z + 30° + 90° = 180°$

(By angle sum property of a triangle)

$\Rightarrow \quad z + 120° = 180°$

$\Rightarrow \quad z = 180° - 120° = 60°$

Thus, $x = 90°$, $y = 60°$ and $z = 60°$.

4 Practical Geometry (Construction)

➲ EXERCISE 4.1

1–8. Do it yourself.

➲ EXERCISE 4.2

1–8. Do it yourself.

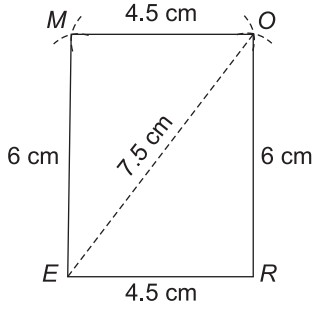
➲ HOTS

1–5. Do it yourself.

➲ NCERT CORNER

1. (a) **Steps for construction :**

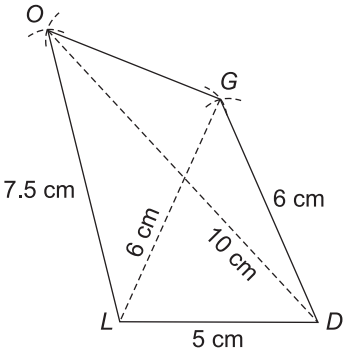
1. Draw a line segment $MO = 4.5$ cm.
2. With M as centre and radius $ME = 6$ cm, draw an arc.
3. With O as centre and radius $OE = 7.5$ cm, draw an arc to intersect the previous arc at E.
4. With O as centre and radius $OR = 6$ cm, draw an arc on the side of OE opposite to that of M.
5. With E as centre and radius $ER = 4.5$ cm, draw another arc to intersect the previous arc at R.
6. Join OR, RE, EM and EO.



Thus, $MORE$ is the required parallelogram.

(b) **Steps for construction :**

1. Draw a line segment $LD = 5$ cm.
2. With L as centre and radius $LG = 6$ cm, draw an arc.
3. With D as centre and radius $DG = 6$ cm, draw another arc to intersect the previous arc at G.
4. With L as centre and radius $LO = 7.5$ cm, draw an arc.
5. With D as centre and radius $DO = 10$ cm, draw another arc to intersect the previous arc at O.
6. Join DG, GO, OL, LG and DO.



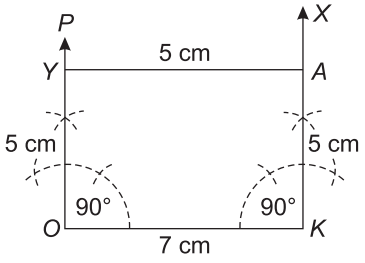
Thus, $GOLD$ is the required quadrilateral.

(c) **Steps for construction :**

1. Draw a line segment $OK = 7$ cm.
2. At K, draw a ray KX, such that $\angle OKX = 90°$.
3. From the ray KX, cut-off $KA = 5$ cm.
4. With A as centre and radius $AY = 7$ cm, draw an arc.

5. With O as centre and radius $OY = 5$ cm, draw another arc to intersect the previous arc at Y.

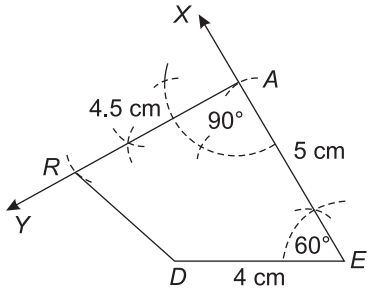
6. Join AY to OY.



Thus, $OKAY$ is the required rectangle.

(d) **Steps for construction :**

1. Draw a line segment $DE = 4$ cm.
2. At E, draw a ray EX, such that $\angle DEX = 60°$.
3. From the ray EX, cut-off $EA = 5$ cm.
4. At A, draw another ray AY, such that $\angle EAY = 90°$.
5. From the ray AY, cut-off $AR = 4.5$ cm.
6. Join RD.



Thus $DEAR$ is the required quadrilateral.

5 Data Handling

➲ EXERCISE 5.1

1–4. Do it yourself.

➲ EXERCISE 5.2

1–6. Do it yourself.

➲ EXERCISE 5.3

1–7. Do it yourself.

➲ EXERCISE 5.4

1. Possible outcomes = 2 (H, T)
Favourable outcomes = 1 (H)
$\therefore$ Probability $= \frac{1}{2}$

2. Possible outcomes = 6 (1, 2, 3, 4, 5, 6)
Favourable outcomes = 3 (2, 4, 6)
$\therefore$ Probability $= \frac{3}{6} = \frac{1}{2}$

3. Possible outcomes = 6 (1, 2, 3, 4, 5, 6)
Favourable outcomes = 2 (4, 6)
$\therefore$ Probability $= \frac{2}{6} = \frac{1}{3}$

4. Probability $= \frac{20}{70} = \frac{2}{7}$

5. Probability $= \frac{30}{120} = \frac{1}{4}$

6. (a) Possible outcomes = 15
Favourable outcomes = 6
$\therefore$ Probability $= \frac{6}{15} = \frac{2}{5}$

(b) Favourable outcomes $= 5 + 4 = 9$
$\therefore$ Probability $= \frac{9}{15} = \frac{3}{5}$

7. (a) Possible outcomes = 10
Favourable outcomes = 1
$\therefore$ Probability $= \frac{1}{10}$

(b) Favourable outcomes = 5 (2, 3, 5, 7, 1)
$\therefore$ Probability $= \frac{5}{10} = \frac{1}{2}$

8. Possible outcomes = 180
Favourable outcomes = 60
$\therefore$ Probability $= \frac{60}{180} = \frac{1}{3}$

9. Possible outcomes = 100
Favourable outcomes = 35
$\therefore$ Probability $= \frac{35}{100} = \frac{7}{20}$

➲ HOTS

1. (a) Tabla $= \frac{78}{360} \times 300 = 65$

(b) Violin $= \frac{90}{360} \times 300 = 75$

(c) Guitar $= \frac{90}{360} \times 300 = 75$

(d) Other than Piano $= \frac{(360 - 66)}{360} \times 300$

$= \frac{294}{360} \times 300 = 245$

2. Angle in pie chart for TV watching

$= \frac{\text{Time spend on TV watching} \times 360°}{\text{Total time}}$

$$= \frac{5}{24} \times 360° = 75°$$

3. Number of red balls = 4

Number of yellow balls = 2

Probability (Red balls) $= \frac{4}{6} = \frac{2}{3}$

Probability (Yellow balls) $= \frac{2}{6} = \frac{1}{3}$

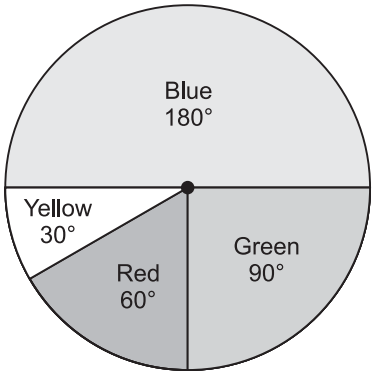
Probability of picking red balls is more than that of probability of picking yellow balls.

➲ NCERT CORNER

1. A frequency distribution table by using tally marks for the above data is as follows :

Class intervals	Tally marks	Frequency (Number of workers)
800–810	|||	3
810–820	||	2
820–830	|	1
830–840	𝍸 ||	9
840–850	𝍸	5
850–860	|	1
860–870	|||	3
870–880	|	1
880–890	|	1
890–900	||||	4
	Total	**30**

2.



Colours	No. of people	Proportion	Corresponding angle
Blue	18	$\frac{18}{36} = \frac{1}{2}$	$\frac{1}{2} \times 360° = 180°$
Green	9	$\frac{9}{36} = \frac{1}{4}$	$\frac{1}{4} \times 360° = 90°$
Red	6	$\frac{6}{36} = \frac{1}{6}$	$\frac{1}{6} \times 360° = 60°$
Yellow	3	$\frac{3}{36} = \frac{1}{12}$	$\frac{1}{12} \times 360° = 30°$
Total	**36**	1	360°

3. (i) Total marks = 540

∴ Central angle corresponding to 540 marks = 360°

For 105 marks, the central angle

$$= \frac{360°}{540} \times 105 = 70°$$

Hence, the student obtained 105 marks in Hindi.

(ii) The central angle corresponding to the sector of Mathematics = 90°

∴ Marks obtained in mathematics

$$= \frac{90}{360} \times 540 = 135$$

Hence, marks more in Mathematics than in Hindi= 135 – 105 = 30

(iii) The sum of the central angles for Social Science and Mathematics

= 65° + 90° = 155°

The sum of the central angles for Science and Hindi = 80° + 70° = 150°

∵ 155° > 150°

∴ The sum of marks obtained in Science and Mathematics is more than the sum of marks obtained in Science and Hindi.

4. (i) (a) Outcomes of getting a prime number are 2, 3 or 5.

(b) Outcomes of not getting a prime number are 1,4 or 6.

(ii) (a) Outcome of getting a number greater than 5 is 6.

(b) Outcomes of getting a number not greater than 5 are 1, 2, 3, 4 or 5.

5. There are 5 sectors in a spinning wheel in which 3 are green sectors, 1 is blue sector and 1 is red sector.

∴ Total possible outcomes = 5.

Now, we can get a green sector in 3 ways. So, favourable outcomes = 3.

∴ Probability of getting a green sector $= \frac{3}{5}$.

We will get a non-blue sector when we will get either a green sector or a red sector. Hence, 4 cases of such type are possible in which we will get a non-blue sector.

∴ Probability of getting a non-blue sector $= \frac{4}{5}$.

6 Squares and Square Roots

➲ EXERCISE 6.1

1. Given in answersheet.

2. Given in answersheet.

3. Given in answersheet.

4. Given in answersheet.

5. (a) $57^2 - 56^2 = 2 \times 56 + 1 = 112 + 1 = 113$

(b) $82^2 - 81^2 = 2 \times 81 + 1 = 162 + 1 = 163$

(c) $64^2 - 63^2 = 2 \times 63 + 1 = 126 + 1 = 127$

(d) $102^2 - 101^2 = 2 \times 101 + 1 = 202 + 1 = 203$

(e) $242^2 - 241^2 = 2 \times 241 + 1 = 482 + 1 = 483$

(f) $349^2 - 348^2 = 2 \times 348 + 1 = 696 + 1 = 697$

6. (a) 7^2 = Sum of the first 7 odd numbers

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 = 49$

(b) 8^2 = Sum of the first 8 odd numbers

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = 64$

(c) 12^2 = Sum of first 12 odd numbers

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23$

$= 144$

(d) 13^2 = Sum of first 13 odd numbers

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25$

$= 169$

(e) 15^2 = Sum of first 15 odd numbers

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29$

$= 225$

7. (a) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = 8^2 = 64$

(b) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = 10^2 = 100$

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

(d) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 = 13^2 = 169$

8. (a) $64 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15$

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

(c) $196 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27$

(d) $225 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29$

(e) $576 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29 + 31 + 33 + 35 + 37 + 39 + 41 + 43 + 45 + 47$

9. Pythagorean triplet

$(2m, m^2 - 1, m^2 + 1)$

(a) Let $2m = 12$

$\therefore \quad m = 6$

$m^2 - 1 = 6^2 - 1 = 36 - 1 = 35$

$m^2 + 1 = 6^2 + 1 = 36 + 1 = 37$

(b) Let $2m = 10$

$\therefore \quad m = 5$

$m^2 - 1 = 5^2 - 1 = 25 - 1 = 24$

$m^2 + 1 = 5^2 + 1 = 25 + 1 = 26$

(c) Let $2m = 20$

$\therefore \quad m = 10$

$m^2 - 1 = 10^2 - 1 = 100 - 1 = 99$

$m^2 + 1 = 10^2 + 1 = 100 + 1 = 101$

(d) Let $2m = 14$

$\therefore \quad m = 7$

$m^2 - 1 = 7^2 - 1 = 49 - 1 = 48$

$m^2 + 1 = 7^2 + 1 = 49 + 1 = 50$

(e) Let $2m = 36$

$\therefore \quad m = 18$

$m^2 - 1 = 18^2 - 1 = 324 - 1 = 323$

$m^2 + 1 = 18^2 + 1 = 324 + 1 = 325$

10. (a)

3	441
3	147
7	49
7	7
	1

$\underline{3 \times 3} \times \underline{7 \times 7}$

Numbers are in pair so it is perfect square

(b)

2	628
2	314
	157

$\underline{2 \times 2} \times 157$

157 is not making pair so 628 is not perfect square.

(c)

5	1025
5	205
	41

$\underline{5 \times 5} \times 41$

No

(d)

2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

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

Yes

(e)

2	728
2	364
2	182
7	91
13	13
	1

$\underline{2 \times 2} \times 2 \times 7 \times 13$

No

(f)

7	3549
3	507
13	169
13	13
	1

$7 \times 3 \times \underline{13 \times 13}$

No

(g)

2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

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

Yes

(h)

2	9216
2	4608
2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

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

Yes

➲ EXERCISE 6.2

1. (a) $(28)^2 = (30-2)^2$

$= (30-2)(30-2)$

$= 30(30-2) - 2(30-2)$

$= 900 - 60 - 60 + 4 = 784$

(b) $42^2 = (40+2)^2$

$= (40+2)(40+2)$

$= 40(40+2) + 2(40+2)$

$= 1600 + 80 + 80 + 4$

$= 1764$

(c) $63^2 = (60+3)^2$

$= (60+3)(60+3)$

$= 60(60+3) + 3(60+3)$

$= 3600 + 180 + 180 + 9$

$= 3969$

(d) $98^2 = (100-2)^2$

$= (100-2)(100-2)$

$= 100(100-2) - 2(100-2)$

$= 10000 - 200 - 200 + 4$

$= 9604$

(e) $106^2 = (100+6)^2$

$= (100+6)(100+6)$

$= 100(100+6) + 6(100+6)$

$= 10000 + 600 + 600 + 36$

$= 11236$

(f) $172^2 = (170+2)^2$

$= (170+2)(170+2)$

$= 170(170+2) + 2(170+2)$

$= 28900 + 340 + 340 + 4 = 29584$

(g) $204^2 = (200+4)^2$

$= (200+4)\,(200+4)$

$= 200\,(200+4) + 4\,(200+4)$

$= 40000 + 800 + 800 + 16$

$= 41616$

(h) $308^2 = (300+8)^2$

$= (300+8)\,(300+8)$

$= 300\,(300+8) + 8\,(300+8)$

$= 90000 + 2400 + 2400 + 64 = 94864$

2. (a)

3	729
3	243
3	81
3	27
3	9
3	3
	1

$729 = \sqrt{3\times3\times3\times3\times3\times3}$

$= 3\times3\times3 = 27$

(b)

23	529
23	23
	1

$\sqrt{529} = \sqrt{23\times23} = 23$

(c)

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

$\sqrt{1764} = \sqrt{2\times2\times3\times3\times7\times7}$

$= 2\times3\times7 = 42$

(d)

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$\sqrt{4096} = \sqrt{2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2}$

$= 2\times2\times2\times2\times2\times2 = 64$

(e)

2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

$\sqrt{1296} = \sqrt{2\times2\times2\times2\times3\times3\times3\times3}$

$= 2\times2\times3\times3 = 36$

(f)

7	5929
7	847
11	121
11	11
	1

$\sqrt{5929} = \sqrt{7\times7\times11\times11}$

$= 7\times11 = 77$

(g)

2	9216
2	4608
2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

$\sqrt{9216} = \sqrt{2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times3\times3}$

$= 2\times2\times2\times2\times2\times3 = 96$

(h)

2	9604
2	4802
7	2401
7	343
7	49
7	7
	1

$\sqrt{9604} = \sqrt{2\times2\times7\times7\times7\times7}$

$= 2\times7\times7 = 98$

(i)

2	7744
2	3872
2	1936
2	968
2	484
2	242
11	121
11	11
	1

$$\sqrt{7744} = \sqrt{2\times2\times2\times2\times2\times2\times11\times11}$$
$$= 2\times2\times2\times11 = 88$$

(j)

7	8281
7	1183
13	169
13	13
	1

$$\sqrt{8281} = \sqrt{7\times7\times13\times13}$$
$$= 7\times13 = 91$$

(k)

5	11025
5	2205
3	441
3	147
7	49
7	7
	1

$$\sqrt{11025} = \sqrt{5\times5\times3\times3\times7\times7}$$
$$= 5\times3\times7$$
$$= 105$$

(l)

7	47089
7	6727
31	961
31	31
	1

$$\sqrt{47089} = \sqrt{7\times7\times31\times31}$$
$$= 7\times31 = 217$$

3.

5	525
5	105
3	21
7	7
	1

$$525 = 5\times5\times3\times7$$

3 and 7 are not making pair so 525 must be multiplied by 21 (3×7) to make it perfect square.

$$\sqrt{525\times3\times7} = \sqrt{5\times5\times3\times3\times7\times7}$$
$$= 5\times3\times7 = 105$$

4.

2	2352
2	1176
2	588
2	294
3	147
7	49
7	7
	1

$$2352 = 2\times2\times2\times2\times3\times7\times7$$

3 is not making pair

So 2352 must be multiplied by 3 to make it perfect square.

$$\sqrt{2352\times3} = \sqrt{2\times2\times2\times2\times3\times3\times7\times7}$$
$$= 2\times2\times3\times7 = 84$$

5.

2	2028
2	1014
3	507
13	169
13	13
	1

$$2028 = 2\times2\times3\times13\times13$$

3 is not making pair so 2028 must be divided by 3 to make it perfect square.

$$2028\div3 = 676$$
$$\sqrt{676} = \sqrt{2\times2\times13\times13}$$
$$= 2\times13 = 26$$

6.

5	2645
23	529
23	23
	1

$$2645 = 5\times23\times23$$

5 is not making pair so 2645 must be divided by 5 to make it perfect square.

$$2645\div5 = 529$$
$$\sqrt{529} = \sqrt{23\times23} = 23$$

7. Find LCM of 6, 9 and 15

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

$$\text{LCM} = 3\times2\times3\times5 = 90$$

Here 2 and 5 are not making pair so it should be multiplied by $2 \times 5 = 10$ to make it perfect square.

So, required number is $90 \times 10 = 900$

8.

2	8, 15, 20
2	4, 15, 10
2	2, 15, 5
5	1, 15, 5
3	1, 3, 1
	1, 1, 1

$$\text{LCM} = 2 \times 2 \times 2 \times 5 \times 3 = 120$$

So, required number $= 120 \times 2 \times 5 \times 3 = 3600$

9. Let number of rows be x and soldiers in each row is x

So, $x \times x = 2601$

$x^2 = 2601$

$x = \sqrt{2601}$

3	2601
3	867
17	289
17	17
	1

$$2601 = \sqrt{\underline{3 \times 3} \times \underline{17 \times 17}}$$

$$= 3 \times 17 = 51$$

So, number of soldiers and rows is 51.

10. Let numbers of students be x and each student.

Contributed ₹ x r

So, $x \times x = 1225$

$x^2 = 1225$

$x = \sqrt{1225}$

5	1225
5	245
7	49
7	7
	1

$\therefore \quad x = \sqrt{\underline{5 \times 5} \times \underline{7 \times 7}} = 5 \times 7 = 35$

➲ EXERCISE 6.3

1. (a)

	59
5	$\overline{34}$ $\overline{81}$
5	–25
109	9 81
9	–9 81
	0

$\therefore \quad \sqrt{3481} = 59$

(b)

	76
7	$\overline{57}$ $\overline{76}$
7	–49
146	8 76
6	8 76
	0

$\therefore \quad \sqrt{5776} = 76$

(c)

	89
8	$\overline{79}$ $\overline{21}$
8	–64
169	15 21
9	15 21
	0

$\therefore \quad \sqrt{7921} = 89$

(d)

	57
5	$\overline{32}$ $\overline{49}$
5	–25
107	7 49
7	7 49
	0

$\therefore \quad \sqrt{3249} = 57$

(e)

	222
2	$\overline{04}$ $\overline{92}$ $\overline{84}$
2	–04
42	92
2	–84
442	8 84
2	8 84
	0

$\therefore \quad \sqrt{49284} = 222$

(f)

	210
2	$\overline{04}$ $\overline{41}$ $\overline{00}$
2	– 4
41	41
1	–41
41	00
0	–00
	0

$\therefore \quad \sqrt{44100} = 210$

(g)

	316
3	$\overline{09}$ $\overline{98}$ $\overline{56}$
3	– 9
61	98
1	61
626	37 56
6	37 56
	0

$\therefore \quad \sqrt{99856} = 316$

(h)

	539
5	$\overline{29}\ \overline{05}\ \overline{21}$
5	−25
103	4 05
3	3 09
1069	96 21
9	96 21
	0

$\therefore \quad \sqrt{290521} = 539$

(i)

	1213
1	$\overline{01}\ \overline{47}\ \overline{13}\ \overline{69}$
1	−01
22	47
2	−44
241	3 13
1	−2 41
2423	72 69
3	−72 69
	0

$\therefore \quad \sqrt{1471369} = 1213$

(j)

	589
5	$\overline{34}\ \overline{69}\ \overline{21}$
5	−25
108	9 69
8	−8 64
1169	1 05 21
9	1 05 21
	0

$\therefore \quad \sqrt{346921} = 589$

(k)

	365
3	$\overline{13}\ \overline{32}\ \overline{25}$
3	− 9
66	4 32
6	−3 96
725	36 25
5	−36 25
	0

$\therefore \quad \sqrt{133225} = 365$

(l)

	257
2	$\overline{06}\ \overline{60}\ \overline{49}$
2	− 4
45	2 60
5	−2 25
507	35 49
7	−35 49
	0

$\therefore \quad \sqrt{66049} = 257$

(m)

	3021
3	$\overline{09}\ \overline{12}\ \overline{64}\ \overline{41}$
3	− 9
602	12 64
2	−12 04
6041	60 41
1	−60 41
	0

$\therefore \quad \sqrt{9126441} = 3021$

(n)

	657
6	$\overline{43}\ \overline{16}\ \overline{49}$
6	−36
125	7 16
5	−6 25
1307	91 49
7	−91 49
	0

$\therefore \quad \sqrt{431649} = 657$

(o)

	2543
2	$\overline{06}\ \overline{46}\ \overline{68}\ \overline{49}$
2	− 4
45	2 46
5	−2 25
504	21 68
4	−20 16
5083	1 52 49
3	−1 52 49
	0

$\therefore \quad \sqrt{6466849} = 2543$

(p)

	3547
3	$\overline{12}\ \overline{58}\ \overline{12}\ \overline{09}$
3	− 9
65	3 58
5	−3 25
704	33 12
4	−28 16
7087	4 96 09
7	−4 96 09
	0

$\therefore \quad \sqrt{12581209} = 3547$

2.

	651
6	$\overline{42}\ \overline{48}\ \overline{73}$
6	−36
125	6 48
5	−6 25
1301	23 73
	−13 01
	10 72

424873 is greater than $(651)^2$ and next perfect square is $(652)^2$ or 425104

So, required number = 425104 – 424873 = 231

3.

	711
7	$\overline{50}$ $\overline{69}$ $\overline{00}$
7	–49
141	1 69
1	–1 41
1421	28 00
1	–14 21
	13 79

$506900 > (711)^2$ and next perfect square is $(712)^2$ or 506944

So required number = 506944 – 506900 = 44

$\sqrt{506944} = 712$

4.

	80
8	$\overline{64}$ $\overline{12}$
8	–64
160	0 12
	– 00
	12

$6412 > (80)^2$ and next perfect square is $(81)^2$ or 6561.

So, required number = 6561 – 6412 = 149

$\sqrt{6561} = 81$

5.

	57
5	$\overline{32}$ $\overline{50}$
5	–25
107	7 50
7	–7 49
	1

So, 1 should be subtracted from 3250

$\sqrt{3249} = 57$

6.

	364
3	$\overline{13}$ $\overline{26}$ $\overline{38}$
3	– 9
66	4 26
6	–3 96
724	30 38
4	–28 96
	1 42

So, 142 should be subtracted from 132638.

$\sqrt{132496} = 364$

7.

	625
6	$\overline{39}$ $\overline{07}$ $\overline{00}$
6	–36
122	3 07
2	–2 44
1245	63 00
5	–62 25
	75

So, 75 should be subtracted from 390700

$\sqrt{390625} = 625$

8. Greatest number of 4-digit is 9999

	99
9	$\overline{99}$ $\overline{99}$
9	–81
189	18 99
9	–17 01
	1 98

So, required number = 9999 – 198 = 9801

9. Greatest number of 5-digit is 99999

	316
3	$\overline{09}$ $\overline{99}$ $\overline{99}$
3	– 9
61	99
1	–61
626	38 99
6	–37 56
	1 43

So, required number = 99999 – 143 = 99856

10. Least number of 8-digit is 10000000

	3162
3	$\overline{10}$ $\overline{00}$ $\overline{00}$ $\overline{00}$
3	– 9
61	1 00
1	–61
626	39 00
6	–37 56
6322	1 44 00
2	–1 26 44
	17 56

So required number $(3163)^2$ = 10004569

EXERCISE 6.4

1. (a)

	3 . 05
3	$\overline{09}$. $\overline{30}$ $\overline{25}$
3	– 9
60	0 30
0	–0
605	30 25
5	–30 25
	0

$\therefore$ $\sqrt{9.3025} = 3.05$

(b)

	5 . 23
5	$\overline{27}$. $\overline{35}$ $\overline{29}$
5	–25
102	2 35
2	–2 04
1043	31 29
3	–31 29
	0

$\therefore$ $\sqrt{27.3529} = 5.23$

(c)

	3 . 47
3	$\overline{12}$. $\overline{04}$ $\overline{09}$
3	− 9
64	3 04
4	−2 56
687	48 09
7	−48 09
	0

$\therefore \quad \sqrt{12.0409} = 3.47$

(d)

	6 . 37
6	$\overline{40}$. $\overline{57}$ $\overline{69}$
6	−36
123	4 57
3	−3 69
1267	88 69
7	−88 69
	0

$\therefore \quad \sqrt{40.5769} = 6.37$

(e)

	0 . 612
6	0 . $\overline{37}$ $\overline{45}$ $\overline{44}$
6	−36
121	1 45
1	−1 21
1222	24 44
2	−24 44
	0

$\therefore \quad \sqrt{0.374544} = 0.612$

(f)

	9 . 21
9	$\overline{84}$. $\overline{82}$ $\overline{42}$
9	−81
182	3 82
2	−3 64
1841	18 41
1	−18 41
	0

$\therefore \quad \sqrt{84.8241} = 9.21$

(g)

	23 . 54
2	$\overline{05}$ $\overline{54}$. $\overline{13}$ $\overline{16}$
2	−4
43	1 54
3	−1 29
465	25 13
5	−23 25
4704	1 88 16
4	1 88 16
	0

$\therefore \quad \sqrt{554.1316} = 23.54$

(h)

	0 . 0197
1	0 . $\overline{00}$ $\overline{03}$ $\overline{88}$ $\overline{09}$
1	− 1
29	2 88
9	−2 61
387	27 09
7	−27 09
	0

$\therefore \quad \sqrt{0.00038809} = 0.0197$

(i)

	0 . 0243
2	0 . $\overline{00}$ $\overline{05}$ $\overline{90}$ $\overline{49}$
2	− 4
44	1 90
4	−1 76
483	14 49
3	−14 49
	0

$\therefore \quad \sqrt{0.00059049} = 0.0243$

(j)

	65 . 38
6	$\overline{42}$ $\overline{74}$. $\overline{54}$ $\overline{44}$
6	−36
125	6 74
5	−6 25
1303	49 54
3	−39 09
13068	10 45 44
8	10 45 44
	0

$\therefore \quad \sqrt{4274.5444} = 65.38$

(k)

	62 . 24
6	$\overline{38}$ $\overline{73}$. $\overline{81}$ $\overline{76}$
6	−36
122	2 73
2	−2 44
1242	29 81
2	−24 84
12444	4 97 76
4	4 97 76
	0

$\therefore \quad \sqrt{3873.8176} = 62.24$

(l)

	92 . 14
9	$\overline{84}$ $\overline{89}$. $\overline{77}$ $\overline{96}$
9	−81
182	3 89
2	−3 64
1841	25 77
1	−18 41
18424	7 36 96
4	7 36 96
	0

$\therefore \quad \sqrt{8489.7796} = 92.14$

2. (a)

	1 . 73205
1	03 . $\overline{00}$ $\overline{00}$ $\overline{00}$ $\overline{00}$
1	– 1
27	2 00
7	–1 89
343	11 00
3	–10 29
3462	71 00
2	69 24
346405	1 76 00 00
5	–1 73 20 25
	2 79 75

$\sqrt{3} = 1.73205$

$= 1.732$ (correct upto 3 decimal places)

(b)

	3 . 8729
3	15 . $\overline{00}$ $\overline{00}$ $\overline{00}$ $\overline{00}$
3	– 9
68	6 00
8	–5 44
767	56 00
7	–53 69
7742	2 31 00
2	1 54 84
77449	76 16 00
9	–69 70 41
	6 45 59

$\therefore \quad \sqrt{15} = 3.8729 = 3.873$

(c)

	4 . 0496
4	16 . $\overline{40}$ $\overline{00}$ $\overline{00}$ $\overline{00}$
4	–16
804	0 40 00
4	– 32 16
8089	7 84 00
9	–7 28 01
80986	55 99 00
6	48 59 16
	7 39 84

$\therefore \quad \sqrt{16.4} = 4.0496 = 4.050$

(d)

	1 . 3784
1	01 . $\overline{90}$ $\overline{00}$ $\overline{00}$
1	– 1
23	90
3	–69
267	21 00
7	18 69
2748	2 31 00
8	–2 19 84
27564	11 16 00
4	–11 02 56
	13 44

$\therefore \quad \sqrt{1.9} = 1.3784 = 1.378$

(e)

	0 . 3464
3	0 . $\overline{12}$ $\overline{00}$ $\overline{00}$ $\overline{00}$
3	–9
64	3 00
4	–2 56
686	44 00
6	–41 16
6924	2 84 00
4	2 76 96
	8 04

$\therefore \quad \sqrt{0.12} = 0.3464 = 0.346$

(f)

	0 . 4029
4	0 . $\overline{16}$ $\overline{24}$ $\overline{00}$ $\overline{00}$
4	–16
802	24 00
2	–16 04
8049	7 96 00
9	–7 24 41
	71 59

$\sqrt{0.1624} = 0.4029 = 0.403$

(g)

	1 . 0392
1	01 . $\overline{08}$ $\overline{00}$ $\overline{00}$
1	– 1
203	08 00
3	–6 09
2069	1 91 00
9	–1 86 21
20782	4 79 00
2	–4 15 64
	63 36

$\sqrt{1.08} = 1.0392 = 1.039$

(h)

	0 . 411
4	0 . $\overline{16}$ $\overline{90}$ $\overline{00}$ $\overline{00}$
4	–16
81	90
1	–81
821	9 00
1	–8 21
	79

$\therefore \quad \sqrt{0.169} = 0.411$

3. (a) $\sqrt{\frac{196}{625}}$

	14
1	$\overline{01}$ $\overline{96}$
1	–01
24	96
4	–96
	0

	25
2	$\overline{06}$ $\overline{25}$
2	– 4
45	2 25
5	–2 25
	0

$\therefore \quad \sqrt{\frac{196}{625}} = \frac{14}{25}$

(b) $\sqrt{\frac{1369}{1849}}$

	37
3	$\overline{13}\ \overline{69}$
3	− 9
67	4 69
7	−4 69
	0

	43
4	$\overline{18}\ \overline{49}$
4	−16
83	2 49
3	−2 49
	0

$\therefore \quad \sqrt{\frac{1369}{1849}} = \frac{37}{43}$

(c) $\sqrt{\frac{2116}{15129}}$

	46
4	$\overline{21}\ \overline{16}$
4	−16
86	5 16
6	−5 16
	0

	123
1	$\overline{01}\ \overline{51}\ \overline{29}$
1	− 1
22	51
2	−44
243	7 29
3	7 29
	0

$\therefore \quad \sqrt{\frac{2116}{15123}} = \frac{46}{123}$

(d) $\sqrt{\frac{1369}{3249}}$

	37
3	$\overline{13}\ \overline{69}$
3	− 9
67	4 69
7	−4 69
	0

	57
5	$\overline{32}\ \overline{49}$
5	−25
107	7 49
7	−7 49
	0

$\therefore \quad \sqrt{\frac{1369}{3249}} = \frac{37}{57}$

(e) $\sqrt{1\frac{56}{169}} = \sqrt{\frac{225}{169}}$

	15
1	$\overline{02}\ \overline{25}$
1	− 1
25	1 25
5	−1 25
	0

	13
1	$\overline{01}\ \overline{69}$
1	
23	−69
	−69
	0

$\therefore \quad \sqrt{1\frac{56}{169}} = \frac{15}{13}$

$= 1\frac{2}{13}$

(f) $\sqrt{23\frac{394}{729}} = \sqrt{\frac{17161}{729}}$

	131
1	$\overline{01}\ \overline{71}\ \overline{61}$
1	−1
23	71
3	−69
261	2 61
1	−2 61
	0

	27
2	$\overline{07}\ \overline{29}$
2	− 4
47	3 29
7	−3 29
	0

$\therefore \quad \sqrt{23\frac{394}{729}} = \frac{131}{27} = 4\frac{23}{27}$

(g) $\sqrt{56\frac{569}{1225}} = \sqrt{\frac{69169}{1225}}$

	263
2	$\overline{06}\ \overline{91}\ \overline{69}$
2	−4
46	2 91
6	−2 76
523	15 69
3	−15 69
	0

	35
3	$\overline{12}\ \overline{25}$
3	− 9
65	3 25
5	−3 25
	0

$\therefore \quad \sqrt{56\frac{569}{1225}} = \frac{263}{35} = 7\frac{18}{35}$

(h) $\sqrt{21\frac{2797}{3364}} = \sqrt{\frac{73441}{3364}}$

	271
2	$\overline{07}\ \overline{34}\ \overline{41}$
2	−4
47	3 34
7	−3 29
541	5 41
1	−5 41
	0

	58
5	$\overline{33}\ \overline{64}$
5	−25
108	8 64
	−8 64
	0

$\therefore \quad \sqrt{21\frac{2797}{3364}} = \frac{271}{58}$

$= 4\frac{39}{58}$

4. (a) $\sqrt{162} \times \sqrt{128}$

2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

2	162
3	81
3	27
3	9
3	3
	1

$\therefore \sqrt{162\times128}$

$=\sqrt{2\times3\times3\times3\times2\times2\times2\times2\times2\times2\times2}$

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

$=2\times2\times2\times2\times3\times3=144$

(b) $\sqrt{72}\times\sqrt{288}$

2	72
2	36
2	18
3	9
3	3
	1

2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

$\sqrt{72\times288}$

$=\sqrt{2\times2\times2\times3\times3\times2\times2\times2\times2\times3\times3}$

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

$=2\times2\times2\times2\times3\times3=144$

(c) $\sqrt{243\times147}=\sqrt{\underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}\times\underline{7\times7}}$

$=3\times3\times3\times7=189$

(d) $\sqrt{288}\times\sqrt{50}=\sqrt{288\times50}$

$=\sqrt{2\times2\times2\times2\times2\times3\times3\times2\times5\times5}$

$=\sqrt{\underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{3\times3}\times\underline{5\times5}}$

$=2\times2\times2\times3\times5=120$

5. (a) $\dfrac{\sqrt{59.29}-\sqrt{5.29}}{\sqrt{59.29}+\sqrt{5.29}}$

	7.7
7	$\overline{59}\,.\,\overline{29}$
7	−49
147	10 29
7	−10 29
	0

	2.3
2	$\overline{05}\,.\,\overline{29}$
2	− 4
43	1 29
3	−1 29
	0

$\therefore \quad \dfrac{7.7-2.3}{7.7+2.3}=\dfrac{5.4}{10}=0.54$

(b) $\dfrac{\sqrt{13.69}-\sqrt{2.89}}{\sqrt{13.69}+\sqrt{2.89}}$

	3.7
3	$\overline{13}\,.\,\overline{69}$
3	− 9
67	4 69
7	−4 69
	0

	1.7
1	2 . $\overline{89}$
1	−1
27	1 89
7	−1 89
	0

$\therefore \quad \dfrac{3.7-1.7}{3.7+1.7}=\dfrac{2}{5.4}=\dfrac{20}{54}=\dfrac{10}{27}$

(c) $\dfrac{\sqrt{462.29}+\sqrt{33.64}}{\sqrt{462.25}-\sqrt{33.64}}$

	21.5
2	$\overline{04}\,\overline{62}\,.\,\overline{25}$
2	−4
41	62
1	−41
425	21 25
5	−21 25
	0

	5.8
5	$\overline{33}\,.\,\overline{64}$
5	−25
108	8 64
8	−8 64
	0

$\therefore \quad \dfrac{21.5+5.8}{21.5-5.8}=\dfrac{27.3}{15.7}=\dfrac{273}{157}$

(d) $\dfrac{\sqrt{605.16}+\sqrt{21.16}}{\sqrt{605.16}-\sqrt{21.16}}$

	24.6
2	$\overline{06}\,\overline{05}\,.\,\overline{16}$
2	−4
44	2 05
4	−1 76
486	29 16
6	−29 16
	0

	4.6
4	$\overline{21}\,.\,\overline{16}$
4	−16
86	5 16
6	−5 16
	0

$\therefore \quad \dfrac{24.6+4.6}{24.6-4.6}=\dfrac{29.2}{20}=1.46$

6.

