Chapter 1

Rational Numbers

Exercise 1.1

1. Fill in the blanks with >, < or = sign.

(a) $-8 \square \frac{-15}{6}$

or $\frac{-8}{1} \times \frac{-15}{6}$

Using cross multiplication, we get

$-8 \times 6 \qquad -15 \times 1$

$-48 \qquad -15$

since, $-48 < -15$

So, $\frac{-8}{1} < \frac{-15}{6}$

(b) $\frac{-3}{8} \square \frac{6}{-11}$

or $\frac{-3}{8} \times \frac{-6}{11}$

Using cross multipli- cation we get

$-3 \times 11 \qquad -6 \times 8$

$-33 \qquad -48$

Since, $-33 > -48$

So, $\frac{-3}{8} > \frac{6}{-11}$

(c) $\frac{-4}{13} \square \frac{9}{10}$

or $\frac{-4}{13} \times \frac{9}{10}$

We see other no. is positive and positive no. is always greater then negative integers

so $\frac{-4}{13} < \frac{9}{10}$

(d) $\frac{-4}{7} \square \frac{-5}{13}$

or $\frac{-4}{7} \times \frac{-5}{13}$

Using cross multiplication, we get

$-4 \times 13 \qquad -5 \times 7$

$-52 \qquad -35$

$-52 < -35$

Since, $\frac{-4}{7} < \frac{-5}{13}$

2. Express the following rational numbers in standard form :

(a) $\frac{125}{625} = \frac{\cancel{125}^{\cancel{25}\,5^{1}}}{\cancel{625}_{\cancel{125}\,\cancel{25}\,5}} = \frac{1}{5}$

(b) $\frac{-144}{-300} = \frac{\cancel{144}^{\cancel{72}\,\cancel{36}\,12}}{\cancel{300}_{\cancel{150}\,\cancel{75}\,\cancel{25}}} = \frac{12}{25}$

(