	22.5
2	$\overline{05}\,\overline{06}\,\overline{25}$
2	−04
42	1 06
2	−84
445	22 25
5	−22 25
	0

$\sqrt{50625}=22.5$

$\sqrt{506.25}+\sqrt{5.0625}=22.5+2.25=24.75$

7.

	0.231
2	$0\,.\,\overline{05}\,\overline{33}\,\overline{61}$
2	−04
43	1 33
3	−1 29
461	4 61
1	−4 61
	0

$\sqrt{0.053361}=0.231$

$\sqrt{5.3361}+\sqrt{533.61}=2.31+23.1$

$=25.41$

8. Let decimal fraction be x

$\therefore \quad x\times x=0.001521$

$$x^2 = 0.001521$$

or $$x = \sqrt{0.001521}$$

	0.039
3	$0.\overline{00}\,\overline{15}\,\overline{21}$
3	−9
69	621
9	−621
	0

$\therefore \quad x = 0.039$

9. Let decimal fraction be x

$\therefore \quad x \times x = 84.8241$

$$x^2 = 84.8241$$

or $$x = \sqrt{84.8241}$$

	9.21
9	$\overline{84}.\overline{82}\,\overline{41}$
9	−81
182	382
2	−364
1841	1841
1	−1841
	0

$\therefore \quad x = 9.21$

10. Let decimal fraction be x

$\therefore \quad x \times x = 0.431649$

$$x^2 = 0.431649$$

$$x = \sqrt{0.431649}$$

	0.657
6	$0.\overline{43}\,\overline{16}\,\overline{49}$
6	−36
125	716
5	−625
1307	9149
7	−9149
	0

$\therefore \quad x = 0.657$

➲ EXERCISE 6.5

1. Area of square park $= 7396\ \text{m}^2$

$$\text{side}^2 = 7396$$

$$\text{side} = \sqrt{7396}$$

$$= 86$$

	86
8	$\overline{73}\,\overline{96}$
8	−64
166	996
6	−996
	0

So perimeter of the square park $= 4 \times \text{side}$

$$= 4 \times 86 = 344\ \text{m}$$

2. Area of square field $= 35721\ \text{m}^2$

$$\text{side}^2 = 35721$$

$$\text{side} = \sqrt{35721}$$

$$= 189$$

	189
1	$\overline{03}\,\overline{57}\,\overline{21}$
1	−01
28	257
8	−224
369	3321
9	−3321
	0

Perimeter of the field $= 4 \times 189 = 756\ \text{m}$

Distance covered in four rounds $= (4 \times 756)\ \text{m}$

$$= 3024\ \text{m}$$

$$\text{Speed} = 12\ \text{km/hr}$$

$$= 12 \times \frac{5}{18} = \frac{10}{3}\ \text{m/s}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{So time} = \frac{3024}{10/3}$$

$$= \frac{3024 \times 3}{10} = \frac{9072}{10}\ \text{seconds}$$

$$= \frac{9072}{10} \times \frac{1}{60}\ \text{minutes}$$

$$= 15.12\ \text{minutes}$$

3. Area of square field $= 60025\ \text{m}^2$

$$\text{side}^2 = 60025$$

$$\text{side} = \sqrt{60025}$$

$$= 245\ \text{m}$$

	245
2	$\overline{06}\,\overline{00}\,\overline{25}$
2	−04
44	200
4	−176
485	2425
5	−2425
	0

Perimeter of the field $= 4 \times 245 = 980\ \text{m}$

$$\text{Speed} = 18 \times \frac{5}{18} = 5\ \text{m/s}$$

$$\text{T} = \frac{980}{5} = 196\ \text{sec}$$

4. Area of field $= \dfrac{7203735}{135} = 53361 \text{ m}^2$

$\text{side}^2 = 53361$

$\text{side} = \sqrt{53361} = 231 \text{ m}$

	231
2	$\overline{05}\,\overline{33}\,\overline{61}$
2	–04
43	133
3	–129
461	461
1	–461
	0

Perimeter of the square lawn = 4 × side = 4 × 231

$= 924 \text{ m}$

Length of wire needed $= 2 \times 924 \text{ m} = 1848 \text{ m}$

Cost of wire $= ₹ (1848 \times 2.85)$

$= ₹ 5266.80$

5. Area of ground $= \dfrac{91936.80}{1.80}$

$\text{side}^2 = 51076 \text{ m}^2$

$\text{side} = \sqrt{51076} = 226$

	226
2	$\overline{05}\,\overline{10}\,\overline{76}$
2	–04
42	110
2	–84
446	2676
6	–2676
	0

Perimeter $= 4 \times 226 = 904 \text{ m}$

Cost of fencing $= ₹ (904 \times 2.25) = ₹ 2034$

6.

	24
2	$\overline{06}\,\overline{10}$
2	–4
44	210
4	–176
	34

So, total students required $= (25)^2 = 625$

but we have 610 students. So we need 15 more students.

7.

	34
3	$\overline{11}\,\overline{90}$
3	–9
64	290
4	–256
	34

So, total plants required $(35)^2 = 1225$

But we have 1190 plants so we need 35 more plants.

➲ HOTS

1. (a) $10^2 = 100$

$11^2 = 121$

Numbers lying between 100 and 124

$= 121 - 100 - 1 = 20$

(b) $15^2 = 225$

$16^2 = 256$

Numbers lying between 225 and 256

$= 256 - 225 - 1 = 30$

(c) $100^2 = 10000$

$101^2 = 10201$

Number lying between 10000 and 10201

$= 10201 - 10000 - 1 = 200$

2. $4^2 + \underline{5^2} + 20^2 = 21^2$

$5^2 + 6^2 + \underline{30^2} = 31^2$

$6^2 + \underline{7^2} + \underline{42^2} = \underline{43^2}$

3. Number $= 2 \times 2 \times 5 \times 5 = 100$

4. $9^2 = 81$

$84 - 81 = 3$

➲ NCERT CORNER

1. (i) The number 431 is an odd number, so its square is also an odd number.

(ii) The number 2826 is an even number, so its square is not an odd number.

(iii) The number 7779 is an odd number, so its square is also an odd number.

(iv) The number 82004 is an even number, so its square is not an odd number.

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

(ii) $121 = (11)^2$

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21$

3. (i) Let $2n = 6 \therefore n = \dfrac{6}{2} = 3$

Now, $n^2 - 1 = 3^2 - 1 = 9 - 1 = 8$

and $n^2 + 1 = 3^2 + 1 = 9 + 1 = 10$

Thus, a Pythagorean triplet, whose one number is 6, is 6, 8, 10.

(ii) Let $2n = 14 \therefore n = \dfrac{14}{2} = 7$

Now, $n^2 - 1 = 7^2 - 1 = 49 - 1 = 48$

and $n^2 + 1 = 7^2 + 1 = 49 + 1 = 50$

Thus, a Pythagorean triple, whose one number is 14, is 14, 48 and 50.

(iii) Let $2n = 16 \therefore n = \frac{16}{2} = 8$

Now, $n^2 - 1 = 8^2 - 1 = 64 - 1 = 63$

and $n^2 + 1 = 8^2 + 1 = 64 + 1 = 65$

Thus, a Pythagorean triplet, whose one number is 16, is 16, 63 and 65.

(iv) Let $2n = 18 \therefore n = \frac{18}{2} = 9$

Now, $n^2 - 1 = 9^2 - 1 = 81 - 1 = 80$

and $n^2 + 1 = 9^2 + 1 = 81 + 1 = 82$

Thus, a Pythagorean triplet, whose one number is 18, is 18, 80 and 82.

4. Let the number of students in the class $= x$

Each student denoted $= ₹\, x$

$\therefore$ ₹ denoted by x students $= ₹\, x \times x = x^2$

Total donation amount = ₹ 2401

7	2401
7	343
7	49
	7

$\therefore \quad x^2 = 2401$

$\Rightarrow \quad \sqrt{x} = \sqrt{2401} = \sqrt{7 \times 7 \times 7 \times 7} = 7 \times 7 = 49$

5. Let the number of rows $= x$

Then, the number of plants in a row $= x$

$\therefore$ Number of plants in x rows $= x \times x = x^2$

Total number of plants to be planted $= 2025$

3	2025
3	675
3	225
3	75
5	25
	5

$\therefore \quad x^2 = 2025$

$\Rightarrow \quad \sqrt{x} = \sqrt{2025} = \sqrt{\underline{3 \times 3} \times \underline{3 \times 3} \times \underline{5 \times 5}}$

$= 3 \times 3 \times 5 = 45$

Hence, the number of rows is 45 and the number of plants in each row is 45.

6. Let the number of rows $= x$

Then, the number of columns $= x$

$\therefore$ The number of plants $= x \times x = x^2$ and x^2 is a perfect square.

The gardener has 1000 plants. Find out the square root of 1000 by division method.

This shows $31^2 < 1000$.

Next perfect square is $32^2 = 1024$.

	31	
3	$\overline{10}$	$\overline{00}$
	-9	
61	1	00
		-61
		39

Hence, the minimum number of plants he needs more for this = 1024 – 1000 = 24.

7. Let the number of rows $= x$, then, the number of columns $= x$

$\therefore$ The number of children $= x \times x = x^2$ and x^2 is a perfect square.

There are 500 children. Find out the square root of 500 by division method.

	22	
2	$\overline{5}$	$\overline{00}$
	-4	
42	1	00
		-84
		16

$\because$ We get a remainder 16

$\therefore$ 22^2 is less than 500 by 16.

Hence, 16 children would be left out in this arrangement.

7 Cubes and Cube Roots

EXERCISE 7.1

1. (a) $5^3 = 21 + 23 + 25 + 27 + 29$

(b) $6^3 = 31 + 33 + 35 + 37 + 39 + 41$

(c) $8^3 = 57 + 59 + 61 + 63 + 65 + 67 + 69 + 71$

(d) $10^3 = 91 + 93 + 95 + 97 + 99 + 101 + 103 + 105 + 107 + 109$

(e) $12^3 = 133 + 135 + 137 + 139 + 141 + 143 + 145 + 147 + 149 + 151 + 153 + 155$

2. $(m+1)^3 - m^3 = 1 + (m+1) \times m \times 3$

(a) $5^3 - 4^3 = 1 + 5 \times 4 \times 3 = 1 + 60 = 61$

(b) $7^3 - 6^3 = 1 + 7 \times 6 \times 3 = 1 + 126 = 127$

(c) $10^3 - 9^3 = 1 + 10 \times 9 \times 3 = 1 + 270 = 271$

(d) $12^3 - 11^3 = 1 + 12 \times 11 \times 3 = 1 + 396 = 397$

(e) $20^3 - 19^3 = 1 + 20 \times 19 \times 3 = 1 + 1140 = 1141$

(f) $39^3 \times 38^3 = 1 + 39 \times 38 \times 3 = 1 + 4446 = 4447$

(g) $52^3 - 51^3 = 1 + 52 \times 51 \times 3 = 1 + 7956 = 7957$

(h) $61^3 - 60^3 = 1 + 61 \times 60 \times 3 = 1 + 10980 = 10981$

3. Given in the answersheet.

4. (a) $(12)^3 = 12 \times 12 \times 12 = 1728$

(b) $(-15)^3 = (-15) \times (-15) \times (-15) = -3375$

(c) $(27)^3 = 27 \times 27 \times 27 = 19683$

(d) $(2.5)^3 = 2.5 \times 2.5 \times 2.5 = 15.625$

(e) $(0.37)^3 = 0.37 \times 0.37 \times 0.37 = 0.050653$

(f) $\left(\frac{-4}{9}\right)^3 = \left(\frac{-4}{9}\right) \times \left(\frac{-4}{9}\right) \times \left(\frac{-4}{9}\right) = \frac{-64}{729}$

(g) $\left(\frac{3}{11}\right)^3 = \frac{3}{11} \times \frac{3}{11} \times \frac{3}{11} = \frac{27}{1331}$

(h) $\left(\frac{5}{18}\right)^3 = \frac{5}{18} \times \frac{5}{18} \times \frac{5}{18} = \frac{125}{5832}$

(i) $\left(\frac{6}{17}\right)^3 = \frac{6}{17} \times \frac{6}{17} \times \frac{6}{17} = \frac{216}{4913}$

(j) $\left(\frac{9}{13}\right)^3 = \frac{9}{13} \times \frac{9}{13} \times \frac{9}{13} = \frac{729}{2197}$

5. (a)

5	3375
5	675
5	135
3	27
3	9
3	3
	1

$3375 = \underline{5 \times 5 \times 5} \times \underline{3 \times 3 \times 3}$

5 and 3 are in group of three so it is a perfect cube.

(b)

2	2744
2	1372
2	686
7	343
7	49
7	7
	1

$2744 = \underline{2 \times 2 \times 2} \times \underline{7 \times 7 \times 7}$

Yes, it is a perfect cube.

(c)

2	15360
2	7680
2	3840
2	1920
2	960
2	480
2	240
2	120
2	60
2	30
3	15
5	5
	1

$15360 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 2 \times 3 \times 5$

2, 3 and 5 are not in group of three so it is not a perfect cube.

(d)

2	17576
2	8788
2	4394
13	2197
13	169
13	13
	1

$17576 = \underline{2 \times 2 \times 2} \times \underline{13 \times 13 \times 13}$

So, it is a perfect cube.

(e)

2	7842
3	3921
1307	1307
	1

It is not a perfect cube

(f)

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$15625 = \underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5}$

So, it is a perfect cube.

(g)

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$4096 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}$

So, it is a perfect cube

(h)

2	32256
2	16128
2	8064
2	4032
2	2016
2	1008
2	504
2	252
2	126
3	63
3	21
7	7
	1

$32256 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times3\times3\times7$

So, it is not a perfect cube.

(i)

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

$13824 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}$

So, it is a perfect cube.

(j)

5	91125
5	18225
5	3645
3	729
3	243
3	81
3	27
3	9
3	3
	1

$91125 = \underline{5\times5\times5}\times\underline{3\times3\times3}\times\underline{3\times3\times3}$

So, it is a perfect cube.

(k)

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

$54000 = \underline{2\times2\times2}\times2\times\underline{3\times3\times3}\times\underline{5\times5\times5}$

So, it is not a perfect cube.

(l)

2	110592
2	55296
2	27648
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

$110592 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}$
$\times\underline{2\times2\times2}\times\underline{3\times3\times3}$

So, it is a perfect cube.

6.

2	6750
5	3375
5	675
5	135
3	27
3	9
3	3
	1

$6750 = 2 \times \underline{5 \times 5 \times 5} \times \underline{3 \times 3 \times 3}$

2 is not in group of three so we need $(2 \times 2 = 4)$ to make it a perfect cube.

7.

5	46305
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

$46305 = 5 \times \underline{3 \times 3 \times 3} \times \underline{7 \times 7 \times 7}$

So, 46305 should be multiplied by $(5 \times 5 = 25)$

8.

2	53240
2	26620
2	13310
5	6655
11	1331
11	121
11	11
	1

$53240 = \underline{2 \times 2 \times 2} \times 5 \times \underline{11 \times 11 \times 11}$

So, 53240 should be divided by 5 to make it a perfect cube.

9.

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

$2560 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 5$

So, 2560 should be divided by 5 to make it a perfect cube.

10.

5	128625
5	25725
5	5145
3	1029
7	343
7	49
7	7
	1

$128625 = \underline{5 \times 5 \times 5} \times 3 \times \underline{7 \times 7 \times 7}$

So, 128625 should be divided by 3 to make it a perfect cube.

EXERCISE 7.2

1. (a)

3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

$\sqrt[3]{9261} = \sqrt[3]{\underline{3 \times 3 \times 3} \times \underline{7 \times 7 \times 7}} = 3 \times 7 = 21$

(b)

2	32768
2	16384
2	8192
2	4096
2	2048
2	1024
2	512
2	256
2	128

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

$32768 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$

$\sqrt[3]{32768} = 2 \times 2 \times 2 \times 2 \times 2 = 32$

(c)

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

$5832 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3}$

$\sqrt[3]{5832} = 2 \times 3 \times 3$

$= 18$

(d)

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$15625 = \underline{5\times5\times5}\times\underline{5\times5\times5}$

$\sqrt[3]{15625} = 5\times5 = 25$

(e)

2	27000
2	13500
2	6750
5	3375
5	675
5	135
3	27
3	9
3	3
	1

$27000 = \underline{2\times2\times2}\times\underline{5\times5\times5}\times\underline{3\times3\times3}$

$\sqrt[3]{27000} = 2\times5\times3 = 30$

(f)

2	39304
2	19652
2	9826
17	4913
17	289
17	17
	1

$39304 = \underline{2\times2\times2}\times\underline{17\times17\times17}$

$\sqrt[3]{39304} = 2\times17 = 34$

(g)

2	110592
2	55296
2	27648
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

$110592 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}$

$\sqrt[3]{110592} = 2\times2\times2\times2\times3 = 48$

(h)

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

$74088 = \underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{7\times7\times7}$

$\sqrt[3]{74088} = 2\times3\times7$

$= 42$

(i)

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

$175616 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{7\times7\times7}$

$\sqrt[3]{175616} = 2\times2\times2\times7 = 56$

(j)

3	250047
3	83349
3	27783
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

$250047 = \underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{7\times7\times7}$

$\sqrt[3]{250047} = 3\times3\times7$

$= 63$

(k)

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

$531441 = \underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{3\times3\times3}$

$\sqrt[3]{531441} = 3\times3\times3\times3 = 81$

(l)

2	140608
2	70304
2	35152
2	17576
2	8788
2	4394
13	2197
13	169
13	13
	1

$140608 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{13\times13\times13}$

$\sqrt[3]{140608} = 2\times2\times13 = 52$

2. (a)

2	55296
2	27648
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

2	54
3	27
3	9
3	3
	1

$\sqrt[3]{55296}\times\sqrt[3]{54} = \sqrt[3]{55296\times54}$

$= \sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}}$

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

$= 2\times2\times2\times3\times2\times3 = 144$

(b)

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	8000
2	4000
2	2000
2	1000
2	500
2	250
5	125
5	25
5	5
	1

$\sqrt[3]{729}\times\sqrt[3]{8000} = \sqrt[3]{729\times8000}$

$= \sqrt[3]{\underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{2\times2\times2}\times\underline{2\times2\times2}}$

$\times\underline{5\times5\times5}$

$= 3\times3\times2\times2\times5 = 180$

(c)

2	13824
2	6912
2	3456
3	1728
3	576
3	192
2	64
2	32
2	16
2	8
2	4
2	2
	1

$\sqrt[3]{13.824}\times\sqrt[3]{8000} = \sqrt[3]{\dfrac{13824\times8000}{1000}}$

$= \sqrt[3]{13824\times8}$

$\sqrt[3]{13824\times8}$

$= \sqrt[3]{\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{2\times2\times2}\times\underline{2\times2\times2}}$

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

$= 2\times3\times2\times2\times2 = 48$

(d) $\sqrt[3]{432}\times\sqrt[3]{4000}$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

2	4000
2	2000
2	1000
2	500
2	250
5	125
5	25
5	5
	1

$\sqrt[3]{432\times4000}$

$=\sqrt[3]{\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{5\times5\times5}}$

$=2\times3\times2\times2\times5=120$

3. (a) $\sqrt[3]{-1728}=-\sqrt[3]{1728}$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

$-\sqrt[3]{1728}=-\sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}}$

$=-(2\times2\times3)$

$=-12$

(b) $\sqrt[3]{-17576}=-\sqrt[3]{17576}$

2	17576
2	8788
2	4394
13	2197
13	169
13	13
	1

$17576=2\times2\times2\times13\times13\times13$

$-\sqrt[3]{17576}=-(2\times13)$

$=-26$

(c) $\sqrt[3]{-39304}=-\sqrt[3]{39304}$

2	39304
2	19652
2	9826
17	4913
17	289
17	17
	1

$39304=2\times2\times2\times17\times17\times17$

$-\sqrt[3]{39304}=-(2\times17)$

$=-34$

(d) $\sqrt[3]{-140608}=-\sqrt[3]{140608}$

2	140608
2	70304
2	35152
2	17576
2	8788
2	4394
13	2197
13	169
13	13
	1

$140608=\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{13\times13\times13}$

$-\sqrt[3]{140608}=-(2\times2\times13)$

$=-52$

(e) $\sqrt[3]{\frac{-2197}{3375}}=-\sqrt[3]{\frac{2197}{3375}}$

13	2197
13	169
13	13
	1

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$\frac{2197}{3375}=\frac{\underline{13\times13\times13}}{\underline{3\times3\times3}\times\underline{5\times5\times5}}$

$-\sqrt[3]{\frac{2197}{3375}}=-\left(\frac{13}{3\times5}\right)$

$=\frac{-13}{15}$

(f) $\sqrt[3]{\frac{-343}{6859}}=-\sqrt[3]{\frac{-343}{6859}}$

7	343
7	49
7	7
	1

19	6859
19	361
19	19
	1

$\frac{343}{6859}=\frac{\underline{7\times7\times7}}{\underline{19\times19\times19}}$

$-\sqrt[3]{\frac{343}{6859}}=\frac{-7}{19}$

(g) $\sqrt[3]{\frac{15625}{117649}}$

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

7	117649
7	16807
7	2401
7	343
7	49
7	7
	1

$$\frac{15625}{117649} = \frac{5\times5\times5\times5\times5\times5}{7\times7\times7\times7\times7\times7}$$

$$\sqrt[3]{\frac{15625}{117649}} = \frac{5\times5}{7\times7} = \frac{25}{49}$$

(h) $\sqrt[3]{\frac{4096}{42875}}$

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

$$\frac{4096}{42875} = \frac{2\times2\times2\times2\times2\times2}{\times2\times2\times2\times2\times2\times2}{5\times5\times5\times7\times7\times7}$$

$$\sqrt[3]{\frac{4096}{42875}} = \frac{2\times2\times2\times2}{5\times7} = \frac{16}{35}$$

4. (a) $\sqrt[3]{32.768} = \sqrt[3]{\frac{32768}{1000}}$

2	32768
2	16384
2	8192
2	4096
2	2048
2	1024
2	512
2	256

→

2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$\sqrt[3]{\frac{32768}{1000}} = \sqrt[3]{\frac{2\times2\times2\times2\times2\times2\times2\times2\times2\times2}{\times2\times2\times2\times2\times2\times2}{2\times2\times2\times5\times5\times5}}$$

$$= \frac{2\times2\times2\times2\times2}{2\times5} = \frac{32}{10} = 3.2$$

(b) $\sqrt[3]{3.375} = \sqrt[3]{\frac{3375}{1000}}$

5	3375
5	675
5	135
3	27
3	9
3	3
	1

10	1000
10	100
10	10
	1

$$\sqrt[3]{\frac{3375}{1000}} = \sqrt[3]{\frac{5\times5\times5\times3\times3\times3}{10\times10\times10}}$$

$$= \frac{5\times3}{10} = \frac{15}{10} = 1.5$$

(c) $3\sqrt{74.088} = 3\sqrt{\frac{74088}{1000}}$

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

$$\sqrt[3]{\frac{74088}{1000}} = 3\sqrt{\frac{2\times2\times2\times3\times3\times3\times7\times7\times7}{10\times10\times10}}$$

$$= \frac{2\times3\times7}{10} = \frac{42}{10} = 4.2$$

(d) $\sqrt[3]{175.616} = \sqrt[3]{\frac{1756616}{1000}}$

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

$$\sqrt[3]{\frac{175616}{1000}} = \sqrt[3]{\frac{2\times2\times2\times2\times2\times2\times2\times2\times7\times7\times7}{10\times10\times10}}$$

$$= \frac{2\times2\times2\times7}{10}$$

$$= \frac{56}{10}$$

$$= 5.6$$

5. $\frac{\sqrt[3]{729}}{\sqrt[3]{-8000}} = \sqrt[3]{\frac{729}{-8000}}$

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	8000
2	4000
2	2000
2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$\frac{\sqrt[3]{729}}{\sqrt[3]{-8000}} = \frac{\sqrt[3]{3\times3\times3\times3\times3\times3}}{-\sqrt[3]{2\times2\times2\times2\times2\times2\times5\times5\times5}}$$

$$= \frac{3\times3}{-(2\times2\times5)}$$

$$= \frac{9}{-20}$$

$$\sqrt[3]{\frac{729}{-8000}} = \frac{-9}{20}$$

6. $\frac{\sqrt[3]{-2197}}{\sqrt[3]{4096}} = \sqrt[3]{\frac{-2197}{4096}}$

13	2197
13	169
13	13
	1

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$$\frac{\sqrt[3]{-2197}}{\sqrt[3]{4096}} = \frac{-\sqrt[3]{13\times13\times13}}{\sqrt[3]{2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2}}$$

$$= \frac{-13}{2\times2\times2\times2} = \frac{-13}{16}$$

$$\sqrt[3]{\frac{-2197}{4096}} = \frac{-13}{16}$$

➲ HOTS

1. $13832 = 5832 + 8000 = 18^3 + 20^3$

and $13832 = 13824 + 8 = 24^3 + 2^3$

$4104 = 4096 + 8 = 16^3 + 2^3$

and $4104 = 3375 + 729 = 15^3 + 9^3$

2. (a) $27\times64 = 3\times3\times3\times2\times2\times2\times2\times2\times2$

$\sqrt[3]{27\times64} = \sqrt[3]{3^3\times2^6} = 3\times2^2 = 12$

(b) $-1000\times729 = 10\times10\times10\times9\times9\times9$

$\sqrt[3]{-1000\times729} = -10\times9 = -90$

3. $\sqrt[3]{27000} + \sqrt[3]{\frac{27}{1000}} + \sqrt[3]{\frac{27}{1000000}} + \sqrt[3]{\frac{27}{1000000000}}$

$$= 30 + \frac{3}{10} + \frac{3}{100} + \frac{3}{1000}$$

$$= 30 + 0.3 + 0.03 + 0.003 = 30.333$$

➲ NCERT CORNER

1. (i) 216

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

Prime factors of 216 are

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

$\because$ All prime factors appear in triplets.

$\therefore$ 216 is a perfect cube.

(ii) 128

2	128
2	64
2	32
2	18
3	9
3	3
	1

Prime factors of 128 are

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

$\because$ $2\times3\times3$ remain after grouping in triplets.

$\therefore$ 128 is not a perfect cube.

(iii) 1000

2	1000
2	500
2	250
5	125
5	25
5	5
	1

Prime factors of 1000 are

$$\underline{2\times2\times2}\times\underline{5\times5\times5}$$

$\because$ All factors appear in triplets.

$\therefore$ 1000 is a perfect cube.

(iv) 100

2	100
2	50
5	25
5	5
	1

Prime factors of 100 are $2\times2\times5\times5$

$\because$ All prime factors are not appeared in triplets.

$\therefore$ 100 is not a perfect cube.

(v) 46656

2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

Prime factors of 46656 are

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

$\because$ All factors appear in triplets.

$\therefore$ 46656 is a perfect cube.

2. (i) 81

3	81
3	27
3	9
3	3
	1

Prime factors of 81 are $\underline{3\times3\times3}\times3$

In the above factorisation, 3 remains after grouping in triplets.

$\therefore$ 81 is not a perfect cube.

To get the perfect cube,

$$81\div3=(3\times3\times3\times3)\div3$$

$\therefore$ $27=\underline{3\times3\times3}$

Hence, the smallest number by which 81 must be divided to obtain a perfect cube is 3.

(ii) 128

2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factors of 128 are $\underline{2\times2\times2}\times\underline{2\times2\times2}\times2$

In the above factorisation, 2 remains after grouping in triplets.

$\therefore$ 128 is not a perfect cube. To get the perfect cube,

$$128\div2=(2\times2\times2\times2\times2\times2\times2)\div2$$

$\therefore$ $64=\underline{2\times2\times2}\times\underline{2\times2\times2}$

Hence, the smallest number by which 128 must be divided to obtain a perfect cube is 2.

(iii) 135

3	135
3	45
3	15
5	5
	1

Prime factors of 135 are $\underline{3\times3\times3}\times5$

In the above factorisation, 2 remains after grouping in triplets.

$\therefore$ 135 is not a perfect cube.

To get the perfect cube,

$$135 \div 5 = (3 \times 3 \times 3 \times 5) \div 5$$

$$\therefore \quad 27 = \underline{3 \times 3 \times 3}$$

Hence, the smallest number by which 135 must be divided to obtain a perfect cube is 5.

(iv) 192

2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

Prime factors of 192 are $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 3$

In the above factorisation, 3 remains after grouping in triplets.

$\therefore$ 192 is not a perfect cube.

To get the perfect cube,

$$192 \div 3 = (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3) \div 3$$

$$\therefore \quad 64 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$$

Hence, the smallest number by which 192 must be divided to obtain a perfect cube is 3.

(v) 704

2	704
2	352
2	176
2	88
2	44
2	22
11	11
	1

Prime factors of 704 are $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 11$

In the above factorisation, 11 remains after grouping in triplets.

$\therefore$ 704 is not a perfect cube.

To get the perfect cube,

$$704 \div 11 = (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 11) \div 11$$

$$\therefore \quad 64 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$$

Hence, the smallest number by which 704 must be divided to obtain a perfect cube is 11.

3. Given in answersheet.

4. (i) Cube root of 1331

The given number is 1331.

Step 1. Form groups of three starting from the rightmost digit of 1331. $\underline{1}\,\underline{331}$

In this case, one group *i.e.,* 331 has three digits whereas 1 has only 1 digit.

Step 2. Take 331.

The digit 1 is at one's place. We take the one's place of the required cube root as 1.

Step 3. Take the other group, *i.e.,* 1. Cube of 1 is 1.

Take 1 as ten's place of the cube root of 1331.

Thus, $\sqrt[3]{1331} = 11$

(ii) Cube root of 4913

The given number is 4913.

Step 1. Form groups of three starting from the rightmost digit of 4913.

In this case one group, *i.e.,* 913 has three digits whereas 4 has only one digit.

Step 2. Take 913.

The digit 3 is at its one's place.

We take the one's place of the required cube root as 7.

Step 3. Take the other group, *i.e.,* 4. Cube of 1 is 1 and cube of 2 is 8. 4 lies between 1 and 8.

The smaller number among 1 and 2 is 1.

The one's place of 1 is 1 itself.

Take 1 as ten's place of the cube root of 4913.

Thus, $\sqrt[3]{4913} = 17.$

(iii) Cube root of 12167

The given number is 12167.

Step 1. Form groups of three starting from the rightmost digit of 12167.

12 **167**. In this case; one group, *i.e.,* 167 has three digits whereas 12 has only two digits.

Step 2. Take 167.

The digit 7 is at its one's place. We take the one's place of the required cube root as 3.

Step 3. Take the other group, *i.e.,* 12. Cube of 2 is 8 and cube of 3 is 27. 12 lies between 8 and 27.

The smaller among 2 and 3 is 2.

The one's place of 2 is 2 itself. Take 2 as ten's place of the cube root of 12167.

Thus, $\sqrt[3]{12167} = 23.$

(iv) Cube root of 32768

The given number is 32768.

Step 1. Form groups of three starting from the rightmost digit of 32768.

32 **768**. In this case one group, *i.e.,* 768 has three digits whereas 32 has only two digits.

Step 2. Take 768.

The digit 8 is at its one's place. We take the one's place of the required cube root as 2.

Step 3. Take the other group, *i.e.,* 32. Cube of 3 is 27 and cube of 4 is 64.

32 lies between 27 and 64.

The smaller number between 3 and 4 is 3.

The one's place of 3 is 3 itself. Take 3 as ten's place of the cube root of 32768.

Thus, $\sqrt[3]{32768} = 32.$

8 Comparing Quantities

➲ EXERCISE 8.1

1. Number of girls $= 60\%$ of $70 = \frac{60}{100} \times 70 = 42$

So number of boys $= 70 - 42 = 28$

Ratio of boys to girls $= 28 : 42 = 2 : 3$

2. Weak students in mathematics $= 42\%$ of 50

$$= \frac{42}{100} \times 50 = 21$$

So good students $= 50 - 21 = 29$

3. Let total students be x

$\therefore$ 35% of $x = 14$

$\Rightarrow$ $\frac{35}{100} \times x = 14$

$$x = \frac{14 \times 100}{35}$$

$$x = 40$$

4. Let total matches be x

$\therefore$ 40% of $x = 12$

$\Rightarrow$ $\frac{40}{100} \times x = 12$

$\Rightarrow$ $x = \frac{12 \times 100}{40}$

$$x = 30$$

5. Let total money be ₹ x

He spends 70%

So remaining is $(100 - 70) = 30\%$

$\therefore$ 30% of $x =$ ₹ 480

$\Rightarrow$ $\frac{30}{100} \times x = 480$

$$x = \frac{480 \times 100}{30} = ₹\ 1600$$

6. Percentage of people who like cricket

$$= 100 - (70 + 20)\% = 10\%$$

People who like football $= 70\%$ of 20 lakh

$$= \frac{70}{100} \times 20 = 14 \text{ lakh}$$

People who like hockey $= 20\%$ of 20 lakh

$$= \frac{20}{100} \times 20 = 4 \text{ lakh}$$

People who like cricket $= 20 - (14 + 4) = 2$ lakh

7. New price $=$ ₹ $(18 + 10\%$ of $18)$

$$= ₹\ (18 + \frac{10}{100} \times 18)$$

$$= ₹\ (18 + 1.80) = ₹\ 19.80$$

8. New price of scooty $=$ ₹ $(38000 + 6\%$ of $38000)$

$$= ₹\ (38000 + \frac{6}{100} \times 38000)$$

$$= ₹\ (38000 + 2280) = ₹\ 40280$$

9. New price of LCD $=$ ₹ $(72000 - 25\%$ of $72000)$

$$= ₹\ (72000 - \frac{25}{100} \times 72000)$$

$$= ₹\ (72000 - 18000) = ₹\ 54000$$

10. New price of the car $=$ ₹ $(212000 - 5\%$ of $212000)$

$$= ₹\ (212000 - \frac{5}{100} \times 212000)$$

$$= ₹\ (212000 - 10600)$$

$$= ₹\ 201400$$

➲ EXERCISE 8.2

1. Rakesh bought TV for ₹4000

Spend on repairing ₹ 800

Total cost of TV $=$ ₹ 4800

S.P. of TV $=$ ₹ 5600

Gain $=$ ₹ $(5600 - 4800) =$ ₹ 800

$$\text{Gain\%} = \frac{\text{Gain}}{\text{CP}} \times 100$$

$$= \frac{800}{4800} \times 100 = 16.66\%$$

2. Total cost of mobile $=$ ₹ $(2500 + 450) =$ ₹ 2950

She sold to her friend for ₹ 4000

$\therefore$ Gain $= 4000 - 2950 =$ ₹ 1050

$$\text{Gain\%} = \frac{1050 \times 100}{2950} = 35.59\%$$

3. Total cost of 55 kg tea-leaf $=$ ₹ $(25 \times 80 + 30 \times 110)$

$$= ₹\ (2000 + 3300) = ₹\ 5300$$

Total S.P. of 55 kg tea-leaf $=$ ₹ (55×105)

$$= ₹\ 5775$$

Gain $=$ ₹ $(5775 - 5300) =$ ₹ 475

$$\text{Gain\%} = \frac{475}{5300} \times 100 = 8.96\%$$

4. Total cost of 50 kg rice $= ₹(30 \times 20 + 20 \times 35)$

$= ₹(600 + 700) = ₹ 1300$

Total S.P. of 50 kg rice $= ₹(50 \times 30) = ₹ 1500$

So, Gain $= ₹(1500 - 1300) = ₹ 200$

$$\text{Gain\%} = \frac{200}{1300} \times 100 = 15.38\%$$

5. Total cost of 60 kg apples $= ₹(60 \times 48) = ₹ 2880$

70% of total apples = 70% of 60 kg

$$= \frac{70}{100} \times 60 = 42 \text{ kg}$$

S.P. of 42 kg $= ₹(42 \times 60) = ₹ 2520$

S.P. of remaining 18 kg apples $= ₹(18 \times 35)$

$= ₹ 630$

Total S.P. $= ₹(2520 + 630) = ₹ 3150$

Gain $= ₹(3150 - 2880) = ₹ 270$

$$\text{Gain\%} = \frac{270}{2880} \times 100 = 9.38\%$$

6. C.P. of 100 kg oranges $= ₹(42 \times 100) = ₹ 4200$

Rotten oranges = 20% of 100

$$= \frac{20}{100} \times 100 = 20 \text{ kg}$$

Remaining oranges $= 100 - 20 = 80$ kg

S.P. of 80 kg $= ₹(80 \times 54) = ₹ 4320$

$\therefore$ Gain $= ₹(4320 - 4200) = ₹ 120$

$$\text{Gain\%} = \frac{120}{4200} \times 100 = 2.86\%$$

7. Total cost of 120 items $= ₹(120 \times 150) = ₹ 18000$

C.P. of 40 items $= ₹(40 \times 150) = ₹ 6000$

C.P. of remaining 80 items $= ₹(18000 - 6000)$

$= ₹ 12000$

S.P. of 40 items at 6% gain $= ₹\left(\frac{100+6}{100} \times 6000\right)$

$= ₹\left(\frac{106}{100} \times 6000\right)$

$= ₹ 6360$

S.P. of 120 items at 25% $= ₹\left(\frac{100+25}{100} \times 18000\right)$

$= ₹\left(\frac{125}{100} \times 18000\right)$

$= ₹ 22500$

S.P. of 80 items $= ₹(22500 - 6360)$

$= ₹ 16140$

Gain on 80 items $= ₹(16140 - 12000)$

$= ₹ 4140$

$$\text{Gain\%} = \frac{4140}{12000} \times 100 = 34.5\%$$

8. C.P. of first bullock at 10% profit

$$= ₹\left(\frac{100}{100+10} \times 4950\right)$$

$$= ₹\left(\frac{100}{110} \times 4950\right) = ₹ 4500$$

C.P. of second bullock at 10% loss

$$= ₹\left(\frac{100}{100-10} \times 4950\right)$$

$$= ₹\left(\frac{100}{90} \times 4950\right) = ₹ 5500$$

C.P. of both bullocks $= ₹(4500 + 5500) = ₹ 10000$

S.P. of both bullocks $= ₹(2 \times 4950) = ₹ 9900$

Loss $= ₹(10000 - 9900) = ₹ 100$

$$\text{Loss\%} = \frac{100}{10000} \times 100 = 1\%$$

9. S.P. of first watch at 10% gain

$$= ₹\left(\frac{100}{100+10} \times 990\right)$$

$$= ₹\left(\frac{100}{110} \times 990\right) = ₹ 900$$

S.P. of second watch at 10% loss

$$= ₹\left(\frac{100}{100-10} \times 990\right)$$

$$= ₹\left(\frac{100}{90} \times 990\right) = ₹ 1100$$

$\therefore$ S.P. of both watches $= ₹(900 + 1100) = ₹ 2000$

C.P. of both watches $= ₹(2 \times 990) = ₹ 1980$

Loss $= ₹(2000 - 1980) = ₹ 20$

$$\text{Loss\%} = \frac{20}{2000} \times 100 = 1\%$$

10. C.P. of chair $= \left(\frac{100}{100-4} \times 432\right)$

$$= ₹\left(\frac{100}{96} \times 432\right) = ₹ 450$$

S.P. of chair at 12% profit $= ₹\left(\frac{100+12}{100} \times 450\right)$

$$= ₹\left(\frac{112}{100} \times 450\right) = ₹ 504$$

11. C.P. of refrigerator $= ₹\left(\frac{100}{100+10} \times 6600\right)$

$$= ₹\left(\frac{100}{110} \times 6600\right)$$

$= ₹ 6000$

S.P. at 28% gain $= ₹\left(\frac{100+28}{100}\times 6000\right)$

$= ₹\left(\frac{128}{100}\times 6000\right) = ₹\ 7680$

12. Let C.P. of 1 pen $= ₹\ 1$

C.P. of 12 pens $= ₹\ 12$

S.P. of 15 pens $= ₹\ 12$

$\therefore$ S.P. of 1 pen $= ₹\frac{12}{15}$

$\therefore$ Loss $= ₹\left(1-\frac{12}{15}\right)$

$= ₹\left(\frac{15-12}{15}\right)$

$= ₹\frac{3}{15} = ₹\frac{1}{5}$

$\text{Loss\%} = \frac{\frac{1}{5}}{1}\times 100 = 20\%$

13. Let C.P. of 1 copy $= ₹\ 1$

C.P. of 10 copies $= ₹\ 10$

$\therefore$ S.P. of 9 copies $= ₹\ 10$

$\therefore$ S.P. of 1 copy $= ₹\frac{10}{9}$

$\therefore$ Profit $= \frac{10}{9}-1 = \frac{1}{9}$

$\text{Profit\%} = \frac{1}{9}\times 100 = 11\frac{1}{9}\%$

14. Let C.P. of the toy car be $₹\ x$

S.P. of toy car $= ₹\left(\frac{100+16}{100}\times x\right)$

$= ₹\left(\frac{116}{110}\times x\right)$

New S.P. $= ₹\left(\frac{116}{100}x+100\right)$

New S.P. $= ₹\left(\frac{100+20}{100}\times x\right)$

$\frac{116}{100}x+100 = \frac{120}{100}x$

$\Rightarrow \frac{120}{100}x-\frac{116}{100}x = 100$

$\Rightarrow \frac{4x}{100} = 100$

$x = \frac{100\times 100}{4}$

$x = ₹\ 2500$

➲ EXERCISE 8.3

1. Discount = M.P. − S.P. $= ₹\ (800-720) = ₹\ 80$

$\text{Discount\%} = \frac{80}{800}\times 100 = 10\%$

2. Discount $= ₹\ (1200-1150) = ₹\ 50$

$\text{Discount\%} = \frac{50}{1200}\times 100 = 4.17\%$

3. S.P. $= \left(1-\frac{\text{D\%}}{100}\right)\times \text{M.P.} = \left(1-\frac{20}{100}\right)\times 950$

$= ₹\left(1-\frac{1}{5}\right)\times 950 = ₹\left(\frac{4}{5}\times 950\right) = ₹\ 760$

4. S.P. $= ₹\left(1-\frac{8}{100}\right)\times 46000$

$= ₹\left(\frac{92}{100}\times 46000\right) = ₹\ 42320$

5. S.P. $= ₹\left(1-\frac{15}{100}\right)\times 12000$

$= ₹\left(\frac{85}{100}\times 12000\right) = ₹\ 10200$

6. S.P. $= ₹\left(1-\frac{10}{100}\right)\times 1250 = ₹\left(\frac{90}{100}\times 1250\right) = ₹\ 1125$

C.P. $= ₹\left(\frac{100}{100+25}\times 1125\right) = ₹\left(\frac{100}{125}\times 1125\right) = ₹\ 900$

7. S.P. $= \left(1-\frac{4}{100}\right)\times 680 = ₹\left(\frac{96}{100}\times 680\right) = ₹\ 652.80$

C.P. $= \left(\frac{100}{100+20}\times 652.80\right)$

$= ₹\left(\frac{100}{120}\times 652.80\right) = ₹\ 544$

8. Let M.P. of an article be $₹\ 100$

$\therefore$ S.P. $= 100\left(1-\frac{10}{100}\right)\left(1-\frac{15}{100}\right)$

$= ₹\left(100\times\frac{90}{100}\times\frac{85}{100}\right) = ₹\ 76.50$

So, discount $= ₹\ (100-76.50) = ₹\ 23.5$

So discount% $= \frac{23.5}{100}\times 100 = 23.5\%$

➲ EXERCISE 8.4

1. Cost of shoes $= ₹\ 850$

Sales tax $= ₹\ (5\%\text{ of }850) = ₹\left(\frac{5}{100}\times 850\right) = ₹\ 42.50$

$\therefore$ Cost of shoes after sales tax

$= ₹\ (850+42.50) = ₹\ 892.50$

2. Price of soap = ₹ 45

Sales tax = ₹ (8% of 45)

$$= ₹\left(\frac{8}{100}\times 45\right) = ₹\,3.60$$

$\therefore$ Price of soap after sales tax = ₹ (45 + 3.60)

= ₹ 48.60

3. Cost of CTV = ₹ 10500

Vat on CTV = ₹ (4% of 10500)

$$= ₹\left(\frac{4}{100}\times 10500\right)$$

= ₹ 420

Cost of CTV after vat = ₹ (10500 + 420)

= ₹ 10920

4. Let cost of shirt before vat be ₹ x

$\therefore$ $x + 5\%$ of $x = 630$

$\Rightarrow$ $x + \frac{5}{100}\times x = 630$

$\Rightarrow$ $x + \frac{x}{20} = 630$

$\Rightarrow$ $\frac{21x}{20} = 630$

$\Rightarrow$ $x = ₹\left(\frac{630\times 20}{21}\right)$

$x = ₹\,600$

5. Let price of cooler before vat be ₹ x

$\therefore$ $x + 5\%$ of $x = 3465$

$\Rightarrow$ $x + \frac{5}{100}\times x = 3465$

$\Rightarrow$ $x + \frac{x}{20} = 3465$

$\Rightarrow$ $\frac{21x}{20} = 3465$

$\Rightarrow$ $x = \frac{3465\times 20}{21}$

$\Rightarrow$ $x = ₹\,3300$

6. Let cost of hair-dryer be ₹ x

$\therefore$ $x + 8\%$ of $x = 2160$

$\Rightarrow$ $x + \frac{8}{100}\times x = 2160$

$\Rightarrow$ $\frac{108x}{100} = 2160$

$\Rightarrow$ $x = \frac{2160\times 100}{108}$

$x = 2000$

$\therefore$ $x = ₹\,2000$

➲ HOTS

1. A's income $= 125x$

B's income $= 100x$

% of B's income less than A $= \frac{25x}{125x}\times 100 = 20\%$

2. Old price $= 100y$

New price $= 125y$

% Decrease in price $= \frac{25y}{125y}\times 100 = 20\%$

3. Cost price $= 100x$

Sell price $= 108x$

Marked price $\times \frac{90}{100}$ = Sell price

Marked price $= 108x \times \frac{100}{90} = 120x$

Marked price should be marked 20% above cost price.

➲ NCERT CORNER

1. (a) $3 : 4 = \frac{3}{4}$

$\therefore$ $\frac{3}{4} = \frac{3}{4}\times 100\% = \frac{3}{4}\times\frac{100}{1} = \frac{300}{4} = 75\%$

(b) $2 : 3 = \frac{2}{3}$

$\therefore$ $\frac{2}{3} = \frac{2}{3}\times 100\% = \frac{2}{3}\times\frac{100}{1} = \frac{200}{3} = 66\frac{2}{3}\%$

2. Chameli is spending her money = 75%

She had left after spending = 100% – 75% = 25%

$\therefore$ 25% of total money = ₹ 600

$\Rightarrow$ $\frac{25}{100}$ of total money = ₹ 600

$\therefore$ Total money = ₹ $\frac{600\times 100}{25}$ = ₹ 2400

Hence, she had ₹ 2400 in the beginning.

3. Cost price of 80 articles = ₹ 2400

Profit rate = 16%

$\therefore$ Profit amount $= \frac{16}{100}\times 2400 =$ ₹ 384

SP = CP + Profit

= ₹ 2400 + ₹ 384 = ₹ 2784

$\because$ SP of 80 articles = ₹ 2784

$\therefore$ SP of 1 article $= \frac{2784}{80} =$ ₹ 34.80

Hence, the selling price of one article is ₹ 34.80.

4. Combined CP of the VCR and TV

= ₹ 8,000 + ₹ 8,000 = ₹ 16,000

Loss of 4% on the VCR = 4% of ₹ 8,000

$$= \frac{4}{100} \times 8000 = ₹\ 320$$

Gain of 8% on the TV = 8% of ₹ 8,000

$$= \frac{8}{100} \times 8000 = ₹\ 640$$

Gain on whole transaction = ₹ 640 – ₹ 320 = ₹ 320

Gain % on whole transaction $= \frac{320}{16000} \times 100 = 2\%$

Hence, the gain per cent on whole transaction is 2%.

5. Let the original price = ₹ 100

VAT = 8%

VAT amount = 8% of ₹ 100 $= \frac{8}{100} \times 100 = ₹\ 8$

∴ Price after VAT = ₹ 100 + ₹ 8 = ₹ 108

When the price is ₹ 108, then the original price

= ₹ 100

When the price ₹ 5,400, then the original price

$$= \frac{100}{108} \times 5400 = ₹\ 5,000$$

Hence, the price of the hair-dryer before VAT is ₹ 5,000.

9 Compound Interest

➲ EXERCISE 9.1

1. (a) Amount $= P\left(1+\frac{r}{100}\right)^n$

$$= 5000\left(1+\frac{6}{100}\right)^3 = 5000\left(\frac{106}{100}\right)^3$$

$$= 5000 \times \frac{106}{100} \times \frac{106}{100} \times \frac{106}{100}$$

$$= ₹\ 5955.08$$

∴ C.I. = ₹ (5955.08 – 5000)

= ₹ 955.08

(b) $A = 8000\left(1+\frac{8}{100}\right)^2\left(1+\frac{4}{100}\right)^1$

$$= 8000 \times \left(\frac{108}{100}\right)^2 \times \frac{104}{100}$$

$$= 8000 \times \frac{108}{100} \times \frac{108}{100} \times \frac{104}{100}$$

$$= ₹\ 9704.45$$

∴ C.I. = ₹ (9704.45 – 8000)

= ₹ 1704.45

(c) $A = 12000\left(1+\frac{25}{4\times100}\right)^4$

$$= 12000\left(1+\frac{1}{16}\right)^4 = 12000 \times \left(\frac{17}{16}\right)^4$$

$$= 12000 \times \frac{17}{16} \times \frac{17}{16} \times \frac{17}{16} \times \frac{17}{16}$$

$$= ₹\ 15293.15$$

C.I. = ₹ (15293.15 – 12000) = ₹ 3293.15

(d) $A = 16000 \times \left(1+\frac{9}{100}\right)^3\left(1+\frac{9}{3\times100}\right)^1$

$$= 16000 \times \left(\frac{109}{100}\right)^3 \times \left(\frac{103}{100}\right)$$

$$= 16000 \times \frac{109}{100} \times \frac{109}{100} \times \frac{109}{100} \times \frac{103}{100}$$

$$= ₹\ 21342.08$$

C.I. = ₹ (21342.08– 16000) = ₹ 5342.08

2. Amount $= 40500\left(1+\frac{8}{100}\right)^2 = 40500\left(\frac{108}{100}\right)^2$

$$= 40500 \times \frac{108}{100} \times \frac{108}{100}$$

$$= ₹\ 47239.20$$

So, Rakesh will pay ₹ 47239.20 to Mahesh.

3. $A = 28500\left(1+\frac{12}{100}\right)^3 = 28500\left(\frac{112}{100}\right)^3$

$$= 28500 \times \frac{112}{100} \times \frac{112}{100} \times \frac{112}{100}$$

$$= ₹\ 40040.45$$

So, Vimal will pay ₹ 40040.45 to clear loan.

4. S.I. $= \frac{P \times R \times T}{100} = \frac{15000 \times 10 \times 4}{100} = ₹\ 6000$

Amount at compound interest

$$= 15000\left(1+\frac{8}{100}\right)^4$$

$$= 15000 \times \left(\frac{108}{100}\right)^4 = ₹\ 20407.33$$

∴ C.I. = ₹ (20407.33 – 15000) = ₹ 5407.33

So, Rajia will pay more interest by ₹

= (6000 – 5407.33) = ₹ 592.67

5. Amount after 2 years $= 80000\left(1+\frac{10}{100}\right)\left(1+\frac{12}{100}\right)$

$$= 80000 \times \frac{110}{100} \times \frac{112}{100}$$

$$= ₹\ 98560$$

6. $P = \frac{S.I. \times 100}{R \times T} = \frac{1800 \times 100}{6 \times 3} = ₹\ 10000$

$$A = 10000\left(1 + \frac{6}{100}\right)^3$$

$$= ₹10000 \times \left(\frac{106}{100}\right)^3 = ₹\ 11910.16$$

$\therefore$ C.I. $= ₹\ (11910.16 - 10000) = ₹\ 1910.16$

7. $P = \frac{5200 \times 100}{2 \times \frac{13}{2}} = ₹\ 40000$

$$A = 40000\left(1 + \frac{213}{200}\right)^2 = 40000\left(\frac{213}{200}\right)^2 = ₹\ 45369$$

$\therefore$ C.I. $= ₹\ (45369 - 40000) = ₹\ 5369$

8. S.I. $= \frac{20000 \times 6 \times 2}{100} = ₹\ 2400$

$$A = 20000\left(1 + \frac{6}{100}\right)^2$$

$$= 20000 \times \left(\frac{106}{100}\right)^2 = ₹\ 22472$$

C.I. $= ₹\ (22472 - 20000) = ₹\ 2472$

So, difference between C.I. and S.I.

$= ₹\ (2472 - 2400) = ₹\ 72$

So, he would pay ₹ 72 more.

9. $A = P\left(1 + \frac{r}{100}\right)^n$

$$\Rightarrow \quad 9261 = P\left(1 + \frac{5}{100}\right)^3$$

$$\Rightarrow \quad 9261 = P\left(\frac{105}{100}\right)^3$$

$$\Rightarrow \quad P = 9261 \times \left(\frac{100}{105}\right)^3$$

$$\Rightarrow \quad P = ₹\ 8000$$

10. $A = P\left(1 + \frac{r}{100}\right)^n$

$$\Rightarrow \quad 45369 = P\left(1 + \frac{13}{2 \times 100}\right)^2$$

$$\Rightarrow \quad 45369 = P\left(\frac{213}{200}\right)^2$$

$$\Rightarrow \quad P = 45369 \times \left(\frac{200}{213}\right)^2$$

$$\Rightarrow \quad P = ₹\ 40000$$

11. $A = P\left(1 + \frac{r}{100}\right)^n$

$$\Rightarrow \quad 10404 = P\left(1 + \frac{2}{100}\right)^2$$

$$\Rightarrow \quad 10404 = P\left(\frac{102}{100}\right)^2$$

$$\Rightarrow \quad P = 10404 \times \left(\frac{100}{102}\right)^2$$

$$\Rightarrow \quad P = ₹\ 10000$$

12. $P = ₹\ 4000$

$A = P + C.I. = ₹\ (4000 + 410) = ₹\ 4410$

$$A = P\left(1 + \frac{r}{100}\right)^n$$

$$\Rightarrow \quad 4410 = 4000\left(1 + \frac{r}{100}\right)^2$$

$$\Rightarrow \quad \frac{4410}{4000} = \left(1 + \frac{r}{100}\right)^2$$

$$\Rightarrow \quad \left(\frac{21}{20}\right)^2 = \left(1 + \frac{r}{100}\right)^2$$

Taking square root of both sides, we get

$$\frac{21}{10} = 1 + \frac{r}{100}$$

or $$\frac{r}{100} = \frac{21}{20} - 1$$

$$\frac{r}{100} = \frac{21 - 20}{20} = \frac{1}{20}$$

$\therefore$ $$r = \frac{1}{20} \times 100 = 5\%$$

$$r = 5\%$$

13. $A = P\left(1 + \frac{r}{100}\right)^n$

$$774.40 = 640\left(1 + \frac{r}{100}\right)^2$$

$$\Rightarrow \quad \frac{774.40}{640} = \left(1 + \frac{r}{100}\right)^2$$

$$\Rightarrow \quad \frac{7744}{6400} = \left(1 + \frac{r}{100}\right)^2$$

$$\Rightarrow \quad \left(\frac{88}{80}\right)^2 = \left(1 + \frac{r}{100}\right)^2$$

or $$\frac{88}{80} = 1 + \frac{r}{100}$$

$$\Rightarrow \quad 1+\frac{r}{100}=\frac{88}{80}$$

$$\Rightarrow \quad \frac{r}{100}=\frac{88}{80}-1$$

$$\Rightarrow \quad \frac{r}{100}=\frac{8}{80}=\frac{1}{10}$$

$$\Rightarrow \quad r=\frac{1}{10}\times 100$$

$$\Rightarrow \quad r=10\%$$

14. $A=P\left(1+\frac{r}{100}\right)^n$

$$2662=2000\left(1+\frac{10}{100}\right)^n$$

$$\Rightarrow \quad \frac{2662}{2000}=\left(\frac{110}{100}\right)^n$$

$$\Rightarrow \quad \frac{1331}{1000}=\left(\frac{11}{10}\right)^n$$

$$\Rightarrow \quad \left(\frac{11}{10}\right)^3=\left(\frac{11}{10}\right)^n$$

On comparing, $n=3$

15. $A=P\left(1+\frac{r}{100}\right)^n$

$$2178=1800\left(1+\frac{10}{100}\right)^n$$

$$\Rightarrow \quad \frac{2178}{1800}=\left(\frac{11}{10}\right)^n$$

$$\Rightarrow \quad \frac{1089}{900}=\left(\frac{11}{10}\right)^n$$

$$\Rightarrow \quad \left(\frac{33}{30}\right)^2=\left(\frac{11}{10}\right)^n$$

$$\Rightarrow \quad \left(\frac{11}{10}\right)^2=\left(\frac{11}{10}\right)^n$$

$$\therefore \quad n=2$$

➲ EXERCISE 9.2

1. P = ₹ 80000

$r=10\%$ p.a. or $\frac{10}{2}=5\%$ half-yearly

$n=3\times 2=6$ (due to half-yearly)

$$\therefore \quad A=P\left(1+\frac{r}{100}\right)^n=80000\left(1+\frac{5}{100}\right)^6$$

$$=80000\left(\frac{105}{100}\right)^6=₹\ 107207.65$$

So, Reena paid ₹ 1,07,207.65 at the end of 3 years.

2. A = ₹ 7500

$r=8\%$ p.a. or $\frac{8}{2}=4\%$ half yearly

$n=2\times 2=4$ (due to half-yearly)

$$A=P\left(1+\frac{r}{100}\right)^n$$

$$\Rightarrow \quad 7500=P\left(1+\frac{4}{100}\right)^n$$

$$\Rightarrow \quad 7500=P\left(1+\frac{4}{100}\right)^4$$

$$\Rightarrow \quad 7500=P\left(\frac{104}{100}\right)^4$$

$$\Rightarrow \quad P=7500\times\left(\frac{100}{104}\right)^4$$

$$\Rightarrow \quad P=₹\ 6411 \text{ (approx.)}$$

3. Ist case, when interest is compounded annually,

$$A=20000\left(1+\frac{12}{100}\right)^3$$

$$=20000\left(\frac{112}{100}\right)^3=₹\ 28098.56$$

$\therefore$ C.I. = ₹ (28098.56 – 20000) = ₹ 8098.56

IInd case, when interest is compounded half-yearly

$r=\frac{12}{2}=6\%$ half yearly

$n=3\times 2=6$

$$A=20000\left(1+\frac{6}{100}\right)^6$$

$$=₹\ 20000\times\left(\frac{106}{100}\right)^6=₹\ 28370.38$$

$\therefore$ C.I. = ₹ (28370.38 – 20000) = ₹ 8370.38

So difference between C.I. is

= (8370.38 – 8098.56) = ₹ 271.82

So Chitamani earned ₹ 271.82

4. Ist case, when interest is compounded half-yearly,

P = ₹ 20000

$r=\frac{10}{2}=5\%$ half yearly

$n=1\frac{1}{2}=\frac{3}{2}\times 2=3$

$$A=20000\left(1+\frac{5}{100}\right)^3$$

$$=20000\left(\frac{105}{100}\right)^3=₹\ 23152.50$$

IInd case, when interest is compounded annually,

$$A = 20000\left(1+\frac{10}{100}\right)^1\left(1+\frac{5}{100}\right)^1$$

$$= 20000\left(\frac{110}{100}\right)\left(\frac{105}{100}\right) = ₹\,23100$$

Difference between

C.I. $= ₹\,(23152.50 - 23100) = ₹\,52.50$

Yes it would be more.

5. P $= ₹\,50{,}000$

$r = \frac{12}{2} = 6\%$ half yearly

$n = 2 \times 2 = 4$

$$A = 50000\left(1+\frac{6}{100}\right)^4$$

$$= 50000\left(\frac{106}{100}\right)^4 = ₹\,63123.85$$

6. P $= ₹\,10000$

$r = \frac{8}{4} = 2\%$ quarterly

$n = \frac{3}{2} \times 4 = 6$ quarters

$$A = 10000\left(1+\frac{2}{100}\right)^6$$

$$= 10000\left(\frac{102}{100}\right)^6 = ₹\,11261.62$$

7. P $= ₹\,1{,}50{,}000$

$r = \frac{10}{4} = \frac{5}{2}\%$ quarterly

$n = 2 \times 4 = 8$ quarters

$$A = 150000\left(1+\frac{5}{2\times100}\right)^8$$

$$= 150000\left(\frac{205}{200}\right)^8 = ₹\,182760.43$$

8. Ist case, when interest is compounded half-yearly,

P $= ₹\,56000$

$r = \frac{12}{2} = 6\%$ half-yearly

$n = \frac{3}{2} \times 2 = 3$

$$A = 56000\left(1+\frac{6}{100}\right)^3 = 56000\left(\frac{106}{100}\right)^3$$

C.I. $= ₹\,(66696.90 - 56000)$

$= ₹\,10696.90$

IInd case, when interest is compounded quarterly

P $= ₹56000$

$r = \frac{12}{4} = 3\%$ quarterly

$n = \frac{3}{2} \times 4 = 6$ quarters

$$A = 56000\left(1+\frac{3}{100}\right)^6$$

$$= 56000\left(\frac{103}{100}\right)^6 = ₹\,66866.93$$

C.I. $= ₹\,(66866.93 - 56000)$

$= ₹\,10866.93$

Difference in C.I. $= ₹\,(10866.93 - 10696.90)$

$= ₹\,170.03 = ₹\,170$ (approx.)

➲ EXERCISE 9.3

1. Value after 2 years $= 50000\left(1-\frac{10}{100}\right)^2$

$$= 50000 \times \left(\frac{90}{100}\right)^2 = ₹\,40500$$

2. Value of car after 3 years $= 220000\left(1-\frac{5}{100}\right)^3$

$$= 220000\left(\frac{95}{100}\right)^3$$

$= ₹\,188622.50$

3. Population after 2 years $= 15\left(1+\frac{2.5}{100}\right)^2$

$$= 15\left(\frac{102.5}{100}\right)^2$$

$= 15.76$ lakh (approx.)

4. Population in 2005 $= 20\left(1+\frac{4}{100}\right)^4$

$$= 20\left(\frac{104}{100}\right)^4$$

$= 23.40$ lakh (approx.)

5. Net growth rate = Birth rate – death rate

$= 5 - 3.2 = 1.8\%$

Population in 2007 $= 12\left(1+\frac{1.8}{100}\right)^2$

$$= 12\left(\frac{101.8}{100}\right)^2$$

$= 12.44$ lakh (approx.)

6. Population in 2006 = 60000

Let population in 2003 be x

$$\therefore \quad 60000 = x\left(1+\frac{6}{100}\right)^3$$

$$\Rightarrow \quad 60000 = x\left(\frac{106}{100}\right)^3$$

$$\Rightarrow \quad x = 60000\times\left(\frac{100}{106}\right)^3$$

$$= 50377 \text{ (approx.)}$$

7. Bacteria at the end of $2\frac{1}{2}$ hours

$$= 320000\left(1+\frac{3.2}{100}\right)^2\left(1+\frac{1.6}{100}\right)^1$$

$$= 346261 \text{ (approx.)}$$

8. Count of virus at the end of fourth day

$$= 185000\left(1-\frac{4.5}{100}\right)^4$$

$$= 185000\left(\frac{95.5}{100}\right)^4 = 153881 \text{ (approx.)}$$

➲ HOTS

1. C.I. $= P\left(1+\frac{r}{100}\right)^n - P$

$$= 2000\left(1+\frac{10}{100}\right)^3 - 2000 = ₹\,662$$

Difference between C.I. and S.I.

$$= ₹\,(662 - 600) = ₹\,62$$

2. C.I. $= 1600\left(1+\frac{5}{100}\right)^3 - 1600 = ₹\,252.20$

3. Amount $= 2500\left(1+\frac{8}{100}\right)^3 = ₹\,3149.28$

4. Amount $= 24500\left(1+\frac{4}{100}\right)^3 = ₹\,25{,}480$

➲ NCERT CORNER

1. (a) Here, $P = ₹\,10{,}800$, Time $(n) = 3$ years,

$R = 12\frac{1}{2}\%$ p.a. $= \frac{25}{2}\%$ p.a.

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= 10{,}800\left(1+\frac{25}{2\times 100}\right)^3$$

$$= 10{,}800\left(1+\frac{1}{8}\right)^3$$

$$= 10{,}800\times\frac{9}{8}\times\frac{9}{8}\times\frac{9}{8} = ₹\,15377.34$$

$$\text{CI} = A - P$$

$$= ₹\,15377.34 - ₹\,10{,}800$$

$$= ₹\,4577.34$$

(b) Here, $P = 18{,}000$, $n = 2\frac{1}{2}$ years $= 2 + \frac{1}{2}$ years,

$R = 10\%$ p.a.

$$\therefore\ A = P\left(1+\frac{R}{100}\right)^n$$

$$= 18{,}000\left(1+\frac{10}{100}\right)^2\times\left(1+\frac{\frac{1}{2}(10)}{100}\right)^2$$

$$= 18{,}000\left(\frac{11}{10}\right)^2\times\left(\frac{21}{20}\right)^1$$

$$= 18{,}000\times\frac{11}{10}\times\frac{11}{10}\times\frac{21}{20}$$

$$= 9\times 11\times 11\times 21 = ₹\,22{,}869$$

$$\text{CI} = A - P = ₹\,22{,}869 - ₹\,18{,}000 = ₹\,4{,}869$$

(c) $P = ₹\,62{,}500$, $R = 8\%$ p.a. or 4% per half year,

$T = 1\frac{1}{2}$ years, $\therefore\ n = 3$ half years

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= 62{,}500\left(1+\frac{4}{100}\right)^3$$

$$= 62{,}500\left(1+\frac{1}{25}\right)^3$$

$$= 62{,}500\left(\frac{26}{25}\right)^3$$

$$= 62{,}500\times\frac{26}{25}\times\frac{26}{25}\times\frac{26}{25}$$

$$= 4\times 26\times 26\times 26 = ₹\,70{,}304$$

$$\text{CI} = A - P = ₹\,70{,}304 - ₹\,62{,}500$$

$$= ₹\,7{,}804$$

(d) $P = ₹\,8{,}000$, $R = 9\%$ p.a. or $\frac{9}{2}\%$ half yearly

$T = 1$ year,

$\therefore\ n = 2$ half years

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= 8{,}000\left(1+\frac{9}{2\times 100}\right)^2$$

$$= 8{,}000\left(1+\frac{9}{200}\right)^2$$

$$= 8{,}000\left(\frac{209}{200}\right)^2$$

$$= 8{,}000\times\frac{209}{200}\times\frac{209}{200}$$

$$= \frac{2\times 209\times 209}{10} = \frac{87362}{10}$$

$$= ₹\ 8736.20$$

$$\text{CI} = A - P = ₹\ 8736.20 - ₹\ 8{,}000$$

$$= ₹\ 736.20$$

(e) $P = ₹\ 10{,}000$, $R = 8\%$ p.a. or 4% per half year

$T = 1$ year, $\therefore\ n = 2$ half years

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= 10{,}000\left(1+\frac{4}{100}\right)^2$$

$$= 10{,}000\left(1+\frac{1}{25}\right)^2$$

$$= 10{,}000\left(\frac{26}{25}\right)^2$$

$$= 10{,}000\times\frac{26}{25}\times\frac{26}{25}$$

$$= 16\times 26\times 26 = ₹\ 10{,}816$$

$$\text{CI} = A - P = ₹\ 10{,}816 - ₹\ 10{,}000$$

$$= ₹\ 816$$

2. (i) **Compounded half yearly :**

$P = ₹\ 10{,}000$, $R = 10\%$ p.a. or 5% per half year

and $T = 1\frac{1}{2}$ years

$\therefore\ n = 1\frac{1}{2}\times 2 = 3$

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= 10{,}000\left(1+\frac{5}{100}\right)^3$$

$$= 10{,}000\left(1+\frac{1}{20}\right)^3$$

$$= 10{,}000\left(\frac{21}{20}\right)^3$$

$$= 10{,}000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}$$

$$= \frac{5\times 21\times 21\times 21}{4}$$

$$= \frac{46305}{4} = ₹\ 11576.25$$

$$\text{CI} = A - P = ₹\ 11{,}576.25 - ₹\ 10{,}000$$

$$= ₹\ 1{,}576.25$$

(ii) **Compounded annually :**

(a) Amount for 1 year

$P = ₹\ 10{,}000$, $R = 10\%$ p.a.

and Time $= 1$ year or $n = 1$

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= 10{,}000\left(1+\frac{10}{100}\right)^1$$

$$= 10{,}000\left(1+\frac{1}{10}\right)^1$$

$$= 10{,}000\left(\frac{11}{10}\right)$$

$$= 10{,}000\times\frac{11}{10} = ₹\ 11{,}000$$

$\therefore$ Interest for 1 year $= 11{,}000 - 10{,}000$

$= ₹\ 1000$

(b) Simple interest for remaining $\frac{1}{2}$ year

$P = ₹\ 11{,}000$, $R = 10\%$ p.a.

and Time $= \frac{1}{2}$ year

$$\therefore \quad \text{SI} = \frac{P\times R\times T}{100}$$

$$= \frac{11{,}000\times 10\times\frac{1}{2}}{100}$$

$$= 1{,}100\times\frac{1}{2} = ₹\ 550$$

Total interest for $1\frac{1}{2}$ years

$= ₹\ 1000 + ₹\ 550 = ₹\ 1550$

$\because ₹\ 1{,}576.25 > ₹\ 1{,}550$

$\therefore$ The interest when compounded half yearly would be more than the interest when compounded annually.

3. (i) Let the population in 2001 be P.

$\therefore\ P = 54000,\ R = 5\%$ p.a., $n = 2$ years

$$\text{Present population} = P\left(1+\frac{R}{100}\right)^n$$

$$= P\left(1+\frac{5}{100}\right)^2$$

$$= P\left(1+\frac{1}{20}\right)^2$$

$$= P\left(\frac{21}{20}\right)^2$$

According to the question,

$$P\left(\frac{21}{20}\right)^2 = 54{,}000$$

or $$P = 54{,}000\left(\frac{20}{21}\right)^2$$

$\Rightarrow$ $$P = 54{,}000 \times \frac{20}{21} \times \frac{20}{21}$$

$$= \frac{54{,}000 \times 400}{441}$$

$$= 48979.59 \text{ or } 48980 \text{ (approx.)}$$

Hence, the population in 2001 was about 48980.

(ii) $P = 54{,}000,\ R = 5\%$ p.a., $T = 2$ years $\therefore\ n = 2$

$$\text{Population in 2005} = P\left(1+\frac{R}{100}\right)^n$$

$$= 54{,}000\left(1+\frac{5}{100}\right)^2$$

$$= 54{,}000\left(1+\frac{1}{20}\right)^2$$

$$= 54{,}000\left(\frac{21}{20}\right)^2$$

$$= 54{,}000 \times \frac{21}{20} \times \frac{21}{20}$$

$$= 135 \times 21 \times 21$$

$$= 59{,}535$$

Hence, the population in 2005 would be 59,535.

4. Let the value of scooter after one year be A.

$P = ₹\ 42{,}000,\ R = 8\%$ p.a., Time $= 1$ year $\therefore\ n = 1$

$\therefore$ $$A = P\left(1-\frac{R}{100}\right)^n$$

$$= 42{,}000\left(1-\frac{8}{100}\right)^1$$

$$= 42{,}000\left(1-\frac{2}{25}\right)^1$$

$$= 42{,}000 \times \frac{23}{25}$$

$$= 1680 \times 23 = ₹\ 38{,}640$$

Hence, the value of the scooter after one year will be ₹ 38,640.

10 Algebraic Expressions and Identities

➲ EXERCISE 10.1

1. (a) $(4x^3) \times (5x^2 y) = (4 \times 5)\, x^{3+2}\ y = 20x^5 y$

(b) $(3y^2 z) \times (6xy^3 z^2) = (3 \times 6)\, xy^{2+3}\ z^{1+2}$

$$= 18xy^5 z^3$$

(c) $(-3x^2 yz) \times (7x^3 y^2) = (-3 \times 7)\, x^{2+3}\ y^{1+2} z$

$$= -21x^5\ y^3 z$$

(d) $$\left(\frac{-5}{16} x^3\ yt^2\right) \times \left(\frac{4}{25} y^2\ t^3\right)$$

$$= \left(\frac{-5}{16} \times \frac{4}{25}\right) x^3\, y^{1+2}\ t^{2+3}$$

$$= -\frac{1}{20} x^3 y^3 t^5$$

(e) $$\left(\frac{-1}{5} a^3 b^2 c\right) \times \left(\frac{5}{9} b^3 c^3 z^4\right)$$

$$= \left(\frac{-1}{5} \times \frac{5}{9}\right) a^3 b^{2+3}\ c^{1+3}\ z^4$$

$$= -\frac{1}{9} a^3 b^5 c^4 z^4$$

(f) $$\left(\frac{-1}{27} a^2 b^5\right) \times (9a^3 b^4) = \left(\frac{-1}{27} \times 9\right) a^{2+3}\ b^{5+4}$$

$$= -\frac{1}{3} a^5 b^9$$

(g) $$\left(\frac{5}{9} x^3 y^2 t^3\right) \times \left(\frac{27}{25} x^2 y^3 t\right)$$

$$= \left(\frac{5}{9} \times \frac{27}{25}\right) x^{3+2}\ y^{2+3}\ t^{3+1}$$

$$= \frac{3}{5} x^5 y^5 t^4$$

(h) $$\left(\frac{-18}{5} xy^2 z\right) \times \left(\frac{-25}{21} x^3 y^5\right)$$

$$= \left(\frac{-18}{5} \times \frac{-25}{21}\right) x^{1+3}\ y^{2+5} z$$

$$= \frac{30}{7} x^4 y^7 z$$

2. (a) $(-3x^2y)\times(4y^2z) = (-3\times4)x^2\ y^{1+2}z$

$= -12x^2y^3z$

$= -12\times1^2\times(-2)^3\times(-1)$

$= -96$

(b) $(-7ab^2c)\times(3a^2\ bc^2) = (-7\times3)\ a^{1+2}\ b^{2+1}\ c^{1+2}$

$= -21a^3b^3c^3$

$= -21\times3^3\times(4)^3\times(-1)^3$

$= 36288$

(c) $\left(\frac{-7}{5}a^2b\right)\times(5ab^2) = \left(\frac{-7}{5}\times5\right)a^{2+1}\ b^{1+2}$

$= -7a^3b^3$

$= -7\times3^3\times4^3$

$= -12096$

(d) $\left(\frac{9}{7}y^2z^3\right)\times\left(\frac{-14}{27}xy^3b\right) = \left(\frac{9}{7}\times\frac{-14}{27}\right)xy^{2+3}\ z^3b$

$= \frac{-2}{3}xy^5z^3b$

$= \frac{-2}{3}\times1\times(-2)^5\times(-1)^3\times4$

$= \frac{-256}{3}$

(e) $\left(\frac{-3}{14}xy^3\right)\times\left(\frac{7}{6}yb^2\right)$

$= \left(-\frac{3}{14}\times\frac{7}{6}\right)xy^{3+1}\ b^2$

$= -\frac{1}{4}xy^4b^2$

$= \frac{-1}{4}\times1\times(-2)^4\times4^2 = -64$

(f) $\left(\frac{-5}{7}\right)\times\left(\frac{3}{2}x^2y\right)\times\left(\frac{-14}{5}y\right)$

$= \left(\frac{-5}{7}\times\frac{3}{2}\times\frac{-14}{5}\right)x^2\ y^{1+1}$

$= 3x^2y^2$

$= 3(1)^2\ (-2)^2 = 12$

3. (a) $3a^2b\times(-7a^3b^2c^3)\times(-4b^3c^2)$

$= (3\times-7\times-4)a^{2+3}\ b^{1+2+3}\ c^{3+2}$

$= 84a^5b^6c^5$

(b) $(-4x^2y)\times(5xy^2z^3)\times(6y^3z^4)$

$= (-4\times5\times6)\ x^{2+1}\ y^{1+2+3}\ z^{3+4}$

$= -120x^3y^6z^7$

(c) $\left(\frac{4}{3}x^3yz\right)\times\left(\frac{1}{3}y^2z\right)\times(-9xyz^3)$

$= \left(\frac{4}{3}\times\frac{1}{3}\times-9\right)x^{3+1}\ y^{1+2+1}\ z^{1+1+3}$

$= -4x^4\ y^4\ z^5$

(d) $\left(\frac{-6}{7}t^2uv\right)\times(3ut^3v)\times\left(\frac{-14}{15}v^2\right)$

$= \left(\frac{-6}{7}\times3\times\frac{-14}{15}\right)t^{2+3}\ u^{1+1}\ v^{1+1+2}$

$= \frac{12}{5}t^5\ u^2\ v^4$

(e) $\left(\frac{15}{7}st^2w\right)\times\left(\frac{-4}{5}t^3w^2\right)\times\left(\frac{14}{3}s^3w^2\right)$

$= \left(\frac{15}{7}\times\frac{-4}{5}\times\frac{14}{3}\right)s^{1+3}\ t^{2+3}\ w^{1+2+2}$

$= -8s^4t^5w^5$

(f) $\left(\frac{1}{5}a^2b\right)\times-\left(\frac{3}{8}b^3c^2\right)\times\left(\frac{16}{9}a^3b^4\right)$

$= \left(\frac{1}{5}\times\frac{-3}{8}\times\frac{16}{9}\right)a^{2+3}\ b^{1+3+4}\ c^2$

$= -\frac{2}{15}a^5b^8c^2$

4. $(6x^3)\times(-12y^2z)\times(5xyz^2)$

$= (6\times-12\times5)\ x^{3+1}\ y^{2+1}z^{1+2}$

$= -360x^4y^3z^3$

$= -360\ (-1)^4\times(2)^3\times(-3)^3$

$= +77760$

5. $\left(\frac{4}{9}abc^2\right)\times\left(\frac{-27}{5}a^2b\right)\times(10b^3c)$

$= \left(\frac{4}{9}\times\frac{-27}{5}\times10\right)a^{1+2}\ b^{1+1+3}\ c^{2+1}$

$= -24a^3b^5c^3$

$= -24\times1^3\times2^5\times3^3$

$= -20736$

6. $\left(\frac{-3}{14}xy^3\right)\times\left(\frac{7}{6}x^3z\right)\times(-5xy^2)$

$= \left(\frac{-3}{14}\times\frac{7}{6}\times-5\right)x^{1+3+1}\ y^{3+2}z$

$= \frac{5}{4}x^5y^5z$

$= \frac{5}{4}\times(-2)^5\times1^5\times2 = -80$

➲ EXERCISE 10.2

1. $3x^2\ (4y-5xy)=3x^2\times 4y-3x^2\times 5xy$

$=12x^2y-15x^3y$

2. $-4x^2y\,(5x^2-6y)=-4x^2y\times 5x^2+4x^2y\times 6y$

$=-20x^4y+24x^2y^2$

3. $\frac{6}{7}x\,(x^3-3y^3)=\frac{6}{7}x\times x^3-\frac{6}{7}x\times 3y^3$

$=\frac{6}{7}x^4-\frac{18}{7}xy^3$

4. $\frac{1}{2}xy\,(3x-\frac{4}{5}y^3x)=\frac{1}{2}xy\times 3x-\frac{1}{2}xy\times\frac{4}{5}y^3x$

$=\frac{3}{2}x^2y-\frac{2}{5}x^2y^4$

5. $\frac{9}{2}xy^2\ (x+2y)=\frac{9}{2}xy^2\times x+\frac{9}{2}xy^2\times 2y$

$=\frac{9}{2}x^2y^2+9xy^3$

6. $10a^2b\,(0.1a-0.4b^2)$

$=10a^2b\times 0.1a-10a^2b\times 0.4b^2$

$=a^3b-4a^2b^3$

7. $2.5x(2xy^2-3y^3)$

$=2.5x\times 2xy^2-2.5x\times 3y^3$

$=5x^2\ y^2-7.5xy^3$

8. $\frac{-4}{27}xy^2z\left(\frac{9}{2}x^2yz-\frac{3}{4}y\right)$

$=\frac{-4}{27}\times\frac{9}{2}xy^2z\times x^2yz+\frac{4}{27}\times\frac{3}{4}\times xy^2z\times y$

$=\frac{-2}{3}x^3y^3z^2+\frac{1}{9}xy^3z$

9. $xy(y^2-3x)-4\,(x^2y+6z)+2y^2\ (x-4)$

$=xy^3-3x^2y-4x^2y-24z+2y^2x-8y^2$

$=xy^3-7x^2y-8y^2-24z+2y^2x$

10. $x^2\ (2-4y^2)+x\,(xy^2-3x)-3y\,(y-4x^2y)$

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

$=-x^2+9x^2y^2-3y^2$

11. $a\,(b-c)-b\,(c-a)-c\,(a-b)$

$=ab-ac-bc+ab-ca+bc$

$=2ab-2ac$

12. $4t\,(s-4t)+s\,(3t-s)+7t^2+4$

$=4ts-16t^2+3st-s^2+7t^2+4$

$=7ts-9t^2-s^2+4$

13. $\frac{2}{7}t\,(t-16)-3t\left(\frac{5}{9}t-1\right)-\frac{1}{7}(3-4t^2)$

$=\frac{2}{7}t^2-\frac{32}{7}t-\frac{5}{3}t^2+3t\ -\frac{3}{7}+\frac{4t^2}{7}$

$=\frac{-17}{21}t^2-\frac{11}{7}t-\frac{3}{7}$

14. $x\,(3x^2y-4y^2)=3x^3y-4xy^2$

$=3\times 2^3\times(-3)-4\times 2\times(-3)^2$

$=-72-72=-144$

15. $\frac{-5}{2}x^2y\,(4xy-8y)$

$=-10x^3y^2+20x^2y^2$

$=-10\times(-2)^3\times(2.5)^2+20\times(-2)^2\times(2.5)^2$

$=500+500=1000$

➲ EXERCISE 10.3

1. $(3x+5)\times(2x-6)\ =3x\,(2x-6)+5\,(2x-6)$

$=6x^2-18x+10x-30$

$=6x^2-8x-30$

2. $(3p^2+q^2)\times(2p^2-3q^2)$

$=3p^2\,(2p^2-3q^2)+q^2\,(2p^2-3q^2)$

$=6p^4-9p^2q^2+2p^2q^2-3q^4$

$=6p^4-7p^2q^2-3q^4$

3. $(3m-5n)\times(2m+3n)$

$=3m\,(2m+3n)-5n\,(2m+3n)$

$=6m^2+9mn-10mn-15n^2$

$=6m^2-mn-15n^2$

4. $(x+a)\times(x^2-a^2)$

$=x\,(x^2-a^2)+a\,(x^2-a^2)$

$=x^3-xa^2+ax^2-a^3$

5. $(2x^2-5y^2)\times(x^2+3y^2)$

$=2x^2\,(x^2+3y^2)-5y^2\,(x^2+3y^2)$

$=2x^4+6x^2y^2-5y^2x^2-15y^4$

$=2x^4+x^2y^2-15y^4$

6. $(4x-3y)\times(3x^2+4y^2)$

$=4x\,(3x^2+4y^2)-3y\,(3x^2+4y^2)$

$=12x^3+16xy^2-9yx^2-12y^3$

7. $\left(\frac{3}{4}x+\frac{4}{5}y\right)\left(\frac{4}{5}x-\frac{1}{7}y\right)$

$=\frac{3}{4}x\left(\frac{4}{5}x-\frac{1}{7}y\right)+\frac{4}{5}y\left(\frac{4}{5}x-\frac{1}{7}y\right)$

$$= \frac{3}{5}x^2 - \frac{3}{28}xy + \frac{16}{25}xy - \frac{4}{35}y^2$$
$$= \frac{3}{5}x^2 + \frac{373}{700}xy - \frac{4}{35}y^2$$

8. $\left(\frac{5}{2}x - \frac{1}{3}y\right)(x - 3y) = \frac{5}{2}x(x - 3y) - \frac{1}{3}y(x - 3y)$
$$= \frac{5}{2}x^2 - \frac{15}{2}xy - \frac{1}{3}xy + y^2$$
$$= \frac{5}{2}x^2 - \frac{47}{6}xy + y^2$$

9. $\left(x^4 + \frac{1}{x^4}\right)\left(x - \frac{1}{x}\right)$
$$= x^4\left(x - \frac{1}{x}\right) + \frac{1}{x^4}\left(x - \frac{1}{x}\right)$$
$$= x^5 - x^3 + \frac{1}{x^3} - \frac{1}{x^5}$$

10. $\left(\frac{3}{4}a + \frac{2}{3}b\right)(4a - 3b)$
$$= \frac{3}{4}a(4a - 3b) + \frac{2}{3}b(4a - 3b)$$
$$= 3a^2 - \frac{9}{4}ab + \frac{8}{3}ab - 2b^2$$
$$= 3a^2 + \frac{5}{12}ab - 2b^2$$

11. $\left(\frac{2}{5}x - \frac{1}{2}y\right)(10x - 8y)$
$$= \frac{2}{5}x(10x - 8y) - \frac{1}{2}y(10x - 8y)$$
$$= 4x^2 - \frac{16}{5}xy - 5xy + 4y^2$$
$$= 4x^2 - \frac{41}{5}xy + 4y^2$$

12. $\left(\frac{7}{4}a - \frac{3}{5}b\right)(5a + 4b)$
$$= \frac{7}{4}a(5a + 4b) - \frac{3}{5}b(5a + 4b)$$
$$= \frac{35}{4}a^2 + 7ab - 3ab - \frac{12}{5}b^2$$
$$= \frac{35}{4}a^2 + 4ab - \frac{12}{5}b^2$$

13. $(3x - 9)(3x^2 - 4x + 7)$
$$= 3x(3x^2 - 4x + 7) - 9(3x^2 - 4x + 7)$$
$$= 9x^3 - 12x^2 + 21x - 27x^2 + 36x - 63$$
$$= 9x^3 - 39x^2 + 57x - 63$$

14. $(4x - y)(3x + y - 4)$
$$= 4x(3x + y - 4) - y(3x + y - 4)$$
$$= 12x^2 + 4xy - 16x - 3xy - y^2 + 4y$$
$$= 12x^2 + xy - 16x - y^2 + 4y$$

15. $(4a + 3b)(a^2 - ab + b^2)$
$$= 4a(a^2 - ab + b^2) + 3b(a^2 - ab + b^2)$$
$$= 4a^3 - 4a^2b + 4ab^2 + 3ba^2 - 3ab^2 + 3b^3$$
$$= 4a^3 - a^2b + ab^2 + 3b^3$$

16. $(x - y)(x^2 + xy + y^2)$
$$= x(x^2 + xy + y^2) - y(x^2 + xy + y^2)$$
$$= x^3 + x^2y + xy^2 - yx^2 - xy^2 - y^3$$
$$= x^3 - y^3$$

17. $(4x - 2)(x^2 - 3xy + y^2)$
$$= 4x(x^2 - 3xy + 4^2) - 2(x^2 - 3xy + y^2)$$
$$= 4x^3 - 12x^2y + 4xy^2 - 2x^2 + 6xy - 2y^2$$
$$= 4x^3 - 12x^2y + 4xy^2 - 2x^2 + 6xy - 2y^2$$

18. $(3x + 4y - 3)(x - y + 3)$
$$= 3x(x - y + 3) + 4y(x - y + 3) - 3(x - y + 3)$$
$$= 3x^2 - 3xy + 9x + 4yx - 4y^2 + 12y - 3x + 3y - 9$$
$$= 3x^2 + xy + 6x + 15y - 4y^2 - 9$$

19.
$$\begin{array}{l} 9x + 5y \\ \times 4x - 3y \\ \hline 36x^2 + 20xy \\ \quad - 27xy - 15y^2 \\ \hline 36x^2 - 7xy - 15y^2 \end{array}$$

20.
$$\begin{array}{l} 7x - 4y \\ \times 2x + 5 \\ \hline 14x^2 - 8xy \\ \quad + 35x - 20y \\ \hline 14x^2 - 8xy + 35x - 20y \end{array}$$

21.
$$\begin{array}{l} x^2 - x - 1 \\ \times\ 3x^2 - x + 8 \\ \hline 3x^4 - 3x^3 - 3x^2 \\ \quad - x^3 + x^2 + x \\ \quad + 8x^2 - 8x - 8 \\ \hline 3x^4 - 4x^3 + 6x^2 - 7x - 8 \end{array}$$

22.
$$\begin{array}{l} x^2 - 5x + 8 \\ \times\ x^2 + 3x - 6 \\ \hline x^4 - 5x^3 + 8x^2 \\ \quad + 3x^3 - 15x^2 + 24x \\ \qquad - \ 6x^2 + 30x - 48 \\ \hline x^4 - 2x^3 - 13x^2 + 54x - 48 \end{array}$$

23. $(a+b)(c-d)+(c+d)(a-b)+2(ac+bd)$
$= a(c-d)+b(c-d)+c(a-b)+d(a-b)$
$\qquad +2ac+2bd$
$= ac-ad+bc-bd+ca-cb+da$
$\qquad -db+2ac+2bd$
$= 4ac$

24. $(x+y)(2x+y)+(x+2y)(x-y)$
$= x(2x+y)+y(2x+y)+x(x-y)$
$\qquad +2y(x-y)$
$= 2x^2+xy+2xy+y^2+x^2-xy+2yx-2y^2$
$= 3x^2+4xy-y^2$

25. $x(x+y^2+z)+y^2(x-y-2z)-z(x+y^2)$
$= x^2+xy^2+xz+y^2x-y^3-2y^2z$
$\qquad -zx-zy^2$
$= x^2+2xy^2-3zy^2-y^3$

26. $(2x+5y)(3x-4y)-(7x+3y)(2x+y)$
$= 2x(3x-4y)+5y(3x-4y)-7x(2x+y)$
$\qquad -3y(2x+y)$
$= 6x^2-8xy+15yx-20y^2-14x^2-7xy$
$\qquad -6yx-3y^2$
$= -8x^2-6yx-23y^2$

27. $(x^2-5x+6)(2x-3)-(3x^2+4x-5)(x-2)$
$= x^2(2x-3)-5x(2x-3)+6(2x-3)$
$\qquad -3x^2(x-2)-4x(x-2)+5(x-2)$
$= 2x^3-3x^2-10x^2+15x+12x-18$
$\qquad -3x^3+6x^2-4x^2+8x+5x-10$
$= -x^3-11x^2+40x-28$

28. $x^2+(3x-y)(3x+y+x^2)$
$= x^2+3x(3x+y+x^2)-y(3x+y+x^2)$
$= x^2+9x^2+3xy+3x^3-3xy-y^2-yx^2$
$= 10x^2+3x^3-y^2-yx^2$

➲ EXERCISE 10.4

1. (a) $\dfrac{6x^3}{-2x} = \left(\dfrac{6}{-2}\right)x^{3-1} = -3x^2$

(b) $\dfrac{\sqrt{5}x^4}{5x^2} = \left(\dfrac{\sqrt{5}}{5}\right)x^{4-2} = \dfrac{1}{\sqrt{5}}x^2$

(c) $\dfrac{24x^3y^2}{-6xy^3} = \left(\dfrac{24}{-6}\right)\dfrac{x^{3-1}}{y^{3-2}} = \dfrac{-4x^2}{y}$

(d) $\dfrac{\frac{-7}{9}y^4}{3y^2} = \left(\dfrac{\frac{-7}{9}}{3}\right)y^{4-2} = \dfrac{-7}{24}y^2$

(e) $\dfrac{-56mnp^2}{7mn} = \left(\dfrac{-56}{7}\right)p^2 = -8p^2$

(f) $-72x^2\dfrac{yz^2}{12xy} = \left(\dfrac{-72}{12}\right)x^{2-1}z^2 = -6xz^2$

(g) $\dfrac{\frac{2}{3}x^2y}{-\frac{1}{3}xy} = \dfrac{\frac{2}{3}}{-\frac{1}{3}}x^{2-1} = -2x$

(h) $\dfrac{-36a^3b^4}{8ab^3} = \dfrac{-36}{8}a^{3-1}b^{4-3} = \dfrac{-9}{2}a^2b$

2. (a) $\dfrac{4x^3-18x^2+14x}{4x} = \dfrac{4x^3}{4x}-\dfrac{18x^2}{4x}+\dfrac{14x}{4x}$
$= x^2-\dfrac{9}{2}x+\dfrac{7}{2}$

(b) $\dfrac{-4p^3+4p^2+2p+6}{2p} = \dfrac{-4p^3}{2p}+\dfrac{4p^2}{2p}+\dfrac{2p}{2p}+\dfrac{6}{2p}$
$= -2p^2+2p+1+\dfrac{3}{p}$

(c) $\dfrac{5z^3-6z^2+8z}{2z} = \dfrac{5z^3}{2z}-\dfrac{6z^2}{2z}+\dfrac{8z}{2z}$
$= \dfrac{5}{2}z^2-3z+4$

(d) $\dfrac{\sqrt{3}y^3+2\sqrt{3}y^2}{3y} = \dfrac{\sqrt{3}y^3}{3y}+\dfrac{2\sqrt{3}y^2}{3y}$
$= \dfrac{y^2}{\sqrt{3}}+\dfrac{2}{\sqrt{3}}y$

(e) $\dfrac{-7x^3y+14xy^2+6xy}{7xy} = \dfrac{-7x^3y}{7xy}+\dfrac{14xy^2}{7xy}+\dfrac{6xy}{7xy}$
$= -x^2+2y+\dfrac{6}{7}$

(f) $\dfrac{-5m^3-35m^2+40m}{5m}$
$= \dfrac{-5m^3}{5m}-\dfrac{35m^2}{5m}+\dfrac{40m}{5m}$
$= -m^2-7m+8$

(g) $\dfrac{y^4-3y^3+\frac{1}{2}y^2}{3y}=\dfrac{y^4}{3y}-\dfrac{3y^3}{3y}+\dfrac{\frac{1}{2}y^2}{3y}$

$=\dfrac{y^3}{3}-y^2+\dfrac{y}{6}$

(h) $\dfrac{8x^2y^2-6x^4y^3+10x^2y^3}{2x^2y}$

$=\dfrac{8x^2y^2}{2x^2y}\dfrac{-6x^4y^3}{2x^2y}+\dfrac{10x^2y^3}{2x^2y}$

$=4y-3x^2y^2+5y^2$

3. (a)
$$\begin{array}{r|l} 6x^2+x-1 & 3x+2 \\ \hline -6x^2-3x & \\ \hline 4x-1 & \\ -4x-2 & \\ \hline 1 & \end{array}$$

(b)
$$\begin{array}{r|l} 4p^4+7p^2-15 & p^2+3 \\ \hline -4p^4-12p^2 & 4p^2-5 \\ \hline -5p^2-15 & \\ -5p^2-15 & \\ \hline 0 & \end{array}$$

(c)
$$\begin{array}{r|l} -24x^3-31x^2+71x-21 & -8x+3 \\ \hline +24x^3+9x^2 & 3x^2+5x-7 \\ \hline -40x^2+71x & \\ -40x^2+15x & \\ \hline 56x-21 & \\ -56x+21 & \\ \hline 0 & \end{array}$$

(d)
$$\begin{array}{r|l} 15b^2+b-6 & 3b+2 \\ \hline -15b^2-10b & 5b-3 \\ \hline -9b-6 & \\ -9b-6 & \\ \hline 0 & \end{array}$$

(e)
$$\begin{array}{r|l} 8x^2+4x-9 & 2x+4 \\ \hline -8x^2-16x & 4x-6 \\ \hline -12x-9 & \\ -12x-24 & \\ \hline 15 & \end{array}$$

(f)
$$\begin{array}{r|l} y^4+4y^3-2y^2+10y-25 & y+5 \\ \hline -y^4-5y^3 & y^3-y^2+3y-5 \\ \hline -y^3-2y^2 & \\ -y^3-5y^2 & \\ \hline 3y^2+10y & \\ -3y^2-15y & \\ \hline -5y-25 & \\ -5y-25 & \\ \hline 0 & \end{array}$$

4. (a)
$$\begin{array}{r|l} 6y^5-y^4+4y^3-5y^2-y-15 & 2y^2-y+3 \\ \hline -6y^5+3y^4+9y^3 & 3y^3+y^2-2y-5 \\ \hline 2y^4-5y^3-5y^2 & \\ -2y^4+y^3+3y^2 & \\ \hline -4y^3-8y^2-y & \\ -4y^3+2y^2+6y & \\ \hline -10y^2+5y-15 & \\ -10y^2+5y-15 & \\ \hline 0 & \end{array}$$

(b)
$$\begin{array}{r|l} 6x^5+4x^4-3x^3-1 & 3x^2-x+1 \\ \hline -6x^5+2x^4+2x^3 & 2x^3+2x^2-x-1 \\ \hline 6x^4-5x^3-1 & \\ -6x^4+2x^3+2x^2 & \\ \hline -3x^3-2x^2-1 & \\ -3x^3+x^2+x & \\ \hline -3x^2+x-1 & \\ -3x^2+x-1 & \\ \hline 0 & \end{array}$$

(c)
$$\begin{array}{r|l} 9t^3+6t^2-4t+6 & t^2+3t-1 \\ \hline -9t^3+27t^2-9t & 9t-21 \\ \hline -21t^2+5t+6 & \\ -21t^2+63t+21 & \\ \hline 68t-15 & \end{array}$$

(d)
$$\begin{array}{r} 2y^2+2y-1 \\ 4y^2+3y-2\overline{)\,8y^4+14y^3-2y^2+7y-8} \\ \underline{-8y^4+6y^3-4y^2} \\ 8y^3+2y^2+7y \\ \underline{-8y^3+6y^2-4y} \\ -4y^2+11y-8 \\ \underline{-4y^2+3y-2} \\ 14y-10 \end{array}$$

(e)
$$\begin{array}{r} t-2 \\ t^2-12t+13\overline{)\,t^3-14t^2+37t-26} \\ \underline{t^3-12t^2+13t} \\ -2t^2+24t-26 \\ \underline{-2t^2+24t-26} \\ 0 \end{array}$$

➲ EXERCISE 10.5

1. (a) $(x+3)(x+5)=x^2+(3+5)x+3\times5$
$=x^2+8x+15$

(b) $(2y+6)(2y-3)=(2y)^2+(6-3)2y+6\times(-3)$
$=4y^2+6y-18$

(c) $(m^2+4)(m^2-6)$
$=(m^2)^2+(4-6)m^2+4\times(-6)$
$=m^4-2m^2-24$

(d) $(b^3+3)(b^3-8)=(b^3)^2+(3-8)b^3+3\times(-8)$
$=b^6-5b^3-24$

(e) $(9m-4)(9m+8)$
$=(9m)^2+(-4+8)9m+(-4)\times8$
$=81m^2+36m-32$

(f) $(ab+6)(ab-3)=(ab)^2+(6-3)ab+6\times(-3)$
$=a^2b^2+3ab-18$

(g) $\left(x^2-\frac{3}{8}\right)\left(x^2+\frac{1}{8}\right)$
$=(x^2)^2+\left(-\frac{3}{8}+\frac{1}{8}\right)x^2+\left(\frac{-3}{8}\right)\left(\frac{1}{8}\right)$
$=x^4-\frac{1}{4}x^2-\frac{3}{64}$

(h) $\left(y^2+\frac{3}{11}\right)\left(y^2+\frac{2}{11}\right)$
$=(y^2)^2+\left(\frac{3}{11}+\frac{2}{11}\right)y^2+\frac{3}{11}\times\frac{2}{11}$
$=y^4+\frac{5}{11}y^2+\frac{6}{121}$

(i) $\left(b^3-\frac{2}{5}\right)\left(b^3+\frac{3}{5}\right)$
$=(b^3)^2+\left(-\frac{2}{5}+\frac{3}{5}\right)b^3+\left(-\frac{2}{5}\right)\left(\frac{3}{5}\right)$
$=b^6+\frac{b^3}{5}-\frac{6}{25}$

(j) $\left(mn-\frac{3}{4}\right)\left(mn+\frac{1}{4}\right)$
$=(mn)^2+\left(-\frac{3}{4}+\frac{1}{4}\right)mn+\left(\frac{-3}{4}\right)\left(\frac{1}{4}\right)$
$=m^2n^2-\frac{1}{2}mn-\frac{3}{16}$

(k) $(m^2-0.5)(m^2+0.4)$
$=(m^2)^2+(-0.5+0.4)m^2+(-0.5)\times(0.4)$
$=m^4-0.1m^2-0.2$

(l) $(k^3+0.6)(k^3-0.5)$
$=(k^3)^2+(0.6-0.5)k^3+(0.6)\times(-0.5)$
$=k^6+0.1k^3-0.3$

2. (a) $(x+3y)^2$
$=x^2+2\times x\times3y+(3y)^2$
$=x^2+6xy+9y^2$

(b) $(4m+2n)^2$
$=(4m)^2+2\times4m\times2n+(2n)^2$
$=16m^2+16mn+4n^2$

(c) $(5m-3mn)^2=(5m)^2-2\times5m\times3mn+(3mn)^2$
$=25m^2-30m^2n+9m^2n^2$

(d) $(y^2+5)^2=(y^2)^2+2\times y^2\times5+5^2$
$=y^4+10y^2+25$

(e) $(7a-3b)^2=(7a)^2-2\times7a\times3b+(3b)^2$
$=49a^2-42ab+9b^2$

(f) $(8ab-3bc)^2=(8ab)^2-2\times8ab\times3bc+(3bc)^2$
$=64a^2b^2-48ab^2c+9b^2c^2$

(g) $(6x^2-5y)^2=(6x^2)^2-2\times6x^2\times5y+(5y)^2$
$=36x^4-60x^2y+25y^2$

(h) $(0.3p-0.4)^2=(0.3p)^2-2\times0.3p\times0.4+(0.4)^2$
$=0.09p^2-0.24p+0.16$

(i) $(0.7x+0.5y)^2$
$=(0.7x)^2+2\times0.7x\times0.5y+(0.5y)^2$
$=0.49x^2+0.7xy+0.25y^2$

(j) $\left(\frac{2}{5}m+\frac{4}{3}n\right)^2=\left(\frac{2}{5}m\right)^2+2\times\frac{2}{5}m\times\frac{4}{3}n+\left(\frac{4}{3}n\right)^2$

$=\frac{4}{25}m^2+\frac{16}{15}mn+\frac{16}{9}n^2$

(k) $\left(\frac{x^2}{3}-\frac{y^2}{4}\right)^2=\left(\frac{x^2}{3}\right)^2-2\times\frac{x^2}{3}\times\frac{y^2}{4}+\left(\frac{y^2}{4}\right)^2$

$=\frac{x^4}{9}-\frac{x^2y^2}{6}+\frac{y^4}{16}$

(l) $\left(\frac{1}{4}mn-\frac{2}{3}p\right)^2$

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

$=\frac{m^2n^2}{16}-\frac{mnp}{3}+\frac{4p^2}{9}$

3. (a) $(2x+5y)(2x-5y)=(2x)^2-(5y)^2$

$=4x^2-25y^2$

(b) $(7a+5b)(7a-5b)=(7a)^2-(5b)^2$

$=49a^2-25b^2$

(c) $(6a-5b)(6a+5b)=(6a)^2-(5b)^2$

$=36a^2-25b^2$

(d) $(3s+4t)(3s-4t)=(3s)^2-(4t)^2$

$=9s^2-16t^2$

(e) $(a^2+b^2)(-a^2+b^2)=(b^2+a^2)(b^2-a^2)$

$=(b^2)^2-(a^2)^2$

$=b^4-a^4$

(f) $(b^4+a^4)(b^4-a^4)=(b^4)^2-(a^4)^2$

$=b^8-a^8$

(g) $(1.1m-0.4)(1.1m+0.4)=(1.1m)^2-(0.4)^2$

$=1.21m^2-0.16$

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

$=9a^2-\frac{1}{4}$

(i) $(mn^2+p)(mn^2-p)=(mn^2)^2-p^2$

$=m^2n^4-p^2$

(j) $\left(\frac{x}{2}+\frac{3y}{4}\right)\left(\frac{x}{2}-\frac{3y}{4}\right)=\left(\frac{x}{2}\right)^2-\left(\frac{3y}{4}\right)^2$

$=\frac{x^2}{4}-\frac{9y^2}{16}$

(k) $\left(\frac{4}{3}m+\frac{1}{5}n\right)\left(\frac{4}{3}m-\frac{1}{5}n\right)=\left(\frac{4}{3}m\right)^2-\left(\frac{1}{5}n\right)^2$

$=\frac{16}{9}m^2-\frac{n^2}{25}$

(l) $\left(\frac{m^2}{5}-\frac{n^2}{4}\right)\left(\frac{m^2}{5}+\frac{n^2}{4}\right)=\left(\frac{m^2}{5}\right)^2-\left(\frac{n^2}{4}\right)^2$

$=\frac{m^4}{25}-\frac{n^4}{16}$

4. (a) $49x^2+70xy+25y^2$

$=(7x)^2+2\times7x\times5y+(5y)^2$

$=(7x+5y)^2$

$=(7\times1+5\times2)^2$

$=(7+10)^2=17^2=289$

(b) $81x^2+54xy+9y^2=(9x)^2+2\times9x\times3y+(3y)^2$

$=(9x+3y)^2$

$=(9\times-2+3\times3)^2$

$=(-18+9)^2=(-9)^2=81$

(c) $16a^2-48ab+36b^2$

$=(4a)^2-2\times4a\times6b+(6b)^2$

$=(4a-6b)^2$

$=(4\times1-6\times-2)^2$

$=(4+12)^2=16^2=256$

(d) $25b^2-40ba+16a^2$

$=(5b)^2-2\times5b\times4a+(4a)^2$

$=(5b-4a)^2$

$=(5\times-4-4\times3)^2$

$=(-20-12)^2=(-32)^2=1024$

5. (a) $(7m-8n)^2+(7m+8n)^2$

$=(7m)^2-2\times7m\times8n+(8n)^2$

$+(7m)^2+2\times7m\times8n+(8n)^2$

$=49m^2-112mn+64n^2+49m^2$

$+112mn+64n^2$

$=98m^2+128n^2$

(b) $(2x+7)^2-(2x-7)^2$

$=(2x)^2+2\times2x\times7+7^2-\{(2x)^2$

$-2\times2x\times7+7^2\}$

$=4x^2+28x+49-4x^2+28x-49$

$=56x$

(c) $(ab+bc)^2-(ab-bc)^2$

$=a^2b^2+2ab^2c+b^2c^2-(a^2b^2$

$-2ab^2c+b^2c^2)$

$=a^2b^2+2ab^2c+b^2c^2-a^2b^2$

$+2ab^2c-b^2c^2$

$=4ab^2c$

(d) $(m^2-n^2)^2+2m^2n^2$

$=m^4-2m^2n^2+n^4+2m^2n^2$

$=m^4+n^4$

(e) $(4pq+3q)^2-(4pq-3q)^2$

$=16p^2q^2+24pq^2+9q^2$

$-(16p^2q^2-24pq^2+9q^2)$

$=16p^2q^2+24pq^2+9q^2-16p^2q^2$

$+24pq^2-9q^2$

$=48pq^2$

(f) $(m^2n-6p)^2+24m^2np$

$=m^4n^2-12m^2np+36p^2+24m^2np$

$=m^4n^2+36p^2+12m^2np$

(g) $(2.5p-1.5q)^2-(2.5p-1.5q)^2=0$

Because both are equal

(h) $\left(\frac{5}{2}mn-p\right)^2+\left(\frac{5}{2}mn+p\right)^2$

$=\frac{25}{4}m^2n^2-5mnp+p^2+\frac{25}{4}m^2n^2$

$+5mnp+p^2$

$=\frac{25}{2}m^2n^2+2p^2$

(i) $(a-b)(a+b)+(b-c)(b+c)+(c-a)(c+a)$

$=a^2-b^2+b^2-c^2+c^2-a^2$

$=0$

(j) $(x^2+y^2)(x^2-y^2)+(y^2+z^2)(y^2-z^2)$

$+(z^2+x^2)(z^2-x^2)$

$=x^4-y^4+y^4-z^4+z^4-x^4$

$=0$

6. (a) $53\times58=(50+3)\times(50+8)$

$=(50)^2+(3+8)\times50+3\times8$

$=2500+550+24$

$=3074$

(b) $106\times108=(100+6)(100+8)$

$=(100)^2+(6+8)\times100+6\times8$

$=10000+1400+48$

$=11448$

(c) $204\times207=(200+4)\times(200+7)$

$=(200)^2+(4+7)\times200+4\times7$

$=40000+2200+28$

$=42228$

(d) $(102)^2=(100+2)^2$

$=100^2+2\times100\times2+2^2$

$=10000+400+4$

$=10404$

(e) $(98)^2=(100-2)^2$

$=(100)^2-2\times100\times2+2^2$

$=10000-400+4$

$=9604$

(f) $(205)^2=(200+5)^2$

$=(200)^2+2\times200\times5+5^2$

$=40000+2000+25$

$=42025$

(g) $(5.2)^2=(5+.2)^2$

$=5^2+2\times5\times.2+(.2)^2$

$=25+2+0.04$

$=27.04$

(h) $(8.9)^2=(9-.1)^2$

$=9^2\times2\times9\times.1+(0.1)^2$

$=81-1.8+0.01$

$=79.21$

(i) $(600+.5)^2=(600)^2+2\times600\times.5+(.5)^2$

$=360000+600+0.25$

$=360600.25$

(j) $52^2-51^2=(52+51)\times(52-51)$

$=103\times1=103$

(k) $153^3-53^2=(153+53)\times(153-53)$

$=206\times100=20600$

(l) $(12.1)^2-(8.9)^2=(12.1+8.9)\times(12.1-8.9)$

$=21\times3.2=67.2$

7. (a) $x+\frac{1}{x}=3$

Squaring both sides

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

$$\Rightarrow \quad x^2 + 2 \times x \times \frac{1}{x} + \frac{1}{x^2} = 9$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} = 9 - 2$$

$$x^2 + \frac{1}{x^2} = 7$$

(b) Again squaring

$$\left(x^2 + \frac{1}{x^2}\right)^2 = 7^2$$

$$\Rightarrow \quad x^4 + 2 \times x^2 \times \frac{1}{x^2} + \frac{1}{x^4} = 49$$

$$\Rightarrow \quad x^4 + \frac{1}{x^4} = 49 - 2 = 47$$

8. (a) $x - \frac{1}{x} = 5$

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

$$\Rightarrow \quad x^2 - 2 \times x \times \frac{1}{x} + \frac{1}{x^2} = 25$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} = 25 + 2 = 27$$

(b) Again

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (27)^2$$

$$x^4 + 2 \times x^2 + \frac{1}{x^2} + \frac{1}{x^4} = 729$$

$$x^4 + \frac{1}{x^4} = 729 - 2 = 727$$

9. $\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2$

$$\Rightarrow \quad \left(x + \frac{1}{x}\right)^2 = 47 + 2$$

$$\Rightarrow \quad \left(x + \frac{1}{x}\right)^2 = 49$$

Or $$x + \frac{1}{x} = \sqrt{49} = 7$$

10. $\left(x - \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} - 2$

$$\left(x - \frac{1}{x}\right)^2 = 83 - 2$$

$$\left(x - \frac{1}{x}\right)^2 = 81$$

or $$\left(x - \frac{1}{x}\right) = \sqrt{81} = 9$$

➲ EXERCISE 10.6

1. (a) $(a + 2b + 3c)^2$

$$= a^2 + (2b)^2 + (3c)^2 + 2 \times a \times 2b + 2 \times 2b \times 3c + 2 \times 3c \times a$$

$$= a^2 + 4b^2 + 9c^2 + 4ab + 12bc + 6ca$$

(b) $(2x - 5y + 4)^2$

$$= (2x)^2 + (-5y)^2 + 4^2 + 2 \times 2x \times (-5y) + 2 \times (-5y) \times 4 + 2 \times 4 \times 2x$$

$$= 4x^2 + 25y^2 + 16 - 20xy - 40y + 16x$$

(c) $(m + n + 2p)^2$

$$= m^2 + n^2 + (2p)^2 + 2 \times m \times n + 2 \times n \times 2p + 2 \times 2p \times m$$

$$= m^2 + n^2 + 4p^2 + 2mn + 4np + 4pm$$

(d) $(m^2 + n^2 + p)^2$

$$= (m^2)^2 + (n^2)^2 + p^2 + 2 \times m^2 \times n^2 + 2 \times n^2 \times p + 2 \times p \times m^2$$

$$= m^4 + n^4 + p^2 + 2m^2n^2 + 2n^2p + 2pm^2$$

(e) $(-5x + 2y + z)^2$

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

$$= 25x^2 + 4y^2 + z^2 - 20xy + 4yz - 10xz$$

(f) $(p + 2q + r)^2$

$$= p^2 + (2q)^2 + r^2 + 2 \times p \times 2q + 2 \times 2q \times r + 2 \times r \times p$$

$$= p^2 + 4q^2 + r^2 + 4pq + 4qr + 2rp$$

(g) $(-x + y + 2z)^2$

$$= (-x)^2 + y^2 + (2z)^2 + 2 \times (-x) \times y + 2 \times y \times 2z + 2 \times 2z \times (-x)$$

$$= x^2 + y^2 + 4z^2 - 2xy + 4yz - 4xz$$

(h) $\left(\frac{1}{5}a - \frac{1}{3}b + 2\right)^2$

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

$$= \frac{a^2}{25} + \frac{b^2}{9} + 4 - \frac{2}{15}ab - \frac{4}{3}b + \frac{4}{5}a$$

(i) $\left(6x-\frac{y}{2}+\frac{z}{3}\right)^2$

$=(6x)^2+\left(\frac{-y}{2}\right)^2+\left(\frac{z}{3}\right)^2+2\times 6x$

$\times\left(\frac{-y}{2}\right)+2\times\left(\frac{-y}{2}\right)\times\frac{z}{3}+2\times\frac{z}{3}\times 6x$

$=36x^2+\frac{y^2}{4}+\frac{z^2}{9}-6xy-\frac{yz}{3}+4xz$

(j) $\left(\frac{mn}{2}+3p+\frac{1}{3}l\right)^2$

$=\left(\frac{mn}{2}\right)^2+(3p)^2+\left(\frac{1}{3}l\right)^2+2\times\frac{mn}{2}\times 3p$

$+2\times 3p\times\frac{1}{3}l+2\times\frac{1}{3}l\times\frac{mn}{2}$

$=\frac{m^2n^2}{4}+9p^2+\frac{l^2}{9}+3mnp+2pl+\frac{lmn}{3}$

(k) $\left(\frac{1}{4}x+\frac{y}{2}-\frac{z}{3}\right)^2$

$=\left(\frac{1}{4}x\right)^2+\left(\frac{y}{2}\right)^2+\left(\frac{-z}{3}\right)^2+2\times\frac{x}{4}\times\frac{y}{2}$

$+2\times\frac{y}{2}\times\left(\frac{-z}{3}\right)+2\times\left(\frac{-z}{3}\right)\times\frac{x}{4}$

$=\frac{x^2}{16}+\frac{y^2}{4}+\frac{z^2}{9}+\frac{xy}{4}-\frac{yz}{3}-\frac{xz}{6}$

(l) $\left(6x-\frac{y}{2}-\frac{z}{4}\right)^2$

$=(6x)^2+\left(-\frac{y}{2}\right)^2+\left(\frac{-z}{4}\right)^2+2\times 6x$

$\times\left(\frac{-y}{2}\right)+2\times\left(\frac{-y}{2}\right)\times\left(\frac{-z}{4}\right)+2\times\left(\frac{-z}{4}\right)\times 6x$

$=36x^2+\frac{y^2}{4}+\frac{z^2}{16}-6xy+\frac{yz}{4}-3xz$

2. (a) $(a+2b+c)^2+(a+2b-c)^2$

$=a^2+4b^2+c^2+4ab+4bc$

$+2ac+a^2+4b^2+c^2+4ab-4bc-2ca$

$=2a^2+8b^2+2c^2+8ab$

(b) $(2x+y-z)^2-(2x+y+z)^2$

$=4x^2+y^2+z^2+4xy-2yz-4xz$

$-4x^2-y^2-z^2-4xy-2yz-4xz$

$=-4yz-8xz$

(c) $(3x-2y+z)^2-(-3x+2y-z)^2$

$=9x^2+4y^2+z^2-12xy-4yz$

$+6xz-9x^2-4y^2-z^2+12xy+4yz-6xz$

$=0$

(d) $(2p-q+3m)^2-(2p+q+3m)^2$

$=4p^2+q^2+9m^2-4pq-6qm$

$+12pm-4p^2-q^2-9m^2-4pq$

$-6qm-12pm$

$=-8pq-12qm$

(e) $\left(\frac{1}{2}m-\frac{n}{3}+\frac{p}{5}\right)^2-\left(\frac{1}{2}m+\frac{n}{3}-\frac{p}{5}\right)^2$

$=\frac{m^2}{4}+\frac{n^2}{9}+\frac{p^2}{25}-\frac{mn}{3}-\frac{2np}{15}+\frac{mp}{5}$

$-\frac{m^2}{4}-\frac{n^2}{9}-\frac{p^2}{25}-\frac{mn}{3}+\frac{2np}{15}+\frac{mp}{5}$

$=\frac{-2mn}{3}+\frac{2mp}{5}$

(f) $\left(mn+\frac{p}{2}+l\right)^2+\left(-mn-\frac{p}{2}+l\right)^2$

$=m^2n^2+\frac{p^2}{4}+l^2+mnp+pl$

$+2mnl+m^2n^2+\frac{p^2}{4}+l^2+mnp-pl-2mnl$

$=2m^2n^2+\frac{p^2}{2}+2l^2+2mnp$

3. $x+y+z=8$

Squaring both sides

$(x+y+z)^2=8^2$

$x^2+y^2+z^2+2(xy+yz+zx)=64$

$x^2+y^2+z^2+2\times 18=64$

$x^2+y^2+z^2=64-36$

$x^2+y^2+z^2=28$

4. $(a+b+c)^2=12^2$

$a^2+b^2+c^2+2(ab+bc+ca)=144$

$a^2+b^2+c^2+2\times 30=144$

$a^2+b^2+c^2=144-60$

$a^2+b^2+c^2=84$

5. $(a+b+c)^2=a^2+b^2+c^2+2(ab+bc+ca)$

$=70+2\times 37$

$=70+74=144$

$\therefore \quad a+b+c=\sqrt{144}$

$=12$

6. $(m+n+p)^2=9^2$

$m^2+n^2+p^2+2(mn+np+pm)=81$

$41+2(mn+np+pm)=81$

$2(mn+np+pm)=81-41$

$=40$

$\therefore \quad mn+np+pm=\frac{40}{2}$

$=20$

➲ HOTS

1. $(3a-5b)+(2a+3b)=5a-2b$

$(5a-2b)-(3a-5b)=2a+3b$

2. $x+\frac{1}{x}=4$

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

$x^2+\frac{1}{x^2}+2=16$

$x^2+\frac{1}{x^2}=14$

$\left(x^2+\frac{1}{x^2}\right)^2=(14)^2$

$x^4+\frac{1}{x^4}+2=196$

$x^4+\frac{1}{x^4}=194$

3. $x-\frac{1}{x}=3$

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

$x^2+\frac{1}{x^2}-2=9$

$x^2+\frac{1}{x^2}=11$

$\left(x^2+\frac{1}{x^2}\right)^2=(11)^2$

$x^4+\frac{1}{x^4}+2=121$

$x^4+\frac{1}{x^4}=119$

➲ NCERT CORNER

1. (i)

	$+$	$ab-bc$	
		$+bc-ca$	
$+$	$-ab$		ca
		0	

(ii)

	$+$	$a-b+ab$		
		$+b$	$-c+bc$	
$+$	$-a$		$+c$	$+ac$
		$ab+bc$		$+ac$

2. (a)

	$12a$	$-9ab$	$+5b$	-3
$-$	$4a$	$-7ab$	$+3b$	$+12$
$-$	$+$	$-$	$-$	
	$8a$	$-2ab$	$+2b$	-15

(b)

	$5xy-2yz-2zx$		$+10xyz$
$-$	$3xy$	$+5yz-7zx$	
$-$	$-$	$+$	
	$2xy-7yz+5zx$		$+10xyz$

3. (i) $xy\times yz\times zx$

$=(1\times1\times1)\times x\times y\times y\times z\times z\times x$

$=1\times(x^2\times y^2\times z^2)=x^2y^2z^2$

(ii) $m\times(-mn)\times mnp$

$=[1\times(-1)\times1]\times m\times mn\times mnp$

$=(-1)\,m^3n^2p$

$=-m^3n^2p$

4. (a) $(3x)(4x)-(3x)(5)+3$

$=(3\times4)\times(x\times x)-(3\times5)\times x+3$

$=12x^2-15x+3$

(i) **For $x=3$:**

$12x^2-15x+3=12(3)^2-15(3)+3$

$=108-45+3=66$

(ii) **For $x=\frac{1}{2}$:**

$12x^2-15x+3=12\left(\frac{1}{2}\right)^2-15\left(\frac{1}{2}\right)+3$

$=3-\frac{15}{2}+3$

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

(b) $a(a^2+a+1)+5=a\times a^2+a\times a+a\times1+5$

$=a^3+a^2+a+5$

(i) **For $a=0$:**

a^3+a^2+a+5

$=(0)^3+(0)^2+(0)+5$

$=5$

(ii) **For $a = 1$:**

$$a^3 + a^2 + a + 5$$
$$= (1)^3 + (1)^2 + (1) + 5$$
$$= 1 + 1 + 1 + 5$$
$$= 8$$

(iii) **For $a = -1$:**

$$a^3 + a^2 + a + 5$$
$$= (-1)^3 + (-1)^2 + (-1) + 5$$
$$= -1 + 1 - 1 + 5 = 4$$

5. First expression :

$$p(p-q) = p \times p - p \times q = p^2 - pq$$

Second expression:

$$q(q-r) = q \times q - q \times r = q^2 - qr$$

Third expression :

$$r(r-p) = r \times r - r \times p = r^2 - rp$$

Adding the three expressions,

$$\begin{array}{rr} & p^2 - pq \\ + & + q^2 - qr \\ + & + r^2 - rp \\ \hline & p^2 - pq + q^2 - qr + r^2 - rp \end{array}$$

6. $(a+b)(c-d) + (a-b)(c+d) + 2(ac+bd)$

$$= a(c-d) + b(c-d) + a(c+d) - b(c+d) + 2(ac+bd)$$
$$= ac - ad + bc - bd + ac + ad - bc - bd + 2ac + 2bd$$
$$= (ac + ac + 2ac) + (ad - ad) + (bc - bc) + (2bd - bd - bd)$$
$$= 4ac$$

7. (i) $(x+3)(x+7) = x^2 + (3+7)x + (3 \times 7)$

$$= x^2 + 10x + 21$$

(ii) $(4x+5)(4x+1) = (4x)^2 + (5+1)4x + (5 \times 1)$

$$= 16x^2 + 6 \times 4x + 5$$
$$= 16x^2 + 24x + 5$$

11 Visualising Solid Shapes

➲ EXERCISE 11.1

1. Given in answersheet.

2. Do it yourself.

➲ EXERCISE 11.2

1. Given in answersheet.

➲ HOTS

1. F + V – E = 2

$$F + 20 - 30 = 2$$
$$F - 10 = 2$$
$$F = 12$$

2. F + V – E = 2

$$20 + V - 30 = 2$$
$$V - 10 = 2$$
$$V = 12$$

3. E = 24, V = 16, F = ?

$$F + V = E + 2$$
$$F + 16 = 24 + 2$$
$$F + 16 = 26$$
$$F = 26 - 16 = 10$$

➲ NCERT CORNER

1. (a) (i) Top view (ii) Front view (iii) Side view
(b) (i) Side view (ii) Front view (iii) Top view
(c) (i) Side view (ii) Front view (iii) Top view
(d) (i) Front view (ii) Top view (iii) Side view

2. Please draw yourself.

3. (i) Top and base of a prism and of a cylinder are congruent and parallel to each other and a prism becomes a cylinder, if the number of sides of its base becomes larger and larger.

(ii) The pyramid and cone are alike, because their lateral faces meet at a vertex. Also, a pyramid becomes a cone, if the number of sides of its base becomes larger and larger.

4. (i) In the given solid, $F = 7, V = 10$ and $E = 15$

From Euler's formula, $F + V - E = 2$

$$F + V - E = 7 + 10 - 15 = 17 - 15 = 2$$

Hence, Euler's formula is verified.

(ii) In the given solid, $F = 9, V = 9$ and $E = 16$

From Euler's formula, $F + V - E = 2$

$$F + V - E = 9 + 9 - 16 = 18 - 16 = 2$$

Hence, Euler's formula is verified.

12 Area of a Trapezium and a Polygon

➲ EXERCISE 12.1

1. Area of trapezium $= \frac{1}{2} \times$ (sum of parallel sides) $\times$ perpendicular distance

$$= \frac{1}{2} \times (30 + 24) \times 10$$
$$= \frac{1}{2} \times 54 \times 10 = 270 \text{ cm}^2$$

2. Area of trapezium $= \frac{1}{2}(54+42)\times 16$

$= \frac{1}{2}\times 96\times 16 = 768\ \text{cm}^2$

3. Area of trapezium $= \frac{1}{2}\times(42+66)\times$ perpendicular

$540 = \frac{1}{2}\times 108\times x$

$\therefore \quad x = \frac{540\times 2}{108}$

$x = 10\ \text{cm}$

4. Let perpendicular distance be x cm

So, $\quad \text{Area} = \frac{1}{2}(38+54)\times x$

$704 = \frac{1}{2}\times 92\times x$

$\therefore \quad x = \frac{704\times 2}{92} = 15.30\ \text{cm}$

5. Let length of other side be x cm

$\text{Area} = \frac{1}{2}\times(18+x)\times 17$

$340 = \frac{1}{2}\times(18+x)\times 17$

$\therefore \quad 18+x = \frac{340\times 2}{17}$

$18+x = 40$

$\therefore \quad x = 40-18$

$x = 22\ \text{cm}$

6. Let length of other side be x cm

$\text{Area} = \frac{1}{2}\times(54+x)\times 13$

$780 = \frac{1}{2}\times(54+x)\times 13$

$\therefore \quad 54+x = \frac{780\times 2}{13}$

$54+x = 120$

$\therefore \quad x = 120-54$

$x = 66\ \text{cm}$

7. Let length of one side be x cm then length of other side will be $(x+8)$ cm

$\text{Area} = \frac{1}{2}\times(x+x+8)\times 14$

$560 = \frac{1}{2}\times(2x+8)\times 14$

or $\quad 2x+8 = \frac{560\times 2}{14}$

$2x+8 = 80$

$2x = 80-8$

$2x = 72$

$\therefore \quad x = \frac{72}{2}$

$x = 36$

So, lengths of parallel sides are 36 cm and 44 cm.

8. Let length of one side be x cm then length of other side will be $(x+4)$ cm.

$\text{Area} = \frac{1}{2}\times(x+4+x)\times 18$

$360 = \frac{1}{2}\times(2x+4)\times 18$

$2x+4 = \frac{360\times 2}{18}$

$2x+4 = 40$

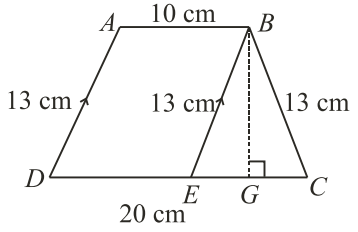
$2x = 40-4$

$2x = 36$

$\therefore \quad x = \frac{36}{2} = 18$

So, lengths of sides are 18 cm and 22 cm

9.



Draw $BG \perp EC$

$EC = DC - AB$

$= 20-10 = 10\ \text{cm}$

$\therefore \quad EG = \frac{1}{2}\times 10 = 5\ \text{cm}$

By Pythagoras, in ΔBEG

$BE^2 = BG^2 + EG^2$

$13^2 = BG^2 + 5^2$

$169 = BG^2 + 25$

$BG^2 = 169-25$

$= 144$

$\therefore \quad BG = \sqrt{144}$

$= 12\ \text{cm}$

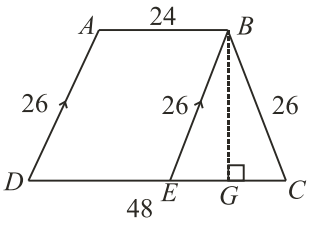
So, area of trapezium

$= \frac{1}{2}(10+20)\times 12$

$= \frac{1}{2}\times 30\times 12$

$= 180\ \text{cm}^2$

10.



Draw $BE \parallel AD$

Draw $BG \perp EC$

$$EC = DC - AB$$
$$= 48 - 24 = 24 \text{ cm}$$

$$\therefore \quad EG = \frac{1}{2} \times 24 = 12 \text{ cm}$$

In ΔBGE,

$$BE^2 = BG^2 + EG^2$$
$$26^2 = BG^2 + 12^2$$
$$676 = BG^2 + 144$$

or $$BG^2 = 676 - 144 = 532$$

$$\therefore \quad BG = \sqrt{532} = 23.07 \text{ cm}$$

$$\text{Area of trapezium} = \frac{1}{2}(24 + 48) \times 23.07$$
$$= 830.52 \text{ cm}^2$$

➲ EXERCISE 12.2

1. (a) $\text{Area of required polygon} = \dfrac{nar}{2}$

$$= \frac{5 \times 6 \times 5}{2} = 75 \text{ cm}^2$$

(b) $\text{Area} = \dfrac{4 \times 4 \times 3.5}{2} = 28 \text{ cm}^2$

(c) $\text{Area} = \dfrac{6 \times 7 \times 4.5}{2} = 94.5 \text{ cm}^2$

(d) $\text{Area} = \dfrac{7 \times 5 \times 6}{2} = 105 \text{ cm}^2$

2. (a) Area of required polygon

$$= \frac{n}{2} \times a \times \sqrt{R^2 - \frac{a^2}{4}}$$
$$= \frac{7}{2} \times 5 \times \sqrt{6^2 - \frac{5^2}{4}}$$
$$= \frac{35}{2} \times \sqrt{36 - \frac{25}{4}}$$
$$= \frac{35}{2} \times \sqrt{\frac{144 - 25}{4}}$$
$$= \frac{35}{2} \times \sqrt{\frac{119}{4}} = 95.45 \text{ cm}^2$$

(b) $\text{Area} = \dfrac{6}{2} \times 8 \times \sqrt{7^2 - \dfrac{8^2}{4}}$

$$= 24 \times \sqrt{49 - 16}$$
$$= 24 \times 5.74 = 137.87 \text{ cm}^2$$

(c) $\text{Area} = \dfrac{8}{2} \times 6 \sqrt{5^2 - \dfrac{6^2}{4}}$

$$= 24 \times \sqrt{25 - 9}$$
$$= 24 \times 4 = 96 \text{ cm}^2$$

(d) $\text{Area} = \dfrac{9}{12} \times 5 \times \sqrt{7^2 - \dfrac{5^2}{4}}$

$$= \frac{45}{2} \times \sqrt{49 - \frac{25}{4}}$$
$$= \frac{45}{2} \times \sqrt{\frac{196 - 25}{4}}$$
$$= \frac{45}{2} \times \sqrt{\frac{171}{4}} = 147.11 \text{ cm}^2$$

3. $\text{Area of regular hexagon} = \dfrac{3\sqrt{3}}{2} a^2$

$$= \frac{3 \times 1.732 \times 8^2}{2}$$
$$= 166.27 \text{ cm}^2$$

4. $\text{Area of regular hexagon} = \dfrac{3\sqrt{3} a^2}{2}$

$$= \frac{3 \times 1.732 \times 7^2}{2}$$
$$= 127.302$$

5. $\text{Area of regular octagon} = 2a^2 (1 + \sqrt{2})$

$$= 2 \times 5^2 (1 + 1.414)$$
$$= 120.71 \text{ cm}^2$$

6. $\text{Area of regular octagon} = 2 \times 6^2 \times (1 + \sqrt{2})$

$$= 72 \times (1 + 1.414)$$
$$= 173.81 \text{ cm}^2$$

➲ HOTS

1. $\text{Area} = \dfrac{1}{2}(\text{Sum of parallel sides}) \times \text{height}$

$$500 = \frac{1}{2}(x + 4x) \times 10$$
$$5x = 100$$
$$x = 20$$

Length of sides $= x, 4x$

$$= 20, 80$$

2. Let radius = r

$$A_1 = \pi r^2$$

When radius is doubled $= 2r$

$$A_2 = \pi(2r^2) = 4\pi r^2$$

Area becomes 4 times.

➲ NCERT CORNER

1. Side of the square plot = 25 m

$\therefore$ Area of the square plot = Side × Side

$$= 25 \times 25 = 625 \text{ m}^2$$

Length of the house = 20 m and breadth = 15 m

$\therefore$ Area of the rectangular house

= Length × Breadth

$$= 20 \times 15 = 300 \text{ m}^2$$

Now, area of the garden = Area of the plot – Area of the house $= 625 - 300 = 325 \text{ m}^2$

Cost of developing the garden = ₹ 55 per m^2

$\therefore$ Total cost of developing the garden

$$= 325 \times 55 = ₹\ 17{,}875$$

2. (a) Diameter of the food piece = 2.8 m

$\therefore$ Radius of the food piece $= \frac{2.8}{2} = 1.4$ cm

Perimeter of a semi-circle $= \frac{2\pi r}{2} = \pi r$

$\therefore$ Perimeter of the food piece $= \pi r +$ Diameter

$$= \frac{22}{7} \times 1.4 + 2.8 = \frac{22}{7} \times \frac{14}{10} + 2.8$$

$$= 4.4 + 2.8 = 7.2 \text{ cm}$$

(b) Perimeter of the semi-circle

$$= \pi r = \frac{22}{7} \times 1.4 = 4.4 \text{ cm}$$

Perimeter of the remaining part

= 1.5 + 2.8 + 1.5

= 5.8 cm

Now, the perimeter of the food piece

= 4.4 + 5.8 = 10.2 cm

(c) Perimeter of semi-circular part

$$= \frac{\pi d}{2} = \frac{22}{7} \times \frac{2.8}{2}$$

$$= 4.4 \text{ cm}$$

Now, perimeter of the food piece

= 4.4 + 2 + 2

= 8.4 cm

$\because$ 7.2 cm < 8.4 < 10.2 cm

$\therefore$ The ant would have to take a longer round for food piece (b).

3. Area of the rhombus $= \frac{1}{2} \times$ Product of diagonals

$$= \frac{1}{2} \times 7.5 \times 12$$

$$= \frac{1}{2} \times \frac{75}{10} \times \frac{12}{1}$$

$$= 15 \times 3 = 45 \text{ cm}^2$$

4. Given : Perpendicular distance $(h) = 100$ m

Area of the trapezium shaped field $= 10500 \text{ m}^2$

Let side along the road be x m and side along the river $= 2x$ m

$\therefore$ Area of the trapezium field $= \frac{1}{2}(a+b) \times h$

$$\Rightarrow \quad 10500 = \frac{1}{2}(x + 2x) \times 100$$

$$\Rightarrow \quad 10500 = 3x \times 50$$

$$\Rightarrow \quad 3x = \frac{10500}{50}$$

$$\Rightarrow \quad x = \frac{10500}{50 \times 3} = 70 \text{ m}$$

Hence, the side along the river

$$= 2x = 2 \times 70 = 140 \text{ m}$$

5. Area of trapezium I :

Given : Parallel sides are 24 cm and 16 cm

$$\text{Height} = \frac{28 - 20}{2} = 4 \text{ cm}$$

$\therefore$ Area of trapezium I $= \frac{1}{2} \times (16 + 24) \times 4$

$$= \frac{1}{2} \times 40 \times 4 = 80 \text{ cm}^2$$

Area of trapezium II :

Given : Parallel sides are 20 cm and 28 cm

$$\text{Height} = \frac{24 - 16}{2} = 4 \text{ cm}$$

$\therefore$ Area of trapezium II $= \frac{1}{2} \times (20 + 28) \times 4$

$$= \frac{1}{2} \times 48 \times 4 = 96 \text{ cm}^2$$

Area of trapezium III :

$\because$ The dimensions of trapezium III and trapezium I are same.

$\therefore$ Area of trapezium III $= 80 \text{ cm}^2$

Area of trapezium IV :

$\because$ The dimensions of trapezium IV and trapezium II are same.

$\therefore$ Area of trapezium IV $= 96 \text{ cm}^2$

13 Surface Area and Volume of Solids

➲ EXERCISE 13.1

1. TSA of room $= 2 \times (lb + bh + hl)$

$= 2\,(14 \times 10 + 10 \times 5 + 5 \times 14)$

$= 2\,(140 + 50 + 70)$

$= 2 \times 260 = 520\ \text{m}^2$

2. TSA of the box $= 2\,(lb + bh + hl)$

$= 2\,(32 \times 28 + 28 \times 12 + 12 \times 32)$

$= 2 \times (896 + 336 + 384)$

$= 2 \times 1616 = 3232\ \text{cm}^2$

Cost of wood used $= ₹\,(3232 \times 14.50)$

$= ₹\,46864$

3. Area of open cuboidal tank = LSA + base area

$= 2h\,(l + b) + l \times b$

$= 2 \times 2 \times (8 + 6) + 8 \times 6$

$= 4 \times 14 + 48$

$= 56 + 48 = 104\ \text{m}^2$

Cost of iron $= ₹\,(104 \times 60)$

$= ₹\,6240$

4. Area of required paper

$= 2 \times (lb + bh + hl) - (l \times h + l \times b)$

$= 2\,(60 \times 40 + 40 \times 30 + 30 \times 60)$

$\quad - (60 \times 30 + 60 \times 40)$

$= 2\,(2400 + 1200 + 1800) - (1800 + 2400)$

$= 10800 - 4200\ \text{cm}^2$

$= 6600\ \text{cm}^2$

5. Area of tarpaulin cloth for one box

$= 2h\,(l + b) + l \times b$

$= 2 \times 32\,(50 + 40) + 50 \times 40$

$= 64 \times 90 + 2000$

$= 5760 + 2000$

$= 7760\ \text{cm}^2$

Length of cloth $= \dfrac{\text{Area}}{\text{Width}}$

$= \dfrac{7760}{64} = 121.25\ \text{cm}$

Cloth required for 100 boxes $= (121.25 \times 100)$

$= 12125\ \text{cm}^2$

$= 121.25\ \text{cm}^2$

6. TSA of one tile $= 2\,(lb + bh + hl)$

$= 2\,(22.5 \times 10 + 10 \times 7.5 + 7.5 \times 22.5)$

$= 2\,(225 + 75 + 168.75)$

$= 937.5\ \text{cm}^2$

Number of tiles painted $= \dfrac{9.375 \times 10000}{937.5}$

$= 100$

7. TSA of one brick $= 2\,(12 \times 10 + 10 \times 8 + 8 \times 12)$

$= 2\,(120 + 80 + 96)$

$= 2 \times 296 = 592\ \text{cm}^2$

Number of bricks painted $= \dfrac{18.56 \times 10000}{592}$

$= 313$

8. Let length, breadth and height are $5x$, $3x$ and $2x$

TSA of box $= 1550\ \text{cm}^2$

$2\,(5x \times 3x + 3x \times 2x + 2x \times 5x) = 1550$

$2\,(15x^2 + 6x^2 + 10x^2) = 1550$

$2 \times 31x^2 = 1550$

$\therefore \quad x^2 = \dfrac{1550}{62}$

$x^2 = 25$

or $\quad x = \sqrt{25} = 5$

So, length $= 5 \times 5 = 25$ cm

breadth $= 3 \times 5 = 15$ cm

and height $= 2 \times 5 = 10$ cm

9. Let length, breadth and height are $4x$, $2x$ and x

TSA of box $= 2800\ \text{cm}^2$

$2\,(4x \times 2x + 2x \times x + x \times 4x) = 2800$

$2\,(8x^2 + 2x^2 + 4x^2) = 2800$

$2 \times 14x^2 = 2800$

$x^2 = \dfrac{2800}{28}$

$x^2 = 100$

$\therefore \quad x = \sqrt{100} = 10$

So, length $= 4 \times 10 = 40$ cm

breadth $= 2 \times 10 = 20$ cm

and height $= 1 \times 10 = 10$ cm

10. Length of longest pole = diagonal of room

$= \sqrt{l^2 + b^2 + h^2}$

$= \sqrt{10^2 + 8^2 + 4^2}$

$= \sqrt{100 + 64 + 16}$

$= \sqrt{180} = 13.42\ \text{m}$

11. Area of four walls $= 2h\,(l + b)$

$= 2 \times 3.5 \times (12 + 8)$

$= 7 \times 20 = 140\ \text{m}^2$

12. Area of four walls $= 2h\,(l + b)$

$= h \times 2\,(l + b)$

$= 4.5 \times 40 = 180\ \text{m}^2$

Cost of paper $= ₹\,(180 \times 25) = ₹\,4500$

➲ EXERCISE 13.2

1. Volume of cubical box $= \text{side}^3$

$= 7^3 = 343\ \text{cm}^3$

2. Length of cuboid $= \dfrac{\text{Volume}}{b \times h}$

$= \dfrac{380}{10 \times 2} = 19\ \text{cm}$

3. Capacity $= 200\ \text{kl}$

Volume $= 200\ \text{m}^3$ $\quad (\because\ 1\text{kl} = 1\text{m}^3\text{h})$

depth $(h) = \dfrac{v}{l \times h} = \dfrac{200}{20 \times 5} = 2\ \text{m}$

4. Width $(b) = \dfrac{v}{l \times h} = \dfrac{480}{10 \times 6} = 8\ \text{m}$

5. Volume of cube $= 512\ \text{cm}^3$

$\text{side}^3 = 512\ \text{cm}^3$

$\therefore$ $\text{side} = \sqrt[3]{512} = 8\ \text{cm}$

Surface area $= 6a^2$

$= 6 \times 8^2 = 384\ \text{cm}^2$

$\text{LSA} = 4a^2 = 4 \times 8^2$

$= 256\ \text{cm}^2$

6. Surface area $= 600\ \text{cm}^2$

$6a^2 = 600$

$a^2 = \dfrac{600}{6}$

$a^2 = 100$

$\therefore$ $a = \sqrt{100} = 10\ \text{cm}$

Volume $= a^3 = 10^3 = 1000\ \text{cm}^3$

7. (a) Length of resulting cuboid $= 9 + 9 + 9 = 27\ \text{cm}$

Breadth $= 9\ \text{cm}$ and height $= 9\ \text{cm}$

$\therefore$ Volume $= l \times b \times h$

$= 27 \times 9 \times 9 = 2187\ \text{cm}^3$

(b) TSA $= 2\,(lb + bh + hl)$

$= 2\,(27 \times 9 + 9 \times 9 + 9 \times 27)$

$= 2\,(243 + 81 + 243)$

$= 1134\ \text{cm}^2$

8. Volume of cube $= 7^3 = 343\ \text{cm}^3$

Length of new cuboid $= 28\ \text{cm}$

Breadth of new cuboid $= 7\ \text{cm}$

Height of new cuboid $= 7\ \text{cm}$

Volume of new cuboid $= 28 \times 7 \times 7 = 1372\ \text{cm}^2$

(a) Ratio $= \dfrac{1372}{343} = \dfrac{4}{1} = 4:1$

(b) Surface area of original cube $= 6 \times 7^2$

$= 294\ \text{cm}^2$

Surface area of new cuboid

$= 2\,(28 \times 7 + 7 \times 7 + 7 \times 28)$

$= 2 \times (196 + 49 + 196)$

$= 2 \times 441 = 882\ \text{cm}^2$

Ratio $= \dfrac{882}{294} = \dfrac{3}{1} = 3\ :\ 1$

9. Volume of metal block $= (200 \times 180 \times 80)\ \text{cm}^3$

Volume of one cube $= (20)^3\ \text{cm}^3$

So, number of cubes $= \dfrac{200 \times 180 \times 80}{20 \times 20 \times 20} = 360$

10. Volume of cubical metal block $= (400)^3\ \text{cm}^3$

Volume of cuboid $= (20 \times 10 \times 5)\ \text{cm}^3$

$\therefore$ Number of cuboid $= \dfrac{400 \times 400 \times 400}{20 \times 10 \times 5} = 64000$

11. Number of wooden cubical blocks

$= \dfrac{600 \times 400 \times 90}{15 \times 15 \times 15} = 6400$

12. Number of cubical boxes $= \dfrac{\text{Vol. of godown}}{\text{Vol. of one box}}$

$= \dfrac{60 \times 40 \times 30}{0.6}$

$= 120000$

13. External dimensions are $60\ \text{cm} \times 40\ \text{cm} \times 32\ \text{cm}$

So, internal length $= 60 - 2 \times 1.8 = 56.4\ \text{cm}$

Internal breadth $= 40 - 2 \times 1.8 = 36.4\ \text{cm}$

and internal height $= 32 - 2 \times 1.8 = 28.4$

(a) Capacity of box = Internal volume of box

$= (56.4 \times 36.4 \times 28.4)\ \text{cm}^3$

$= 58304.06\ \text{cm}^3$

(b) Volume of wood used

= External volume − Internal volume

$= (60 \times 40 \times 32) - 58304.06$

$= (76800 - 58304.06)$

$= 18495.94\ \text{cm}^2$

(c) Weight of empty box = Volume of wood × cost

$= (18495.94 \times 2.8)$

$= 51788.62 \text{ g}$

$= 51.788 \text{ kg}$

$= 51.79 \text{ kg}$

14. (a) Capacity of the box

$=$ Internal volume of the box

$= (80 \times 60 \times 40) \text{ cm}^3$

$= 192000 \text{ cm}^3$

(b) External volume $= 82 \times 62 \times 41$

$= 208444 \text{ cm}^3$

Volume of steel used

$=$ External volume $-$ Internal volume

$= 208444 - 192000$

$= 16444 \text{ cm}^3$

Weight of box $= (16444 \times 9.8)$ gm

$= 161151.2$ gm

$= 161.151$ kg

15. Let rise in water level be x cm

Volume of water displaced by cube = Vol. of cube

$\Rightarrow \quad 30 \times 24 \times x = 8^3$

$\Rightarrow \quad x = \dfrac{8 \times 8 \times 8}{30 \times 24} = 0.71 \text{ cm}$

16. Let rise in water level be x cm

Volume of water displaced by cuboid

$=$ Volume of cuboid

$\Rightarrow \quad 24 \times 16 \times x = 8 \times 6 \times 4$

$\Rightarrow \quad x = \dfrac{8 \times 6 \times 4}{24 \times 16}$

$x = 0.5 \text{ cm}$

17. Let measure of each edge be x unit

So new edge will be $(3x)$ unit

(a) So ratio of surface area $= \dfrac{6 \times (3x)^2}{6x^2}$

$= \dfrac{9x^2}{x^2} = \dfrac{9}{1}$

So surface area will be 9 times of original cube.

(b) Ratio of volume $= \dfrac{(3x)^3}{x^3} = \dfrac{27x^3}{x^3} = 27$

So, volume will be 27 times of original cube.

➲ EXERCISE 13.3

1. Volume of cylinder $= \pi r^2 h$

$= \dfrac{22}{7} \times 14^2 \times 18$

$= 11088 \text{ cm}^3$

$\text{CSA} = 2 \pi r h$

$= 2 \times \dfrac{22}{7} \times 14 \times 18$

$= 1584 \text{ cm}^2$

2. $\text{CSA} = 6600 \text{ cm}^2$

$2\pi rh = 6600$

$220 \times h = 6600$

$h = \dfrac{6600}{220}$

$h = 30 \text{ cm}$

Circumference $= 220$ cm

$2\pi r = 220$

$2 \times \dfrac{22}{7} \times r = 220$

$\therefore \quad r = \dfrac{220 \times 7}{22 \times 2}$

$r = 35 \text{ cm}$

$\therefore$ Volume of cylinder $= \pi r^2 h$

$= \dfrac{22}{7} \times (35)^2 \times 30$

$= 115500 \text{ cm}^3$

3. Diameter $= 14$ cm

$\therefore \quad \text{Radius} = \dfrac{14}{2} = 7 \text{ cm}$

Capacity of tank $= 5390 \text{ cm}^3$

$\pi r^2 h = 5390$

$\dfrac{22}{7} \times 7^2 \times h = 5390$

$\therefore \quad h = \dfrac{5390}{22 \times 7}$

$h = 35 \text{ cm}$

4. Volume of cylinder $= 47432 \text{ cm}^3$

$\pi r^2 h = 47432$

$\dfrac{22}{7} \times r^2 \times 77 = 47432$

$\therefore \quad r^2 = \dfrac{47432 \times 7}{22 \times 77}$

$r^2 = 196$

$\therefore \quad r = \sqrt{196} = 14 \text{ cm}$

$\text{TSA} = 2\pi r (r + h)$

$= 2 \times \dfrac{22}{7} \times 14 (14 + 77)$

$= 8008 \text{ cm}^2$

5. Volume of tank $= \pi r^2 h$

$$= \frac{22}{7} \times \left(\frac{5}{2}\right)^2 \times 21 = 412.5 \text{ m}^3$$

$$1 \text{ m}^3 = 1000 \, l$$

$\therefore$ $412.5 \text{ m}^3 = 4125 \times 1000 = 412500 \, l$

So, capacity of petrol tank is 412500 *l*.

6. TSA of closed tank $= 2\pi r \, (h + r)$

$$= 2 \times \frac{22}{7} \times 63 \times (300 + 63)$$

$$= 143748 \text{ cm}^2$$

$$= 14.3748 \text{ m}^2$$

$\therefore$ Cost of steel $= ₹ \, (14.3748 \times 185)$

$= ₹ \, 2659.34$

7. Volume of iron used to make pipe

= Outer volume − Inner volume

$= \pi h \, [R^2 - r^2]$

$$= \frac{22}{7} \times 42 \, [14^2 - 12^2]$$

$$= 22 \times 6 \, [196 - 144] = 6864 \text{ cm}^3$$

$\therefore$ Weight of pipe $= (6864 \times 12)$ gm

$= 82368$ gm $= 82.368$ kg

8. Let rise in level be *x* m

$\therefore$ Volume of earth in the ground

= Volume of earth taken out from well

$$\Rightarrow \quad 30 \times 28 \times x = \frac{22}{7} \times (2.5)^2 \times 63$$

$$\Rightarrow \quad 840x = 1237.5$$

$$\therefore \quad x = \frac{1237.5}{840}$$

$$x = 1.47 \text{ m}$$

9. Let water level rise in the cylindrical vessel be *x* cm

$\therefore$ Volume of water in cylindrical vessel

= Volume of water in rectangular vessel

$$\Rightarrow \quad \pi r^2 h = l \times b \times h$$

$$\Rightarrow \quad \frac{22}{7} \times 14^2 \times x = 40 \times 36 \times 8$$

$$x = \frac{40 \times 36 \times 8}{22 \times 28}$$

$$x = 18.7 \text{ cm}$$

10. Let level of water in cylindrical vessel be *x* m

$\therefore$ Vol. of water in cylindrical vessel

= Vol of rain water

$$\Rightarrow \quad \frac{22}{7} \times (3.5)^2 \times x = 60 \times 40 \times \frac{8}{100}$$

$$\therefore \quad x = \frac{60 \times 40 \times 8 \times 7}{22 \times (3.5)^2 \times 100}$$

$= 4.99$ m

$= 5$ m (approx.)

11. Let length of wire be *x* cm

Vol. of wire = Vol. of solid cylinder

$$\pi r^2 x = \pi R^2 h$$

$$(.1)^2 \times x = (10.5)^2 \times 12$$

$$x = \frac{(10.5)^2 \times 12}{.1 \times .1}$$

$$x = 132300 \text{ cm}$$

or $x = 1323$ m

12. Let length of wire be *x* cm

Vol. of wire = Vol. of metal cube

$$\frac{22}{7} \times (.2)^2 \times x = 4^3$$

$$\therefore \quad x = \frac{64 \times 7}{22 \times (.2)^2}$$

$$x = 509.1 \text{ cm}$$

or $x = 5.091$ m

13. So circumference of required cylinder = 33

$$\Rightarrow \quad 2\pi r = 33$$

$$\Rightarrow \quad r = \frac{33}{2 \times \frac{22}{7}}$$

$$= \frac{33 \times 7}{44}$$

$$= \frac{21}{4} \text{ cm}$$

Height of cylinder = 14 cm

$$\therefore \text{ Vol. of cylinder} = \frac{22}{7} \times \left(\frac{21}{4}\right)^2 \times 14$$

$$= 1212.75 \text{ cm}^3$$

14. So circumference of required cylinder = 22

$$2\pi r = 22$$

$$r = \frac{22}{2 \times \frac{22}{7}}$$

$$= \frac{22 \times 7}{44} = \frac{7}{2} \text{ cm}$$

Height of cylinder is 28 cm

$$\therefore \quad \text{Volume of cylinder} = \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 28$$

$$= 1078 \text{ cm}^3$$

➲ HOTS

1. (i) Inner curved surface area $= \frac{2200}{20} = 110\ \text{m}^2$

(ii) Height (depth) of the vessel $(h) = 10$ m

Curved surface area of the vessel $= 2\pi rh$

$\Rightarrow \quad 110 = 2 \times \frac{22}{7} \times r \times 10$

$\Rightarrow \quad r = \frac{110 \times 7}{2 \times 22 \times 10}$

$= 1.75$ m

(iii) Capacity of the vessel = Volume of the vessel

$= \pi r^2 h = \frac{22}{7} \times 1.75 \times 1.75 \times 10\ \text{m}^3$

$= 96.25\ \text{m}^3$

$= 96.25$ kl

2. Length = 12 cm, breadth = 6 cm, height = 6 cm

Surface area $= 2(lb + bh + lh)$

$= 2(12 \times 6 + 6 \times 6 + 12 \times 6)$

$= 2(72 + 36 + 72)$

$= 2 \times 180 = 360\ \text{cm}^2$

3. Length = 16 cm, breadth = 8 cm, height = 8 cm

Volume $= 16 \times 8 \times 8 = 1024\ \text{cm}^3$

➲ NCERT CORNER

1. $l = 15$ m, $b = 10$ m and $h = 7$ m

Surface area to be painted

$= 2[lb + bh + hl] - lb$

$= 2[(15 \times 10) + (10 \times 7) + (7 \times 15)] - (15 \times 10)$

$= 2[150 + 70 + 105] - 150 = 2[325] - 150$

$= 650 - 150 = 500\ \text{m}^2$

$100\ \text{m}^2$ of area is painted in $= 1$ can and $500\ \text{m}^2$ of area is painted in $= \frac{500}{100} = 5$ cans.

2. Lateral surface area of the hollow cylinder

$= 4224\ \text{cm}^2$

Area of the rectangular sheet $= 4224\ \text{cm}^2$

Let the length of the rectangular sheet $= l$ cm

$\therefore \quad l \times 33 = 4224$

$\Rightarrow \quad l = \frac{4224}{33} = 128$ cm

Now, Perimeter of the rectangular sheet

$= 2 \times$ (Length + Breadth)

$= 2 \times (128 + 33) = 2 \times 161 = 322$ cm

Hence, the perimeter of the rectangular sheet is 322 cm.

3. Diameter of the road roller = 84 cm

$\therefore$ Radius of the road roller $= \frac{84}{2} = 42$ cm

Length of the road roller $= 1\ \text{m} = 100$ cm

Lateral surface area of the road roller

$= 2\pi rh$

$= 2 \times \frac{22}{7} \times 42 \times 100 = 2 \times 22 \times 6 \times 100$

$= 26{,}400\ \text{cm}^2$

Area levelled by the road roller in 1 revolution

$= 26400\ \text{cm}^2$

Area levelled by the road roller in 750 revolutions

$= 750 \times 26400\ \text{cm}^2$

$= \frac{750 \times 26400}{100 \times 100}$

$= 1980\ \text{m}^2$

4. Let the height of the cylinder be h m.

Diameter $= 140$ cm

$\therefore \quad$ Radius $= \frac{140}{2} = 70$ cm

$\therefore \quad$ Volume $= \pi r^2 h = \frac{22}{7} \times (70)^2 \times h$

$= \frac{22}{7} \times 70 \times 70 \times h$

$= 22 \times 10 \times 70 \times h$

$= 15400 \times h$

According to the question,

Volume of the cylinder $= 1.54\ \text{m}^3$

$= 1.54 \times 100 \times 100 \times 100$

$= 1540000\ \text{cm}^3$

$\therefore \quad 15400 \times h = 1540000$

$h = \frac{1540000}{15400}$

$= 100$ cm or 1 m

Hence, the height of the cylinder is 1 m.

5. Volume of the reservoir $= 108\ \text{m}^3$ [$\because 1\ \text{m}^3 = 1000$ L]

$= 108 \times 1000$ L

$= 108000$ L

Water poured in 1 minute = 60 L

Water poured in 1 hour $= 60 \times 60$ L

$\therefore$ Number of hours required to fill the reservoir

$= \frac{108000}{60 \times 60} = 30$

Hence, the number of hours it will take to fill the reservoir is 30.

14 Exponents and Powers

➲ EXERCISE 14.1

1. (a) $7^8 = 7\times7\times7\times7\times7\times7\times7\times7$

Base = 7, Exponent = 8

(b) $(-6)^7 = (-6)\times(-6)\times(-6)\times(-6)\times(-6)\times(-6)\times(-6)$

Base = -6, Exponent = 7

(c) $(-13)^4 = (-13)\times(-13)\times(-13)\times(-13)$

Base = -13, Exponent = 4

(d) $15^3 = 15\times15\times15$

Base = 15, Exponent = 3

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

Base = $\frac{2}{7}$, Exponent = -5

(f) $\left(\frac{4}{9}\right)^4 = \frac{4}{9}\times\frac{4}{9}\times\frac{4}{9}\times\frac{4}{9}$

Base = $\frac{4}{9}$, Exponent = 4

(g) $\left(\frac{3}{11}\right)^{-3} = \left(\frac{11}{3}\right)^3 = \frac{11}{3}\times\frac{11}{3}\times\frac{11}{3}$

Base = $\frac{3}{11}$, Exponent = -3

(h) $\left(\frac{4}{9}\right)^{-7} = \left(\frac{9}{4}\right)^7 = \frac{9}{4}\times\frac{9}{4}\times\frac{9}{4}\times\frac{9}{4}\times\frac{9}{4}\times\frac{9}{4}\times\frac{9}{4}$

Base = $\frac{4}{9}$, Exponent = -7

2. (a)

3	243
3	81
3	27
3	9
3	3
	1

$\therefore \quad 243 = 3\times3\times3\times3\times3 = 3^5$

(b)

7	343
7	49
7	7
	1

$\therefore \quad -343 = -(7\times7\times7) = (-7)^3$

(c)

5	3125
5	625
5	125
5	25
5	5
	1

$\therefore \quad 3125 = 5\times5\times5\times5\times5 = 5^5$

(d)

3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

$\therefore \quad 6561 = 3\times3\times3\times3\times3\times3\times3\times3\times3 = 3^8$

(e)

3	81
3	27
3	9
3	3
	1

5	625
5	125
5	25
5	5
	1

$\therefore \quad \frac{81}{625} = \frac{3\times3\times3\times3}{5\times5\times5\times5} = \left(\frac{3}{5}\right)^4$

(f)

8	512
8	64
8	8
	1

11	1231
11	121
11	11
	1

$\therefore \quad \frac{-512}{1331} = \frac{-8\times8\times8}{11\times11\times11} = \left(\frac{-8}{11}\right)^3$

(g)

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

19	6859
19	361
19	19
	1

$\therefore \quad \frac{-216}{6859} = -\left(\frac{2\times2\times2\times3\times3\times3}{19\times19\times19}\right) = \left(\frac{-6}{19}\right)^3$

(h)

5	125
5	25
5	5
	1

13	2197
13	169
13	13
	1

$\therefore \quad \dfrac{-125}{2197} = -\left(\dfrac{5\times5\times5}{13\times13\times13}\right) = \left(\dfrac{-5}{13}\right)^3$

3. (a) $8^{2/3} = (2^3)^{2/3} = 2^{3\times\frac{2}{3}} = 2^2 = 4$

(b) $(169)^{3/2} = (13^2)^{3/2} = 13^{2\times\frac{3}{2}} = 13^3 = 2197$

(c) $(729)^{-5/6} = \dfrac{1}{(729)^{5/6}} = \dfrac{1}{\left(3^6\right)^{5/6}}$

$= \dfrac{1}{3^{6\times\frac{5}{6}}} = \dfrac{1}{3^5} = \dfrac{1}{243}$

(d) $(343)^{-2/3} = \dfrac{1}{(343)^{2/3}} = \dfrac{1}{(7^3)^{2/3}}$

$= \dfrac{1}{7^{3\times\frac{2}{3}}} = \dfrac{1}{7^2} = \dfrac{1}{49}$

(e) $\left(\dfrac{343}{125}\right)^{-2/3} = \left(\dfrac{125}{343}\right)^{2/3} = \left(\dfrac{5^3}{7^3}\right)^{2/3}$

$= \left(\dfrac{5}{7}\right)^{3\times\frac{2}{3}} = \left(\dfrac{5}{7}\right)^2 = \dfrac{25}{49}$

(f) $\left(\dfrac{25}{81}\right)^{-3/2} = \left(\dfrac{81}{25}\right)^{3/2} = \left(\dfrac{9}{5}\right)^{2\times\frac{3}{2}}$

$= \left(\dfrac{9}{5}\right)^3 = \dfrac{729}{125}$

(g) $\left(\dfrac{9}{16}\right)^{-3/2} = \left(\dfrac{16}{9}\right)^{3/2} = \left(\dfrac{4}{3}\right)^{2\times\frac{3}{2}} = \left(\dfrac{4}{3}\right)^3 = \dfrac{64}{27}$

(h) $\left(\dfrac{125}{216}\right)^{-2/3} = \left(\dfrac{216}{125}\right)^{2/3} = \left(\dfrac{6}{5}\right)^{3\times\frac{2}{3}} = \dfrac{36}{25}$

4. (a) $7^5 \times 7^3 \div 7^{-4} = 7^{5+3-(-4)} = 7^{8+4} = 7^{12}$

(b) $6^{11} \times 6^3 \times 6^{-5} = 6^{11+3-5} = 6^9$

(c) $(-4)^{-2} \times (5)^{-3} \times (5)^{-4} = (-4)^{-2} \times 5^{-3-4}$

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

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

(d) $(3^{-2})^6 \times 3^0 \div 5^{-1} = 3^{-12} \times 1 \div 5^{-1}$

$= \dfrac{3^{-12}}{5^{-1}} = \dfrac{5}{3^{12}}$

(e) $3^{-2} \times \left(\dfrac{4}{9}\right)^0 \times 4^6 = \dfrac{1}{3^2} \times 1 \times 4^6 = \dfrac{4^6}{3^2}$

(f) $(\sqrt{5})^4 \times (\sqrt{5})^3 \div (\sqrt{5})^7 = (\sqrt{5})^{4+3-7}$

$= (\sqrt{5})^0 = 1$

(g) $(\sqrt{5})^2 \times (\sqrt{5})^7 \times \left(\dfrac{3}{4}\right)^0 \times 3^{-2}$

$= (\sqrt{5})^{2+7} \times 1 \times \dfrac{1}{3^2}$

$= (\sqrt{5})^9 \times \dfrac{1}{3^2} = \dfrac{5^{9/2}}{3^2}$

(h) $(\sqrt{13})^6 \times (\sqrt{13})^8 \div (\sqrt{13})^{-4} = (\sqrt{13})^{6+8-(-4)}$

$= (\sqrt{13})^{14+4}$

$= \sqrt{13^{18}} = (13)^{18/2}$

$= (13)^9$

5. (a) $(3^0 + 4^{-1}) \times 2^2 = \left(1 + \dfrac{1}{4}\right) \times 4 = \left(\dfrac{4+1}{4}\right) \times 4 = 5$

(b) $(2^{-1} \times 4^{-1}) \div 2^{-4} = \left(\dfrac{1}{2} \times \dfrac{1}{4}\right) \div \dfrac{1}{2^4}$

$= \dfrac{1}{8} \times 2^4 = \dfrac{16}{8} = 2$

(c) $\left(\dfrac{1}{2}\right)^{-2} + \left(\dfrac{1}{4}\right)^{-2} + \left(\dfrac{1}{5}\right)^{-2} = 2^2 + 4^2 + 5^2$

$= 4 + 16 + 25 = 45$

(d) $\left\{\left(\dfrac{1}{3}\right)^{-2} - \left(\dfrac{1}{2}\right)^{-3}\right\} \div \left(\dfrac{1}{4}\right)^{-2} = (3^2 - 2^3) \div 4^2$

$= (9-8) \times \dfrac{1}{16} = \dfrac{1}{16}$

(e) $(3^{-1} + 4^{-1} + 8^{-1})^0 = \left(\dfrac{1}{3} + \dfrac{1}{4} + \dfrac{1}{8}\right)^0 = 1$

(f) $(4^0 + 5^0) \times (4^0 - 5^0) = (1+1) \times (1-1)$

$= 2 \times 0 = 0$

(g) $\dfrac{8^{-1} \times 5^3}{2^{-5}} = \dfrac{2^5 \times 5^3}{8} = \dfrac{32 \times 5^3}{8}$

$= 4 \times 5^3 = 4 \times 125 = 500$

(h) $(3^2)^3 \times \left(\dfrac{2}{3}\right)^0 \times \left(\dfrac{1}{6}\right)^0 \times 3^{-2} = 3^6 \times 1 \times 1 \times \dfrac{1}{3^2}$

$= 3^{6-2} = 3^4$

6. (a) $(-3)^{m+1} \times (-3)^5 = (-3)^7$

$(-3)^{m+1+5} = (-3)^7$

$(-3)^{m+6} = (-3)^7$

On comparing

$$m+6=7$$
$$m=7-6=1$$
$$m=1$$

(b) $5^x=625=5^4$

On comparing

$\therefore \quad x=4$

(c) $(\sqrt{2})^{2x}=2^6$

$$(2^{1/2})^{2x}=2^6$$
$$2^x=2^6$$

On comparing

$\therefore \quad x=6$

(d) $6^{x-3}=1=6^0$

$\therefore \quad x-3=0$

$$x=3$$

(e) $(-5)^{2m+1}\times(-5)^3=(-5)^8$

$$(-5)^{2m+1+3}=(-5)^8$$
$$(-5)^{2m+4}=(-5)^8$$

$\therefore \quad 2m+4=8$

$$2m=8-4=4$$
$$m=\frac{4}{2}=2$$

(f) $\left(\frac{-11}{9}\right)^4\times\left(\frac{-11}{9}\right)^{3m-1}=\left(\frac{-11}{9}\right)^3$

$$\left(\frac{-11}{9}\right)^{4+3m-1}=\left(\frac{-11}{9}\right)^3$$
$$\left(\frac{-11}{9}\right)^{3m+3}=\left(\frac{-11}{9}\right)^3$$

$\therefore \quad 3m+3=3$

$$3m=0$$
$$m=0$$

➲ EXERCISE 14.2

1. Given in answersheet.

2. Given in answersheet.

3. (a) $4\times9^{1/2}\times27^{1/3}=4\times3^{2\times\frac{1}{2}}\times3^{3\times\frac{1}{3}}$

$$=4\times3\times3=36$$

(b) $4^{1/3}\times(64)^{1/2}\times4^{2/3}=4^{1/3}\times(4^3)^{1/2}\times4^{2/3}$

$$=4^{\frac{1}{3}+\frac{3}{2}+\frac{2}{3}}=4^{1+\frac{3}{2}}$$
$$=4^{5/2}=2^{2\times\frac{5}{2}}=2^5=32$$

(c) $(125)^{-2/3}\times(64)^{4/3}=\frac{(4^3)^{4/3}}{(5^3)^{2/3}}$

$$=\frac{4^{3\times\frac{4}{3}}}{5^{3\times\frac{2}{3}}}=\frac{4^4}{5^2}=\frac{256}{25}$$

(d) $6\times(36)^{-1/2}\times(36)^{3/2}=6\times\frac{1}{(6^2)^{1/2}}\times(6^2)^{3/2}$

$$=6\times\frac{1}{6}\times6^3=216$$

(e) $(125)^{1/3}\times(125)^{2/3}\times(125)^{-4/3}$

$$=(5^3)^{\frac{1}{3}}\times(5^3)^{\frac{2}{3}}\times\frac{1}{(5^3)^{4/3}}$$
$$=5\times5^2\times\frac{1}{5^4}=\frac{1}{5}$$

(f) $(27)^{2/3}\times(27)^{1/3}\times(27)^{-4/3}$

$$=(3^3)^{\frac{2}{3}}\times(3^3)^{\frac{1}{3}}\times\frac{1}{(3^3)^{4/3}}$$
$$=3^2\times3\times\frac{1}{3^4}=\frac{1}{3}$$

4. (a) $\sqrt{\frac{49}{64}}\times3\sqrt{\frac{512}{343}}=\left[\left(\frac{7}{8}\right)^2\right]^{\frac{1}{2}}\times\left[\left(\frac{8}{7}\right)^3\right]^{\frac{1}{3}}$

$$=\frac{7}{8}\times\frac{8}{7}=1$$

(b) $\sqrt[5]{\frac{2}{5}}\times\sqrt[5]{\frac{16}{514}}=\left(\frac{2}{5}\times\frac{16}{625}\right)^{1/5}=\left(\frac{2^5}{5^5}\right)^{\frac{1}{5}}=\frac{2}{5}$

(c) $\sqrt{\frac{16}{81}}\times\sqrt[5]{\frac{243}{32}}=\left(\frac{16}{81}\right)^{1/2}\times\left(\frac{243}{32}\right)^{1/5}$

$$=\left(\frac{4}{9}\right)^{2\times\frac{1}{2}}\times\left(\frac{3}{2}\right)^{5\times\frac{1}{5}}$$
$$=\frac{4}{9}\times\frac{3}{2}=\frac{2}{3}$$

(d) $\sqrt{\frac{196}{81}}\times\sqrt[5]{\frac{243}{32}}=\left(\frac{196}{81}\right)^{1/2}\times\left(\frac{243}{32}\right)^{1/5}$

$$=\left(\frac{14}{9}\right)^{2\times\frac{1}{2}}\times\left(\frac{3}{2}\right)^{5\times\frac{1}{5}}$$
$$=\frac{14}{9}\times\frac{3}{2}=\frac{7}{3}$$

(e) $\sqrt[5]{\frac{1}{100000}} \times \sqrt[3]{\frac{125}{216}} = \left(\frac{1}{10^5}\right)^{1/5} \times \left\{\left(\frac{5}{6}\right)^3\right\}^{1/3}$

$= \frac{1}{10} \times \frac{5}{6} = \frac{1}{12}$

(f) $\sqrt[3]{\frac{243}{3125}} \times \sqrt[3]{\frac{125}{27}} = \left(\frac{3}{5}\right)^{5\times\frac{1}{5}} \times \left(\frac{5}{3}\right)^{3\times\frac{1}{3}}$

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

5. (a) $(5^2 + 12^2)^{3/2} = (25 + 144)^{3/2}$

$= (169)^{3/2} = (13)^{2\times\frac{3}{2}} = 2197$

(b) $(1^3 + 2^3 + 3^3)^{-5/2} = (1 + 8 + 27)^{-5/2}$

$= (36)^{-5/2} = \frac{1}{(36)^{5/2}}$

$= \frac{1}{6^{2\times\frac{5}{2}}} = \frac{1}{6^5}$

(c) $(3^2 + 4^2)^{1/2} = (9 + 16)^{1/2}$

$= (25)^{1/2} = 5^{2\times\frac{1}{2}} = 5$

(d) $(1^3 + 2^3 + 3^3 + 4^3)^{-3/2} = (1 + 8 + 27 + 64)^{-3/2}$

$= (100)^{-3/2} = \frac{1}{(10^2)^{\frac{3}{2}}}$

$= \frac{1}{10^3} = \frac{1}{1000}$

(e) $(10^2 - 8^2)^{1/2} = (100 - 64)^{1/2}$

$= (36)^{1/2} = 6^{2\times\frac{1}{2}} = 6$

(f) $(17^2 - 8^2)^{1/2} = (289 - 64)^{1/2}$

$= (225)^{1/2} = 15^{2\times\frac{1}{2}} = 15$

6. (a) $(0.125)^{2/3} = (0.5)^{3\times\frac{2}{3}} = (0.5)^2 = 0.25$

(b) $(0.008)^{-2/3} = \frac{1}{(0.2)^{3\times\frac{2}{3}}} = \frac{1}{(0.2)^2} = \frac{1}{0.04}$

(c) $(0.01024)^{3/5} = (0.4)^{5\times\frac{3}{5}} = (0.4)^3 = 0.064$

(d) $(0.00064)^{-2/5} = \frac{1}{(0.2)^{5\times\frac{2}{5}}} = \frac{1}{(0.2)^2} = \frac{1}{0.04}$

7. (a) $3x^{5/6} \times 7x^{-7/3} = 21 \times x^{\frac{5}{6}-\frac{7}{3}} = 21x^{\frac{5-14}{6}}$

$= 21x^{-9/6} = 21x^{-3/2}$

(b) $(y^{-4})^3 \times (x^{-1/4})^{12} = y^{-12} \times x^{-3}$

$= x^{-3}\ y^{-12}$

(c) $\left\{4\sqrt{\left(\frac{x}{y}\right)^{-16}}\right\}^{1/4} = \left\{\left(\frac{x}{y}\right)^{-16\times\frac{1}{4}}\right\}^{\frac{1}{4}} = \left(\frac{y}{x}\right)^{4\times\frac{1}{4}} = \frac{y}{x}$

(d) $\left\{\sqrt[3]{\left(\frac{m}{n}\right)^9}\right\}^{-12} = \left\{\left(\frac{m}{n}\right)^{9\times\frac{1}{3}}\right\}^{-12} = \left\{\left(\frac{m}{n}\right)^3\right\}^{-12}$

$= \left(\frac{n}{m}\right)^{36}$

8. (a) $\frac{3^{-5} \times 5^{-2} \times 27^{2/3}}{6^2 \times (25)^{1/2} \times (49)^{-1/2}} = \frac{27^{2/3} \times 49^{1/2}}{3^5 \times 5^2 \times 6^2 \times 25^{1/2}}$

$= \frac{3^{3\times\frac{2}{3}} \times 7^{2\times\frac{1}{2}}}{3^5 \times 5^2 \times 6^2 \times 5^{2\times\frac{1}{2}}}$

$= \frac{3^2 \times 7}{3^5 \times 6^2 \times 5^{2+1}}$

$= \frac{7}{3^3 \times 6^2 \times 5^3}$

$= \frac{7}{3^3 \times (3\times 2)^2 \times 5^3}$

$= \frac{7}{3^3 \times 3^2 \times 2^2 \times 5^3}$

$= \frac{7}{3^5 \times 2^2 \times 5^3}$

(b) $\frac{(64)^{-1/6} \times (216)^{-1/3} \times (81)^{1/4}}{(512)^{-1/3} \times (16)^{1/4} \times (9)^{-1/2}}$

$= \frac{(2^6)^{-1/6} \times (6^3)^{-1/3} \times (3^4)^{1/4}}{(8^3)^{-1/3} \times (2^4)^{1/4} \times (3^2)^{-1/2}}$

$= \frac{2^{-1} \times 6^{-1} \times 3}{8^{-1} \times 2 \times 3^{-1}} = \frac{8 \times 3 \times 3}{2 \times 2 \times 6} = 3$

(c) $\sqrt[5]{x^{15}\ y^{10}} \div \sqrt[4]{x^8\ y^{-16}}$

$= (x^{15}\ y^{10})^{1/5} \div (x^8\ \ y^{-16})^{1/4}$

$= x^3 y^2 \div x^2 y^{-4}$

$= \frac{x^3 y^2}{x^2 y^{-4}} = xy^{2+4} = xy^6$

(d) $\sqrt[6]{x^{-3}y^6} \times \sqrt[3]{y^{-6}x^6} = (x^{-3}y^{6})^{1/6} \times (y^{-6}x^6)^{1/3}$

$= x^{-1/2}y \times y^{-2}x^2$

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

$= y^{-1}x^{3/2} = \dfrac{x^{3/2}}{y}$

➲ EXERCISE 14.3

1. Given in answersheet.

2. Given in answersheet.

3. Given in answersheet.

➲ HOTS

1. $\dfrac{5\times10^3\times4\times10^5}{2} = ?$

$\Rightarrow \quad 5\times10^3\times2\times10^5 = 10\times10^3\times10^5$

$= 10^{1+3+5} = 10^9$

2. $x = \left(\dfrac{-3}{7}\right)^{-5} \div \left(\dfrac{11}{14}\right)^0 = \left(\dfrac{-3}{7}\right)^{-5} \div 1 = \left(\dfrac{-3}{7}\right)^{-5}$

$x^{-2} = \left[\left(\dfrac{-3}{7}\right)^{-5}\right]^{-2} = \left(\dfrac{-3}{7}\right)^{10}$

3. $x^3 = \left(\dfrac{2}{11}\right)^{12} \div \left(\dfrac{2}{11}\right)^9 = \left(\dfrac{2}{11}\right)^{12-9} = \left(\dfrac{2}{11}\right)$

$x^3 = \left(\dfrac{2}{11}\right)^3 \quad \Rightarrow \quad x = \dfrac{2}{11}$

4. $\left(\dfrac{6}{7}\right)^2 \times \left(\dfrac{6}{7}\right)^{-5} \times \left(\dfrac{1}{2}\right)^{-3} \times \left(\dfrac{3}{5}\right)^{-3}$

$\left(\dfrac{6}{7}\right)^{2+(-5)} \times \left(\dfrac{1}{2}\right)^{-3} \times \left(\dfrac{3}{5}\right)^{-3}$

$= \left(\dfrac{6}{7}\right)^{-3} \times \left(\dfrac{1}{2}\right)^{-3} \times \left(\dfrac{3}{5}\right)^{-3}$

$= \dfrac{7\times7\times7\times2\times2\times2\times5\times5\times5}{6\times6\times6\times3\times3\times3}$

$= \left(\dfrac{35}{9}\right)^3$

5. $(18)^{10} = 4^5\, 3^x$

$3^x = \dfrac{18^{10}}{4^5}$

$= \dfrac{18\times18\times18\times18\times18\times18\times18\times18\times18\times18}{4\times4\times4\times4\times4}$

$= (9)^{10}$

$3^x = [(3)^2]^{10} \quad \Rightarrow \quad 3^x = 3^{20}$

$x = 20$

➲ NCERT CORNER

1. (i) $(3^0 + 4^{-1})\times2^2 = \left(1+\dfrac{1}{4}\right)\times2^2 = \left(\dfrac{5}{4}\right)\times4 = 5$

(ii) $(2^{-1}\times4^{-1})\div2^{-2} = [2^{-1}\times(2^2)^{-1}]\div2^{-2}$

$= \{2^{-1}\times2^{2\times(-1)}\}\div2^{-2}$

$= (2^{-1}\times2^{-2})\div2^{-2}$

$= 2^{(-1)+(-2)}\div2^{-2}$

$= 2^{-3}\div2^{-2} = \dfrac{2^{-3}}{2^{-2}}$

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

$= \dfrac{1}{2^1} = \dfrac{1}{2}$

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

$= \dfrac{1^{-2}}{2^{-2}} + \dfrac{1^{-2}}{3^{-2}} + \dfrac{1^{-2}}{4^{-2}}$

$= \dfrac{2^2}{1^2} + \dfrac{3^2}{1^2} + \dfrac{4^2}{1^2} = \dfrac{4}{1} + \dfrac{9}{1} + \dfrac{16}{1}$

$= 4+9+16 = 29$

2. (i) $\dfrac{25\times t^{-4}}{5^{-3}\times10\times t^{-8}} = \dfrac{25\times\frac{1}{t^4}}{\frac{1}{5^3}\times10\times\frac{1}{t^8}} = \dfrac{\frac{25}{t^4}}{\frac{1}{125}\times10\times\frac{1}{t^8}}$

$= \dfrac{\frac{25}{t^4}}{\frac{2}{25t^8}} = \dfrac{25}{t^4}\times\dfrac{25t^8}{2}$

$= \dfrac{625t^{8-4}}{2} = \dfrac{625}{2}t^4$

(ii) $\dfrac{3^{-5}\times10^{-5}\times125}{5^{-7}\times6^{-5}} = \dfrac{3^{-5}\times(2\times5)^{-5}\times(5\times5\times5)}{5^{-7}\times(2\times3)^{-5}}$

$= \dfrac{3^{-5}\times2^{-5}\times5^{-5}\times5^3}{5^{-7}\times2^{-5}\times3^{-5}}$

$= \dfrac{5^{-5}\times5^3}{5^{-7}}$

$= \dfrac{5^{(-5)+3}}{5^{-7}} = \dfrac{5^{-2}}{5^{-7}}$

$= 5^{(-2)-(-7)} = 5^{-2+7} = 5^5$

3. (i) $\frac{1}{1000000}\text{ m} = \frac{1}{10^6}\text{ m} = 1\times10^{-6}\text{ m}$

(ii) 0.000,000,000,000,000,000,16 Coulomb

$$= \frac{16}{10000000000000000000}$$

$$= \frac{16}{10^{20}} = \frac{1.6\times10}{10^{20}}$$

$$= \frac{1.6\times10^{1}}{10^{20}} = \frac{1.6}{10^{20-1}}$$

$$= \frac{1.6}{10^{19}} = 1.6\times10^{-19}\text{ Coulomb}$$

(iii) $0.0000005\text{ m} = \frac{5}{10000000} = \frac{5}{10^7} = 5\times10^{-7}\text{ mm}$

(iv) $0.00001275 = \frac{1275}{100000000} = \frac{1275}{10^8} = \frac{1.275}{10^5}$

$$= 1.275\times10^{-5}\text{ mm}$$

(v) $0.07\text{ mm} = \frac{7}{100} = \frac{7}{10^2} = 7\times10^{-2}\text{ mm}$

4. Thickness of 1 book = 20 mm

Thickness of 5 books $= 5\times20 = 100$ mm

Thickness of 1 paper sheet = 0.016 mm

Thickness of 5 paper sheets $= 5\times0.016 = 0.080$ m

Total thickness of the stack $= 100\text{ mm} + 0.080\text{ m}$

$$= 100.08\text{ mm}$$

$$= 1.0008\times10^{2}\text{ mm}$$

15 Direct and Inverse Proportions

➲ EXERCISE 15.1

1. Let cost of 25 pens be ₹ x

Number of pens	18	25
Cost (in ₹)	423	x

It is a direct variation,

So $\frac{18}{423} = \frac{25}{x}$

$\Rightarrow 18\times x = 423\times25$

$\Rightarrow x = \frac{423\times25}{18}$

$\Rightarrow x = ₹\,587.50$

2. Let distance travelled in 28 l be x km

Distance	432	x
Petrol	48	28

It is a direct variation

So, $\frac{432}{48} = \frac{x}{28}$

$\Rightarrow x\times48 = 432\times28$

$\Rightarrow x = \frac{432\times28}{48}$

$\Rightarrow x = 252\text{ km}$

3. Let cost of 19 kg sugar be ₹ x

Sugar (kg)	24	19
Cost (₹)	624	x

It is a direct variation,

So, $\frac{24}{624} = \frac{19}{x}$

$\Rightarrow x\times24 = 19\times624$

$\Rightarrow x = \frac{19\times624}{24}$

$\Rightarrow x = ₹\,494$

4. Let quantity of rice be x kg

Rice (kg)	9	x
Cost (₹)	166.50	425.50

It is a direct variation

So $\frac{9}{166.50} = \frac{x}{425.50}$

$\Rightarrow x\times166.50 = 9\times425.50$

$\Rightarrow x = \frac{9\times425.50}{166.50}$

$\Rightarrow x = 23\text{ kg}$

5. Let number of soap bars be x

Soap bars	**5**	$\boldsymbol{x}$
Cost (₹)	**42**	**226.80**

It is a direct variation,

$\frac{5}{42} = \frac{x}{226.80}$

$\Rightarrow 42\times x = 5\times226.80$

$\Rightarrow x = \frac{5\times226.80}{42}$

$\Rightarrow x = 27$

6. Let thickness of sheets be x cm

Sheets	**500**	**325**
Thickness	**3.5**	$\boldsymbol{x}$

It is a direct variation

So $\frac{500}{3.5} = \frac{325}{x}$

$\Rightarrow x\times500 = 325\times3.5$

$\Rightarrow x = \frac{325\times3.5}{500}$

$x = 2.275$ cm

7. Let required cartoons be x

Cakes	1152	5040
Cartoons	8	x

It is a direct variation,

So $\frac{1152}{8}=\frac{5040}{x}$

$\Rightarrow x\times 1152=5040\times 8$

$\Rightarrow x=\frac{5040\times 8}{1152}$

$\Rightarrow x=35$

8. Let length of rod be x m

Length (m)	22.5	x
Weight (kg)	78.75	56

It is a direct variation

So, $\frac{22.5}{78.75}=\frac{x}{56}$

$\Rightarrow x\times 78.75=56\times 22.5$

$\Rightarrow x=\frac{56\times 22.5}{78.75}$

$\Rightarrow x=16$ m

9. Let height of pole be x m

Building (m)	16	x
Shadow (m)	10.5	15

It is a direct variation

So, $\frac{16}{10.5}=\frac{x}{15}$

$\Rightarrow 10.5\times x=16\times 15$

$\Rightarrow x=\frac{16\times 15}{10.5}$

$\Rightarrow x=22.86$ m

10. Let length of the shadow be x m

Height of pole	20	32
Length of shadow	16	x

It is a direct variation

So, $\frac{20}{16}=\frac{32}{x}$

$\Rightarrow 20\times x=32\times 16$

$\Rightarrow x=\frac{32\times 16}{20}$

$\Rightarrow x=25.60$ m

11. Let distance covered be x km

Distance	80	x
Time (min)	60	25

It is a direct variation

So $\frac{80}{60}=\frac{x}{25}$

$\Rightarrow 60\times x=80\times 25$

$\Rightarrow x=80\times\frac{25}{60}$

$x=33.333$ km

12. Let required time be x min

Distance (km)	50	80
Time (min)	60	x

It is a direction variation,

So, $\frac{50}{60}=\frac{80}{x}$

$\Rightarrow 50\times x=80\times 60$

$\Rightarrow x=\frac{80\times 60}{50}$

$x=96$ min

$=1\frac{3}{5}$ hr

13. Let required distance be x cm

Distance on road (km)	18	90
Distance on map (cm)	1	x

It is a direct variation

So, $\frac{18}{1}=\frac{90}{x}$

$\Rightarrow 18\times x=90$

$x=\frac{90}{18}$

$x=5$ cm

14. Let actual distance be x km

Actual distance (cm)	2000000	x
Distance on map (cm)	1	15

It is a direct variation

So, $\frac{2000000}{1}=\frac{x}{15}$

$x=2000000\times 15$ cm

$=\frac{2000000\times 15}{100000}$ km

$=300$ km

EXERCISE 15.2

1. Let required men be x

Men	14	x
Days	48	21

It is an indirect variation

So, $14\times 48=x\times 21$

$\Rightarrow \quad x = \dfrac{14 \times 48}{21}$

$x = 32$

2. Let required days be x

Men	42	56
Days	16	x

It is an indirect variation

So, $42 \times 16 = 56 \times x$

$\Rightarrow \quad x = \dfrac{42 \times 16}{56}$

$x = 12$

3. Let required days be x

Men	24	27
Days	9	x

It is an indirect variation

So, $24 \times 9 = 27 \times x$

$\Rightarrow \quad x = \dfrac{24 \times 9}{27}$

$x = 8$

4. Let number of horses be x

Horses	18	x
Days	32	36

It is an indirect variation

So, $18 \times 32 = x \times 36$

$\Rightarrow \quad x = \dfrac{18 \times 32}{36}$

$x = 16$

5. Let each get x sweets

Children	28	24
Sweets	6	x

It is an indirect variation

So $28 \times 6 = 24 \times x$

$\Rightarrow \quad x = \dfrac{28 \times 6}{24}$

$x = 7$

6. Let required boxes be x

Boxes	25	x
Bottles	12	20

It is an indirect variation

So, $25 \times 12 = x \times 20$

$\Rightarrow \quad x = \dfrac{25 \times 12}{20}$

$\Rightarrow \quad x = 15$

7. Let number of machines be x

Machines	42	x
Days	63	54

It is an indirect variation

So, $42 \times 63 = x \times 54$

$\Rightarrow \quad x = \dfrac{42 \times 63}{54}$

$x = 49$

8. Let required time be x hrs.

Speed	60	40
Time	2	x

It is an indirect variation

So, $60 \times 2 = 40 \times x$

$\Rightarrow \quad x = \dfrac{60 \times 2}{40}$

$\Rightarrow \quad x = 3$ hrs.

9. Let required workers be x

Days	48	36
Workers	60	x

It is an indirect variation,

So, $48 \times 60 = 36 \times x$

$\Rightarrow \quad x = \dfrac{48 \times 60}{36}$

$x = 80$

So, $80 - 60 = 20$ more workers are required.

10. Let time of each period be x minutes

Periods	8	10
Time	50	x

It is an indirect variation

So, $8 \times 50 = 10 \times x$

$\Rightarrow \quad x = \dfrac{8 \times 50}{10}$

$\Rightarrow \quad x = 40$ minutes

11. Let days be x

Soldiers	80	120
Days	60	x

It is an indirect variation

So, $80 \times 60 = 120 \times x$

$\Rightarrow \quad x = \dfrac{80 \times 60}{120}$

$x = 40$

12. Let days be x

Soldiers	120	160
Days	24	x

It is an indirect variation

So, $120 \times 24 = 160 \times x$

$\Rightarrow \quad x = \dfrac{120 \times 24}{160}$

$\Rightarrow \quad x = 18$

➲ HOTS

1. $\dfrac{117}{13} = \dfrac{225}{x}$

$$x = \frac{225 \times 13}{117} = 25 \text{ men}$$

2. $y \propto x^2$

$$y = kx^2$$

$$k = \frac{x^2}{y}$$

$y = 8, \quad x = 4, \quad y = ?, \quad x = 5$

$$\frac{4^2}{8} = \frac{5^2}{y}$$

$$y = \frac{25 \times 8}{16} = 12.5$$

3. $32 \times 5 = 25 \times x$

$\Rightarrow \quad x = \dfrac{32 \times 5}{25} = 6.4$ days

4. $u \propto \dfrac{1}{w}, \quad u = \dfrac{k}{w}, \quad k = uw$

$u = 11, \quad w = 5, \quad u = ?, \quad w = 110$

$uw =$ constant

$11 \times 5 = u \times 110$

$$u = \frac{11 \times 5}{110} = \frac{1}{2}$$

➲ NCERT CORNER

1. Let the required length of the model of the ship be x cm.

We form a table as shown below :

Length of the ship	Height of the most
28	12
x	9

$\because$ More the length of the ship, more would be the height of its most.

$\therefore$ This is a case of direct proportion

$$\frac{x_1}{y_1} = \frac{x_2}{y_2} \quad \Rightarrow \quad \frac{28}{12} = \frac{x}{9}$$

$$\Rightarrow \quad x = \frac{28 \times 9}{12} = 21$$

Hence, the length of the model ship is 21 m.

2. Let the distance covered in the map be x cm.

We form a table as shown below :

Actual distance covered on the rood (in km)	18	72
Distance represented on the map (in cm)	1	x

This is a case of direct proportion.

$\therefore \quad \dfrac{18}{72} = \dfrac{1}{x}$

$$\Rightarrow \quad x = \frac{1 \times 72}{18} = 1 \times 4 = 4$$

Hence, the distance covered in the map would be 4 cm.

3. Let the required distance to be travelled in 5 hours be x km (5 hours = 300 minutes).

We form a table as shown below :

Distance (in km)	14	x
Time (in minutes)	25	300

This is a case of direct proportion.

$\therefore \quad \dfrac{14}{x} = \dfrac{25}{300}$

$$\Rightarrow \quad x = \frac{14 \times 300}{25} = 14 \times 12 = 168 \text{ km}$$

Hence, it can travel 168 km in 5 hours.

4. Suppose, they take x days to complete the job.

We form a table as shown below :

Number of persons	3	4
Number of days	4	x

More is the number of persons, less is the time to complete the job. Therefore, it is a case of inverse proportion.

$\therefore \quad 3 \times 4 = 4 \times x$

$$\Rightarrow \quad x = \frac{3 \times 4}{4} = 3$$

Hence, they would take 3 days to complete the job.

5. (i) Let the job would take x days.

We form a table as shown below :

Number of persons	2	$2 - 1 = 1$
Number of days	3	x

Lesser the number of person, more will be the number of days to complete the job. Therefore, it is a case of inverse proportion.

$\therefore \quad 2 \times 3 = 1 \times x$

$\Rightarrow \quad x = \frac{2 \times 3}{1} = 6$

Hence, the job would now take 6 days by 1 person.

(ii) Let x persons be needed.

We form a table as shown below :

Number of persons	2	x
Number of days	3	1

More the number of persons, lesser would be number of days to do the job. Therefore, it is a case of inverse proportion.

$\therefore \quad 2 \times 3 = 1 \times x$

$\Rightarrow \quad x = \frac{2 \times 3}{1} = 6$

Hence, 6 persons would be needed to complete the job in 1 day.

16 Factorization

➲ EXERCISE 16.1

1. Given in answer sheet.

2. (a) $15ab^2 - 25b^2c = 5b^2\ (3a - 5c)$

(b) $24a^4b + 15ab^3 = 3ab\ (8a^3 + 5b^2)$

(c) $40p^2qr^2 - 50pq^2r = 10pqr\ (4pr - 5q)$

(d) $63ab^3c - 99a^2c^2 = 9ac\ (7b^3 - 11ac)$

(e) $20l^2m + 30lm - 10mn = 10m\ (2l^2 + 3l - n)$

(f) $-4a^2b - 2b^2c - 20a^3b = -2b\ (2a^2 + bc + 10a^3)$

(g) $14a^2bc - 21b^3c^2 + 28ab^2$

$= 7b\ (2a^2c - 3b^2c^2 + 4ab)$

(h) $3xy^2 + 9x^2y - 12x^2y^2 = 3xy\ (y + 3x - 4xy)$

(i) $-15 + 25t^3 - 30t^2 = 5\ (-3 + 5t^3 - 6t^2)$

(j) $8x^2 - 72xy + 18xy^2 = 2x\ (4x - 36y + 9y^2)$

(k) $a^3bc - 6ab^2 + 30b^2a^2 = ab\ (a^2c - 6b + 30ba)$

(l) $-10a^3b + 40b^2 + 25a^2b^2$

$= 5b\ (-2a^3 + 8b + 5a^2b)$

3. (a) $x^2\ (x - y) + y^2\ (x - y)$

$= (x - y)\ (x^2 + y^2)$

(b) $(x + 5)^2 - 5x - 25 = (x + 5)^2 - 5\ (x + 5)$

$= (x + 5)\ (x + 5 - 5) = (x + 5)\ x$

(c) $a\ (b - 5) - c\ (b - 5) = (b - 5)\ (a - c)$

(d) $x^2\ (2a - 3b) + 1\ (2a - 3b)$

$= (2a - 3b)\ (x^2 + 1)$

(e) $x\ (x + y) + 6x + 6y = x\ (x + y) + 6\ (x + y)$

$= (x + y)\ (x + 6)$

(f) $-5\ (x - 3y)^2 + 7\ (3y - x)$

$= -5\ (x - 3y)^2 - 7\ (x - 3y)$

$= (x - 3y)\ \{-5\ (x - 3y) - 7\}$

$= (x - 3y)\ (-5x + 15y - 7)$

$= -\ (x - 3y)\ (5x - 15y + 7)$

(g) $15pq + 15 + 9q + 25p = (15pq + 9q) + (25p + 15)$

$= 3q\ (5p + 3) + 5\ (5p + 3)$

$= (5p + 3)\ (3q + 5)$

(h) $7p^2 + 7q^2 + ap^2 + aq^2$

$= 7\ (p^2 + q^2) + a\ (p^2 + q^2)$

$= (p^2 + q^2)\ (7 + a)$

(i) $6ab - b^2 + 12ac - 2bc = b\ (6a - b) + 2c\ (6a - b)$

$= (6a - b)\ (b + 2c)$

(j) $x^2 - xy + xz - yz = x\ (x - y) + z\ (x - y)$

$= (x - y)\ (x + z)$

(k) $z - 7 + 7xy - xyz = 1\ (z - 7) - xy\ (z - 7)$

$= (z - 7)\ (1 - xy)$

(l) $ar^2 - br^2 + 7a - 7b = r^2\ (a - b) + 7\ (a - b)$

$= (a - b)\ (r^2 + 7)$

4. (a) $m^2 + 6m + 9 = m^2 + 2 \times m \times 3 + 3^2 = (m + 3)^2$

(b) $25m^2 + 30m + 9 = (5m)^2 + 2 \times 5m \times 3 + 3^2$

$= (5m + 3)^2$

(c) $x^2 - 20x + 100 = x^2 - 2 \times x \times 10 + 10^2$

$= (x - 10)^2$

(d) $p^2 - 10p + 25 = p^2 - 2 \times p \times 5 + 5^2 = (p - 5)^2$

(e) $p^2q^2 - 6pqr + 9r^2$

$= (pq)^2 - 2 \times pq \times 3r + (3r)^2$

$= (pq - 3r)^2$

(f) $m^2 - 4mn + 4n^2 = m^2 - 2 \times m \times 2n + (2n)^2$

$= (m - 2n)^2$

(g) $49y^2 + 84yz + 36z^2$

$= (7y)^2 + 2 \times 7y \times 6z + (6z)^2$

$= (7y + 6z)^2$

(h) $64 - 16y + y^2 = 8^2 - 2 \times 8 \times y + y^2 = (8 - y)^2$

(i) $2m^2 + 12m + 18 = 2\ (m^2 + 6m + 9)$

$= 2\ (m^2 + 2 \times m \times 3 + 3^2)$

$= 2\ (m + 3)^2$

(j) $16x^2 + 40x + 25 = (4x)^2 + 2 \times 4x \times 5 + 5^2$

$= (4x + 5)^2$

(k) $49a^4 - 112a^2b^2 + 64b^4$

$= (7a^2)^2 - 2 \times 7a^2 \times 8b^2 + (8b^2)^2$

$= (7a^2 - 8b^2)^2$

(l) $49m^2n^2 - 112mnp + 64p^2$

$= (7mn)^2 - 2 \times 7mn \times 8p + (8p)^2$

$= (7mn - 8p)^2$

5. (a) $m^2 - 25 = m^2 - 5^2 = (m - 5)(m + 5)$

(b) $m^4 - 256 = (m^2)^2 - 16^2$

$= (m^2 - 16)(m^2 + 16)$

$= (m^2 - 4^2)(m^2 + 16)$

$= (m - 4)(m + 4)(m^2 + 16)$

(c) $16x^2 - 49 = (4x)^2 - 7^2 = (4x - 7)(4x + 7)$

(d) $144m^2 - 289n^2 = (12m)^2 - (17n)^2$

$= (12m - 17n)(12m + 17n)$

(e) $16x^5 - 144x^3 = 16x^3 (x^2 - 9)$

$= 16x^3 (x^2 - 3^2)$

$= 16x^3 (x - 3)(x + 3)$

(f) $0.09a^2 - 0.25b^2 = (0.3a)^2 - (0.5b)^2$

$= (0.3a - 0.5b)(0.3a + 0.5b)$

(g) $(l + m)^2 - (l - m)^2$

$= (l + m - l + m)(l + m + l - m)$

$= 2m \times 2l$

$= 4ml$

(h) $y^2 - \frac{49}{64} = y^2 - \left(\frac{7}{8}\right)^2 = \left(y - \frac{7}{8}\right)\left(y + \frac{7}{8}\right)$

(i) $25a^2 - 4b^2 + 28bc - 49c^2$

$= (5a)^2 - [4b^2 - 28bc + 49c^2]$

$= (5a)^2 - [(2b)^2 - 2 \times 2b \times 7c + (7c)^2]$

$= (5a)^2 - (2b - 7c)^2$

$= (5a - 2b + 7c)(5a + 2b - 7c)$

(j) $36 - a^2 - b^2 - 2ab = 6^2 - (a^2 + b^2 + 2ab)$

$= 6^2 - (a + b)^2$

$= (6 - a - b)(6 + a + b)$

(k) $49 - x^2 + 8xy - 16y^2 = 49 - (x^2 - 8xy + 16y^2)$

$= 7^2 - (x - 4y)^2$

$= (7 - x + 4y)(7 + x - 4y)$

(l) $25a^2 + 10ac + c^2 - 49b^2$

$= (5a)^2 + 2 \times 5a \times c + c^2 - (7b)^2$

$= (5a + c)^2 - (7b)^2$

$= (5a + c - 7b)(5a + c + 7b)$

6. (a) $(a + b)^2 - 4ab = a^2 + 2ab + b^2 - 4ab$

$= a^2 - 2ab + b^2$

$= (a - b)^2$

(b) $(m - 2n)^2 + 8mn = m^2 - 4mn + 4n^2 + 8mn$

$= m^2 + 4mn + 4n^2$

$= (m + 2n)^2$

(c) $(a^2 + b^2)^2 - 4a^2b^2$

$= a^4 + 2a^2b^2 + b^4 - 4a^2b^2$

$= a^4 - 2a^2b^2 + b^4$

$= (a^2 - b^2)^2$

(d) $x^4 - \{(y + z)^2\}^2$

$= (x^2)^2 - \{(y + z)^2\}^2$

$= \{x^2 - (y + z)^2\}\{x^2 + (y + z)^2\}$

$= (x - y - z)(x + y + z)\{x^2 + (y + z)^2\}$

(e) $(a^2 - b^2)^2 + 4a^2b^2$

$= a^4 - 2a^2b^2 + b^4 + 4a^2b^2$

$= a^4 + 2a^2b^2 + b^4$

$= (a^2 + b^2)^2$

(f) $(x - z)^4 - x^4$

$= \{(x - z)^2\}^2 - (x^2)^2$

$= \{(x - 2)^2 - x^2\}\{(x - z)^2 + x^2\}$

$= (x - z - x)(x - z + x)\{(x - z)^2 + x^2\}$

$= -z(2x - z)\{(x - z)^2 + x^2\}$

(g) $(mx + ny)^2 + (nx - my)^2$

$= m^2x^2 + 2mnxy + n^2y^2$

$+ n^2x^2 - 2mnxy + m^2y^2$

$= (m^2x^2 + n^2x^2) + (m^2y^2 + n^2y^2)$

$= x^2 (m^2 + n^2) + y^2 (m^2 + n^2)$

$= (m^2 + n^2)(x^2 + y^2)$

(h) $(ax + by)^2 - (bx + ay)^2$

$= a^2x^2 + 2abxy + b^2y^2 - b^2x^2$

$-2abxy - a^2y^2$

$= (a^2x^2 - b^2x^2) - (a^2y^2 - b^2y^2)$

$= x^2 (a^2 - b^2) - y^2 (a^2 - b^2)$

$= (a^2 - b^2)(x^2 - y^2)$

➲ EXERCISE 16.2

1. $x^2 + 5x + 6 = x^2 + (3+2)x + 6$

$= x^2 + 3x + 2x + 6$

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

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

2. $m^2 + 18m + 17 = m^2 + (17+1)m + 17$

$= m^2 + 17m + m + 17$

$= m(m+17) + 1(m+17)$

$= (m+17)(m+1)$

3. $x^2 + 10x + 9 = x^2 + (9+1)x + 9$

$= x^2 + 9x + x + 9$

$= x(x+9) + 1(x+9)$

$= (x+9)(x+1)$

4. $y^2 + 9y + 18 = y^2 + (6+3)y + 18$

$= y^2 + 6y + 3y + 18$

$= y(y+6) + 3(y+6)$

$= (y+6)(y+3)$

5. $p^2 + 9p + 20 = p^2 + (5+4)p + 20$

$= p^2 + 5p + 4p + 20$

$= p(p+5) + 4(p+5)$

$= (p+5)(p+4)$

6. $y^2 - 7y + 12 = y^2 - (4+3)y + 12$

$= y^2 - 4y - 3y + 12$

$= y(y-4) - 3(y-4)$

$= (y-4)(y-3)$

7. $x^2 - 5x + 6 = x^2 - (3+2)x + 6$

$= x^2 - 3x - 2x + 6$

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

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

8. $m^2 - 8m + 15 = m^2 - (5+3)m + 15$

$= m^2 - 5m - 3m + 15$

$= m(m-5) - 3(m-5)$

$= (m-5)(m-3)$

9. $y^2 - 8y - 65 = y^2 - (13-5)y - 65$

$= y^2 - 13y + 5y - 65$

$= y(y-13) + 5(y-13)$

$= (y-13)(y+5)$

10. $a^2 + a - 56 = a^2 + (8-7)a - 56$

$= a^2 + 8a - 7a - 56$

$= a(a+8) - 7(a+8)$

$= (a+8)(a-7)$

11. $x^2 + 19x - 150 = x^2 + (25-6)x - 150$

$= x^2 + 25x - 6x - 150$

$= x(x+25) - 6(x+25)$

$= (x+25)(x-6)$

12. $x^2 - 21x + 68 = x^2 - (17+4)x + 68$

$= x^2 - 17x - 4x + 68$

$= x(x-17) - 4(x-17)$

$= (x-17)(x-4)$

13. $y^2 - 6y - 7 = y^2 - (7-1)y - 7$

$= y^2 - 7y + y - 7$

$= y(y-7) + 1(y-7)$

$= (y-7)(y+1)$

14. $x^2 + 4x - 21 = x^2 + (7-3)x - 21$

$= x^2 + 7x - 3x - 21$

$= x(x+7) - 3(x+7)$

$= (x+7)(x-3)$

15. $p^2 - 25p + 84 = p^2 - (21+4)p + 84$

$= p^2 - 21p - 4p + 84$

$= p(p-21) - 4(p-21)$

$= (p-21)(p-4)$

16. $y^2 - 10y + 24 = y^2 - (6+4)y + 24$

$= y^2 - 6y - 4y + 24$

$= y(y-6) - 4(y-6)$

$= (y-6)(y-4)$

17. $x^2 - 12x + 36 = x^2 - (6+6)x + 36$

$= x^2 - 6x - 6x + 36$

$= x(x-6) - 6(x-6)$

$= (x-6)(x-6)$

18. $x^2 - 23x - 50 = x^2 - (25-2)x - 50$

$= x^2 - 25x + 2x - 50$

$= x(x-25) + 2(x-25)$

$= (x-25)(x+2)$

19. $21 - 10y + y^2 = 21 - (7+3)y + y^2$

$= 21 - 7y - 3y + y^2$

$= 7(3-y) - y(3-y)$

$= (3-y)(7-y)$

20. $x^2 - 22x + 117 = x^2 - (13 + 9)x + 117$

$= x^2 - 13x - 9x + 117$

$= x(x - 13) - 9(x - 13)$

$= (x - 13)(x - 9)$

21. $6z^2 + 7z - 3 = 6z^2 + (9 - 2)z - 3$

$= 6z^2 + 9z - 2z - 3$

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

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

22. $2x^2 + x - 45 = 2x^2 + (10 - 9)x - 45$

$= 2x^2 + 10x - 9x - 45$

$= 2x(x + 5) - 9(x + 5)$

$= (x + 5)(2x - 9)$

23. $4x^2 - 16x + 7 = 4x^2 - (14 + 2)x + 7$

$= 4x^2 - 14x - 2x + 7$

$= 2x(2x - 7) - 1(2x - 7)$

$= (2x - 7)(2x - 1)$

24. $6x^2 - 11x + 4 = 6x^2 - (8 + 3)x + 4$

$= 6x^2 - 8x - 3x + 4$

$= 2(3x - 4) - 1(3x - 4)$

$= (3x - 4)(2x - 1)$

25. $3x^2 - 10x + 8 = 3x^2 - (6 + 4)x + 8$

$= 3x^2 - 6x - 4x + 8$

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

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

26. $2y^2 - y - 45 = 2y^2 - (10 - 9)y - 45$

$= 2y^2 - 10y + 9y - 45$

$= 2y(y - 5) + 9(y - 5)$

$= (y - 5)(2y + 9)$

27. $6x^2 - 11x + 4 = 6x^2 - (8 + 3)x + 4$

$= 6x^2 - 8x - 3x + 4$

$= 2x(3x - 4) - 1(3x - 4)$

$= (3x - 4)(2x - 1)$

28. $3y^2 + 19y + 30 = 3y^2 + (10 + 9)y + 30$

$= 3y^2 + 10y + 9y + 30$

$= y(3y + 10) + 3(3y + 10)$

$= (3y + 10)(y + 3)$

29. $3m^2 + 4m - 4 = 3m^2 + 6m - 2m - 4$

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

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

30. $15x^2 - 26x + 8 = 15x^2 - (20 + 6)x + 8$

$= 15x^2 - 20x - 6x + 8$

$= 5x(3x - 4) - 2(3x - 4)$

$= (3x - 4)(5x - 2)$

➲ EXERCISE 16.3

1. $\frac{7x^2 + 14x}{x + 2} = \frac{7x(x + 2)}{(x + 2)} = 7x$

2. $\frac{m^2 - 14m - 32}{m - 16} = \frac{m^2 - (16 - 2)m - 32}{m - 16}$

$= \frac{m^2 - 16m + 2m - 32}{m - 16}$

$= \frac{m(m - 16) + 2(m - 16)}{m - 16}$

$= \frac{(m - 16)(m + 2)}{(m - 16)} = (m + 2)$

3. $4yz(z^2 + 6z - 16) = 4yz[z^2 + (8 - 2)z - 16]$

$= 4yz[z^2 + 8z - 2z - 16]$

$= 4yz[z(2 + 8) - 2(z + 8)]$

$= 4yz(z + 8)(z - 2)$

Now, $\frac{4yz(z + 8)(z - 2)}{2y(z + 8)} = 2z(z - 2)$

4. $21y^2 - 10y^3 + y^4 = y^2(21 - 10y + y^2)$

$= y^2[21 - (7 + 3)y + y^2]$

$= y^2[21 - 7y - 3y + y^2]$

$= y^2[7(3 - y) - y(3 - y)]$

$= y^2(3 - y)(7 - y)$

Now, $\frac{y^2(3 - y)(7 - y)}{(3 - y)} = y^2(7 - y)$

5. $14x^2(3x^2 - 19x + 30) = 14x^2[3x^2 - (10 + 9)x + 30]$

$= 14x^2[3x^2 - 10x - 9x + 30]$

$= 14x^2[x(3x - 10) - 3(3x - 10)]$

$= 14x^2(3x - 10)(x - 3)$

Now, $\frac{14x^2(3x - 10)(x - 3)}{2(3x - 10)} = 7x^2(x - 3)$

6. $4y^2 - 2y - 90 = 2[2y^2 - y - 45]$

$= 2[2y^2 - (10 - 9)y - 45]$

$= 2[2y^2 - 10y + 9y - 45]$

$= 2[2y(y - 5) + 9(y - 5)]$

$= 2(y - 5)(2y + 9)$

Now, $\frac{2(y-5)(2y+9)}{(2y+9)} = 2(y-5)$

7. $\frac{5mn(m^2-n^2)}{2m(m-n)} = \frac{5mn(m-n)(m+n)}{2m(m-n)}$

$= \frac{5}{2}n(m+n)$

8. $\frac{x(5x^2-80)}{5x(x+4)} = \frac{5x(x^2-16)}{5x(x+4)}$

$= \frac{(x+4)(x-4)}{(x+4)} = (x-4)$

9. $12xy(9x^2-16y^2) = 12xy[(3x)^2-(4y)^2]$

$= 12xy(3x-4y)(3x+4y)$

Now, $\frac{12xy(3x-4y)(3x+4y)}{4xy(3x+4y)} = 3(3x-4y)$

10. $13xy(x^2-49y^2) = 13xy[x^2-(7y)^2]$

$= 13xy(x+7y)(x-7y)$

Now, $\frac{13xy(x+7y)(x-7y)}{y^2(x+7y)} = \frac{13x}{y}(x-7y)$

11. $52y^3(25y^2-49x^2) = 52y^3[(5y)^2-(7x)^2]$

$= 54y^3(5y-7x)(5y+7x)$

Now, $\frac{52y^3(5y-7x)(5y+7x)}{39y(5y+7x)} = \frac{4}{3}y^2(5y-7x)$

12. $28(50m^2-98n^2) = 28\times 2(25m^2-49n^2)$

$= 56[(5m)^2-(7n)^2]$

$= 56(5m-7n)(5m+7n)$

Now, $\frac{56(5m-7n)(5m+7n)}{5m-7n} = 56(5m+7n)$

13. $48(2y^4-36y^2+162) = 48\times 2(y^4-18y^2+81)$

$= 96[(y^2)^2-2\times y^2\times 9+9^2]$

$= 96(y^2-9)^2$

$= 96(y+3)^2(y-3)^2$

Now, $\frac{96(y+2)^2(y-3)^2}{4(y-3)^2} = 24(y+3)^2$

14. $x^2-2xy+y^2-9z^2 = (x-y)^2-(3z)^2$

$= (x-y-3z)(x-y+3z)$

Now, $\frac{(x-y-3z)(x-y+3z)}{(x-y-3z)} = (x-y+3z)$

15. $44(5x^2-20x-8y+2xy)$

$= 44[5x(x-4)+2y(x-4)]$

$= 44(x-4)(5x+2y)$

Now, $\frac{44(x-4)(5x+2y)}{(5x+2y)} = 44(x-4)$

16. $16c^2-4a^2-12ab-9b^2$

$= (4c)^2-(4a^2+12ab+9b^2)$

$= (4c)^2-[(2a)^2+2\times 2a\times 3b+(3b)^2]$

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

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

Now, $\frac{(4c+2a+3b)(4c-2a-3b)}{(2a+3b+4c)} = (4c-2a-3b)$

➲ HOTS

1. (i) $x^4-16 = (x^2)^2-(4)^2$

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

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

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

(ii) $(xy)^4-z^4 = [(xy)^2]^2-(z^2)^2$

$= [(xy)^2+z^2][(xy)^2-z^2]$

$= [(xy)^2+z^2](xy+z)(xy-z)$

(iii) $(9x^2+42x+49)^2-y^4$

$= (9x^2+21x+21x+49)^2-y^4$

$= [3x(3x+7)+7(3x+7)]^2-y^4$

$= [(3x+7)(3x+7)]^2-y^4$

$= (3x+7)^4-y^4$

$= [(3x+7)^2+y^2][(3x+7)^2-y^2]$

$= [(3x+7)^2+y^2](3x+7+y)(3x+7-y)$

2. $49m^2-42m+9 = 49m^2-21m-21m+9$

$= 7m(7m-3)-3(7m-3)$

$= (7m-3)(7m-3)$

$= (7m-3)^2$

3. Area of triangle $= \frac{1}{2}\times$ Base $\times$ Height

$= \frac{1}{2}\times 14xy\times(x^4+y^4)$

$= 7xy(x^4+y^4)$

4. $25a^2-4b^2+28bc-49c^2$

$= 25a^2-4b^2-28bc+49c^2)$

$= 25a^2-[(2b)^2-2\times(2b)\times(7c)+(7c)^2]$

$= (5a)^2-(2b-7c)^2$

$= (5a+2b-7c)(5a-2b+7c)$

➲ NCERT CORNER

1. (i) $12x, 36$

$$12x = 2 \times 2 \times 3 \times x$$
$$36 = 2 \times 2 \times 3 \times 3$$
$\therefore$ Common factors of the given terms
$$= 2 \times 2 \times 3 = 12$$

(ii) $2y, 22xy$

$$2y = 2 \times y$$
$$22xy = 2 \times 11 \times x \times y$$
$\therefore$ Common factors of the given terms
$$= 2 \times y = 2y$$

(iii) $14pq, 28p^2q^2$

$$14pq = 2 \times 7 \times p \times q$$
$$28p^2q^2 = 2 \times 2 \times 7 \times p \times p \times q \times q$$
$\therefore$ Common factors of the given terms
$$= 2 \times 7 \times p \times q = 14pq$$

2. (i) $x^2 + xy + 8x + 8y = x(x + y) + 8(x + y)$
$$= (x + y)(x + 8)$$

(ii) $ax + bx - ay - by = x(a + b) - y(a + b)$
$$= (a + b)(x - y)$$

(iii) $z - 7 + 7xy - xyz = z - 7 - xyz + 7xy$
$$= 1(z - 7) - xy(z - 7)$$
$$= (z - 7)(1 - xy)$$

3. (i) $4p^2 - 9q^2 = (2p)^2 - (3q)^2$
$$= (2p - 3q)(2p + 3q)$$
[Using $a^2 - b^2 = (a + b)(a - b)$]
$\therefore \quad 4p^2 - 9q^2 = (2p - 3q)(2p + 3q)$

(ii) We have $16x^5 = 16x^3 \times x^2$
and $144x^3 = 16x^3 \times 9$
$\therefore 16x^5 - 144x^3 = (16x^3) \times x^2 - (16x^3) \times 9$
$$= 16x^3 [x^2 - 9]$$
$$= 16x^3 [(x)^2 - (3)^2]$$
$$= 16x^3 [(x + 3)(x - 3)]$$
[Using $a^2 - b^2 = (a - b)(a + b)$]
$\therefore \quad 16x^5 - 144x^3 = 16x^3[(x + 3)(x - 3)]$

(iii) $x^2 - 2xy + y^2 = (x - y)^2$
$\therefore (x^2 - 2xy + y^2) - z^2$
$$= (x - y)^2 - (z)^2$$
$$= [(x - y) + z][(x - y) - z]$$
[Using $a^2 - b^2 = (a + b)(a - b)$]
$$= (x - y + z)(x - y - z)$$
$\therefore (x^2 - 2xy + y^2) - z^2 = (x - y + z)(x - y - z)$

4. (i) $(y^2 + 7y + 10) \div (y + 5)$
$$= \frac{y^2 + 7y + 10}{y + 5} = \frac{y^2 + 2y + 5y + 10}{y + 5}$$
[Using $(x + a)(x + b) = x^2 + (a + b)x + ab$]
$$= \frac{y(y + 2) + 5(y + 2)}{y + 5}$$
$$= \frac{(y + 2)(y + 5)}{y + 5}$$
$$= y + 2$$

(ii) $5pq(p^2 - q^2) \div 2p(p + q)$
$$= \frac{5pq(p^2 - q^2)}{2p(p + q)} = \frac{5pq(p + q)(p - q)}{2p(p + q)}$$
[Using $a^2 - b^2 = (a + b)(a - b)$]
$$= \frac{5}{2} q(p - q)$$

(iii) $39y^3(50y^2 - 98) \div 26y^2(5y + 7)$
$$= \frac{39y^3(50y^2 - 98)}{26y^2(5y + 7)}$$
$$= \frac{39y^3 \times 2 \times (25y^2 - 49)}{26y^2(5y + 7)}$$
$$= \frac{39y^3 \times 2 \times [(5y)^2 - (7)^2]}{26y^2(5y + 7)}$$
$$= \frac{39y^3 \times 2 \times (5y + 7)(5y - 7)}{26y^2(5y + 7)}$$
[Using $a^2 - b^2 = (a + b)(a - b)$]
$$= 3y(5y - 7)$$

17 Graphs

➲ EXERCISE 17.1

1–3. Do it yourself.

➲ EXERCISE 17.2

1–4. Do it yourself.

➲ NCERT CORNER

1. (i) True
(ii) False. A point whose y-coordinate is zero and x-coordinate is 5 will lie on x-axis.
(iii) True

2. (i) (I) Draw X-axis and Y-axis are mutually perpendicular to each other.

(II) Take a suitable scale : Horizontal : 2 units = 1 cm, Vertical : 2 units = 4 cm.

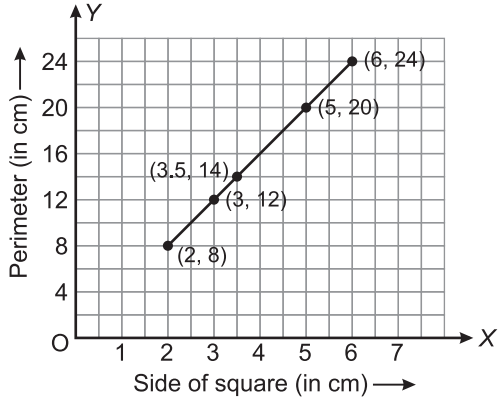
(III) Mark side of the square (in cm) on horizontal axis.

(IV) Mark perimeter (in cm) on vertical axis.

(V) Plot the points : (2, 8); (3, 12); (3.5, 14), (5, 20) and (6, 24).

(VI) Join the points.

We obtain the line graph as shown below :



(ii) (I) Draw X-axis and Y-axis mutually perpendicular to each other.

(II) Take a suitable scale : Horizontal : 2 units = 1 cm, Vertical : 2 units = 4 cm^2.

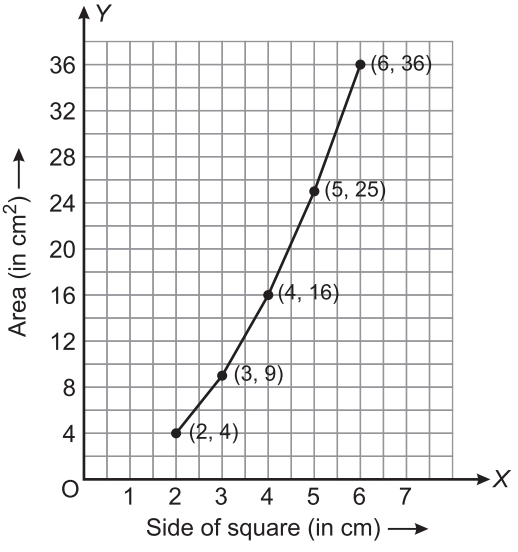
(III) Mark side of the square (in cm) on horizontal axis.

(IV) Mark area (in cm^2) on vertical axis.

(V) Plot the points : (2, 4), (3, 9), (4, 16), (5, 25) and (6, 36).

(VI) Join the points.

We obtain the line graph as shown below :



18 Time, Work and Distance

➲ EXERCISE 18.1

1. A can do in 1 day $= \frac{1}{18}$

B can do in 1 day $= \frac{1}{24}$

So, A and B both can do in 1 day $= \frac{1}{18} + \frac{1}{24}$

$= \frac{4+3}{72} = \frac{7}{72}$

So, A and B can do total work in $1 \div \frac{7}{72} = \frac{1 \times 72}{7}$

$= 10\frac{2}{7}$ days

2. Dinkar can do in 1 day $= \frac{1}{15}$

Sonkar can do in 1 day $= \frac{1}{20}$

So, both can do in 1 day $= \frac{1}{15} + \frac{1}{20} = \frac{4+3}{60} = \frac{7}{60}$

So, they can do whole work in $1 \div \frac{7}{60} = 1 \times \frac{60}{7}$

$= 8\frac{4}{7}$ days

3. 1 day work of Sonu and Sita $= \frac{1}{12}$

1 day work of Sonu $= \frac{1}{18}$

$\therefore$ 1 day work of Sita $= \frac{1}{12} - \frac{1}{18} = \frac{3-2}{36} = \frac{1}{36}$

So, Sita can do in 36 days.

4. 1 day work of A $= \frac{1}{9}$

1 day work of B $= \frac{1}{12}$

1 day work of C $= \frac{1}{15}$

1 day work of A, B and C $= \frac{1}{9} + \frac{1}{12} + \frac{1}{15}$

$= \frac{20+15+12}{180} = \frac{47}{180}$

So, they can do whole work together in $\frac{180}{47}$

$= 3\frac{39}{47}$ days

5. 1 day work of A, B and C $= \frac{1}{9}$

1 day work of B $= \frac{1}{21}$

1 day work of C $= \frac{1}{18}$

$\therefore$ 1 day work of A $= \frac{1}{9} - \left(\frac{1}{21} + \frac{1}{18}\right)$

$= \frac{14 - 6 - 7}{126}$

$= \frac{1}{126}$

So, A can do whole work in 126 days.

6. 1 day work of Rekha and Meeta $= \frac{1}{12}$

1 day work of Meeta and Payal $= \frac{1}{15}$

1 day work of Payal and Rekha $= \frac{1}{20}$

1 day work of Rekha, Meeta and Payal

$= \frac{1}{2}\left(\frac{1}{12} + \frac{1}{15} + \frac{1}{20}\right)$

$= \frac{1}{2}\left(\frac{5 + 4 + 3}{60}\right)$

$= \frac{1}{2} \times \frac{12}{60} = \frac{1}{10}$

So, they will complete in 10 days.

1 day work of Payal $= \frac{1}{10} - \frac{1}{12} = \frac{6 - 5}{60} = \frac{1}{60}$

So Payal can weave alone in 60 days.

1 day work of Rekha $= \frac{1}{10} - \frac{1}{15} = \frac{3 - 2}{30} = \frac{1}{30}$

So, Rekha can weave alone in 30 days.

1 day work of Meeta $= \frac{1}{10} - \frac{1}{20} = \frac{2 - 1}{20} = \frac{1}{20}$

So, Meeta can weave alone in 20 days.

7. 1 day work of Suresh and Manoj $= \frac{1}{30} + \frac{1}{25}$

$= \frac{5 + 6}{150} = \frac{11}{150}$

6 days work of both $= 6 \times \frac{11}{150} = \frac{11}{25}$

Remaining work $= 1 - \frac{11}{25} = \frac{25 - 11}{25} = \frac{14}{25}$

Suresh leaves the work so Manoj do alone remaining work.

Manoj can do $\frac{14}{25}$ work in $\frac{14}{25} \times 25 = 14$ days

8. 1 day work of A and B $= \frac{1}{14} + \frac{1}{21} = \frac{3 + 2}{42} = \frac{5}{42}$

7 days work of both $= \frac{5}{42} \times 7 = \frac{5}{6}$

Remaining work $= 1 - \frac{5}{6} = \frac{1}{6}$

B will complete remaining work in

$21 \times \frac{1}{6} = \frac{7}{2} = 3\frac{1}{2}$ days

9. All three cistern can fill in 1 hr $= \frac{1}{8} + \frac{1}{12} + \frac{1}{15}$

$= \frac{15 + 10 + 8}{120}$

$= \frac{33}{120} = \frac{11}{40}$

So, they can fill in $\frac{40}{11} = 3\frac{7}{11}$ hrs.

10. Both fill in 1 hr $= \frac{1}{8} - \frac{1}{12} = \frac{3 - 2}{24} = \frac{1}{24}$

So, they can fill in 24 hrs.

11. Tank can empty in 1 hr $= \frac{1}{8} - \frac{1}{10} = \frac{5 - 4}{40} = \frac{1}{40}$

So, tank will empty in 40 hrs due to leakage.

12. All three cistern fill in 1 min $= \frac{1}{21} + \frac{1}{28} - \frac{1}{14}$

$= \frac{4 + 3 - 6}{84}$

$= \frac{1}{84}$

So, they fill whole cistern in 84 minutes.

➲ EXERCISE 18.2

1. (a) 36 km/hr $= 36 \times \frac{5}{18} = 10$ m/s

(b) 65 km/hr $= 65 \times \frac{5}{18} = 18.06$ m/s

(c) 120 km/hr $= 120 \times \frac{5}{18} = 33.33$ m/s

(d) 108 km/hr $= 108 \times \frac{5}{18} = 30$ m/s

2. (a) 15 m/s $= 15 \times \frac{18}{5} = 54$ km/hr

(b) 85 m/s $= 85 \times \frac{18}{5} = 306$ km/hr

(c) 40 m/s $= 40 \times \frac{18}{5} = 144$ km/hr

(d) $105 \text{ m/s} = 105 \times \frac{18}{5} = 378 \text{ km/hr}$

3. Speed of car $= 72 \text{ km/hr} = \frac{72}{60} = \frac{6}{5} \text{ km/min}$

So, distance $=$ Speed $\times$ time

$= \frac{6}{5} \times 22 = 26.4 \text{ km}$

4. $\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{140}{80} = \frac{7}{4} = 1\frac{3}{4} \text{ hr}$

5. $\text{Speed} = 15 \text{ km/hr} = \frac{15}{60} \text{ km/min}$

$= \frac{1}{4} \text{ km/min}$

So distance $=$ Speed $\times$ time

$= \frac{1}{4} \times 25$

$= 6.25 \text{ km}$

6. Time $=$ 8hr 50 minutes

$= 8\frac{50}{60} = 8\frac{5}{6} = \frac{53}{6} \text{ hr}$

Distance $=$ Speed $\times$ Time

$= 75 \times \frac{53}{6} = 662.5 \text{ km}$

7. Distance $= 10 \text{ km} = (10 \times 1000) \text{ m} = 10000 \text{ m}$

$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{10000}{2}$

$= 5000 \text{ m/s}$

8. Distance of school from house $= 40 \times \frac{8}{60} = \frac{16}{3} \text{ km}$

New speed 36 km/hr

So $\text{Time} = \frac{\frac{16}{3}}{36} = \frac{16}{3 \times 36} \text{ hr}$

$= \frac{16 \times 60}{3 \times 36} \text{ min}$

$= 8\frac{8}{9} \text{ minutes}$

9. Time for going $= \frac{50}{40} = \frac{5}{4} \text{ hr}$

Time for returning $= \frac{50}{30} \text{ hr} = \frac{5}{3} \text{hr}$

Total time $= \frac{5}{4} + \frac{5}{3}$

$= \frac{15+20}{12} = \frac{35}{12} \text{ hr}$

Total distance $= 50 + 50 = 100 \text{ km}$

Average speed $= \frac{100}{\frac{35}{12}} = \frac{100 \times 12}{35}$

$= 34.29 \text{ km/hr}$

10. Let distance of school from house be x km.

First case, when speed is 6 km/hr

$\text{Time} = \frac{x}{6}$

$\text{Usual time} = \left(\frac{x}{6} - \frac{8}{60}\right) \text{hr}$

Second case, when speed is 8 km/hr

$\text{Time} = \frac{x}{8}$

$\text{Usual time} = \frac{x}{8} + \frac{4}{60}$

So, by putting equal both cases, we get

$\frac{x}{6} - \frac{8}{60} = \frac{x}{8} + \frac{4}{60}$

$\Rightarrow \quad \frac{x}{6} - \frac{x}{8} = \frac{4}{60} + \frac{8}{60}$

$\Rightarrow \quad \frac{4x - 3x}{24} = \frac{4+8}{60}$

$\Rightarrow \quad \frac{x}{24} = \frac{12}{60}$

$\Rightarrow \quad x = \frac{24 \times 12}{60}$

$x = 4.8 \text{ km}$

➲ HOTS

1. $A = \frac{2}{x}$ work in one day

$B = \frac{1}{x}$ work in one day

$\frac{2}{x} + \frac{1}{x} = \frac{1}{12}$

$\frac{3}{x} = \frac{1}{12}$

$x = 36$

$A = \frac{1}{18}$ days, $B = \frac{1}{36}$ days

$B \rightarrow 36$ days (c)

2. Rates of work $=$ A : B

Number of days taken $=$ A : B

$= \frac{1}{3} : \frac{1}{4}$

$= 4 : 3$ (c)

19 Playing with Numbers

➲ EXERCISE 19.1

1. Let digit at tens place be x

So digit at unit place will be $9-x$

Now, number $=10x+(9-x)$

$=9x+9$

On reversing the order of digits,

new number $=10(9-x)+x$

$=90-10x+x$

$=90-9x$

According to given condition,

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

$\Rightarrow \quad 90-9x-9x-9=27$

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

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

$\Rightarrow \quad -18x=-54$

$\Rightarrow \quad x=3$

So, number is $9x+7=9\times3+9$

$=27+9$

$=36$

2. Let digit at tens place be x

So digit at unit place will be $7-x$

Now, number $=10x+(7-x)$

$=9x+7$

On reversing the order of digits, new number will be $10(7-x)+x$

$=70-10x+x$

$=70-9x$

According to given condition,

$(9x+7)-(70-9x)=27$

$\Rightarrow \quad 9x+7-70+9x=27$

$\Rightarrow \quad 18x-63=27$

$\Rightarrow \quad 18x=27+63$

$\Rightarrow \quad 18x=90$

$\Rightarrow \quad x=\frac{90}{18}$

$\Rightarrow \quad x=5$

So, number is $9x+7=9\times5+7$

$=45+7$

$=52$

3. Let digit at tens place be x

So digit at unit place will be $4x$

Now, number will be $10x+4x=14x$

According to given condition

$x+4x=10$

$5x=10$

$\therefore \quad x=\frac{10}{5}=2$

So, number is $14\times2=28$

4. Let digit at tens place be x

So digit at ones place will be $x-1$

Now, number will be

$10x+(x-1)=11x-1$

On reversing the order of digits, new number will be

$10(x-1)+x=10x-10+x$

$=11x-10$

According to given condition,

$\frac{5}{6}(11x-1)=11x-10$

$\Rightarrow \quad 55x-5=66x-60$

$\Rightarrow \quad 55x-66x=-60+5$

$-11x=-55$

$\therefore \quad x=\frac{-55}{-11}$

$x=5$

So number is $11\times5-1=55-1=54$

5. Let digit at tens place be x

and digit at unit place be y

So number is $10x+y$

On reversing the order of digit, new number

$=10y+x$

According to given condition,

$(10x+y)-(10y+x)=9$

$\Rightarrow \quad 9x-9y=9$

$\Rightarrow \quad x-y=1$

So difference of digits is 1.

➲ EXERCISE 19.2

1. Numbers divisible by 2 are

42, 94, 78, 102, 196

2.

$415=4+1+5=10$	No
$603=6+0+3=9$	Yes
$708=7+0+8=15$	Yes
$514=5+1+4=10$	No
$316=3+1+6=10$	No
$516=5+1+6=12$	Yes
$817=8+1+7=16$	No
$918=9+1+8=18$	Yes
$718=7+1+8=16$	No

3. Numbers divisible by 5 are 60, 75, 85, 90, 110 125, 130, 145

4. $819 = 8+1+9 = 18$ Yes

$309 = 3+0+9 = 12$ No

$618 = 6+1+8 = 15$ No

$154 = 1+5+4 = 10$ No

$306 = 3+0+6 = 9$ Yes

$909 = 9+0+9 = 18$ Yes

$678 = 6+7+8 = 21$ No

$514 = 5+1+4 = 10$ No

5. Numbers divisible by 10 are 50, 170, 530, 650, 770

6. $21y5$

Sum of digit should be multiple of 9.

$$2+1+y+5 = 8+y$$

$\therefore \quad 8+y = 9$

or $\quad y = 9-8 = 1$

7. $81x4$

$$8+1+x+4 = 13+x$$

$$13+x = 15$$

$$x = 15-13 = 2$$

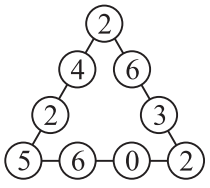
8. $913z$ so z will be 0 or 5.

➲ EXERCISE 19.3

1. Sum of each row, column and diagonal is 14.

3	8	3
6	6	6
5	4	5

2.



3. (a)

C	D	2	5
+3	7	+3	7
6	C	6	2

$\therefore \quad C = 2$ and $D = 5$

(b)

A	B	2	5
×	5	×	5
C	A B	1	2 5

$\therefore \quad A = 2, \ B = 5$

(c)

2	A	B	2	4	7
+A	B	1	+4	7	1
B	1	8	7	1	8

$\therefore \quad A = 4, \ B = 7$

(d)

1	2	A	1	2	8
+6	A	B	+6	8	1
A	0	9	8	0	9

$\therefore \quad A = 8, \ B = 7$

(e)

P	Q		7	4	
×	6		×	6	
Q	Q	Q	4	4	4

$\therefore \quad P = 7$ and $Q = 4$

(f)

B	A		2	5	
×	B	3	×	2	3
5	7	A	5	7	5

$\therefore \quad A = 5, \ B = 2$

4.

$$\begin{array}{r|l} 7 & 5BCD \\ \cline{2-2} & -EF \\ \cline{2-2} & \quad 2C \\ & -H1 \\ \cline{2-2} & \quad\ 2D \\ & -2\ 1 \\ \cline{2-2} & \quad\ \ 0 \end{array} \quad 8GJ$$

$\therefore \quad D = 1, \ C = 3, \ H = 2$

$E = 5, . \ F = 6, \ B = 8$

$G = 3$ and $J = 3$

$$\begin{array}{r|l} 7 & 5831 \\ \cline{2-2} & -56 \\ \cline{2-2} & \quad 23 \\ & -21 \\ \cline{2-2} & \quad\ 21 \\ & -21 \\ \cline{2-2} & \quad\ 0 \end{array} \quad 833$$

➲ HOTS

1. $285963 \div 5$

Remainder = 3

2. $730492 \div 3 = (7+3+0+4+9+2) \div 3$

$= 25 \div 3$

$\therefore$ Remainder = 1

3. $47210369 \div 11$

Sum of odd place digits $= 9+3+1+7$

$= 20$

Sum of even place digits $= 6+0+2+4$

$= 12$

Difference $= 20-12 = 8$

$\therefore$ Remainder $= 8$

4.

$$\begin{array}{cccc} & 2 & a & 3 \\ + & 3 & 2 & 6 \\ \hline & 5 & b & 9 \\ \hline \end{array}$$

Here ten's $5b9$ is divisible by 9. Add all its digit.

$\Rightarrow$ $5 + b + 9$ must be divisible by 9.

$\Rightarrow$ $14 + b$ is divisible by 9 or its multiple.

$\Rightarrow$ $14 + b = 9$ or $b = 4$

Put this value, we get

$$\begin{array}{rccc} & 2 & a & 3 \\ + & 3 & 2 & 6 \\ \hline & 5 & 4 & 9 \end{array}$$

$\therefore a = 2$ and $b - a = 4 - 2 = 2$

5. (i) We have

$$\begin{array}{rccc} & 1 & 2 & A \\ + & 6 & A & B \\ \hline & A & 0 & 9 \end{array}$$

Here, we have two letters A and B.

Look at the tens columns

$2 + A = 0$

$\Rightarrow$ $A = 8$

In ones column, for A = 8, B = 1.

So for A = 8, B = 1, the sum becomes

$$\begin{array}{rccc} & 1 & 2 & 8 \\ + & 6 & 8 & 1 \\ \hline & 8 & 0 & 9 \end{array}$$

Hence, A = 8, B = 1.

(ii) We have

$$\begin{array}{rccc} & 2 & A & B \\ + & A & B & 1 \\ \hline & B & 1 & 8 \end{array}$$

Look at the ones column

$B + 1 = 8$

$\Rightarrow$ $B = 7$

In tens column for B = 7, A = 4

So, for A = 4 and B = 7, the sum becomes

$$\begin{array}{rccc} & 2 & 4 & 7 \\ + & 4 & 7 & 1 \\ \hline & 7 & 1 & 8 \end{array}$$

(iii) We have

$$\begin{array}{rccc} & A & A & \\ \times & A & A & \\ \hline A & B & A & \end{array}$$

Here, $A \times A = A$, so A = 1 or A = 5 or A = 6

For A = 1, $11 \times 11 = 121$

$\Rightarrow$ $B = 2$

No other values of A satisfy the given condition.

Hence, A = 1 and B = 2.

➲ NCERT CORNER

1. (i) Here, we have to find the value of three letters A, B and C.

$\because$ Unit's digit of $3 \times B$ is B. So, it is necessary that $B = 0$

Now,

$$\begin{array}{rccc} & A & 0 & \\ \times & & 3 & \\ \hline C & A & 0 & \end{array}$$

$\because$ Unit's digit of $3 \times A$ is A. So, it is essential that $A = 5$.

Now,

$$\begin{array}{rccc} & 5 & 0 & \\ \times & & 3 & \\ \hline 1 & 5 & 0 & \end{array}$$

Therefore, $A = 5$, $B = 0$ and $C = 1$.

(ii) Here, we have to find the value of two letters A and B.

$$\begin{array}{rccc} & A & B & \\ \times & & 6 & \\ \hline B & B & B & \end{array}$$

Possible values of BBB = 111, 222, 333, 444 or 8888.

Out of them 111 and 333 are rejected because when divided them by 6, we get remainder.

Now, $222 \div 6 = 37$, remainder 0.

But the quotient is not of the form $A2$, so $B = 2$ is not possible.

Now, $444 \div 6 = 74$, remainder 0.

Here, the quotient 74 is of the form $A4$ which clearly works well.

Thus, the puzzle is solved as shown below :

$$\begin{array}{rccc} & 7 & 4 & \\ \times & & 6 & \\ \hline 4 & 4 & 4 & \end{array}$$

Thus, $A = 7$ and $B = 4$.

(iii) Here, we have to find the value of two letters A and B.

Observe the addition in one's column, we have $B + 1$ gives 8, *i.e.*, $B = 7$.

($\because$ B is itself a one digit number)

Then, the puzzle becomes

$$\begin{array}{rccc} & 2 & A & 7 \\ + & A & 7 & 1 \\ \hline & 7 & 1 & 8 \end{array}$$

Now, observe the addition in ten's digit column, we have $A + 7$ gives 1, *i.e.*, whose one's digit is 1.

$\therefore$ $A = 4$

($\because$ A is itself a one digit number)

Thus, the puzzle is solved as shown below :

$$\begin{array}{cccc} & 2 & 4 & 7 \\ + & 4 & 7 & 1 \\ \hline & 7 & 1 & 8 \\ \hline \end{array}$$

Therefore, $A = 4$ and $B = 7$.

2. $\because$ $31z5$ is a multiple of 9

Sum of its digits $3 + 1 + z + 5 = 9 + z$

$9 + z$ must be divisible by 9.

$\therefore$ $9 + z$ should be 0, 9, 18, 27, 36, ...

Since, z is a digit

$\therefore$ $9 + z = 9$ or 18, then, $z = 0$ or 9

3. Since $31z5$ is a multiple of 3, its sum of digits $3 + 1 + z + 5 = 9 + z$ is a multiple of 3; so $9 + z$ is one of these numbers : 0, 3, 6, 9, 12, 15, 18, ... But since z is a digit, it can only be that $9 + z = 9$ or 12 or 15. Therefore, $z = 0$ or 3 or 6.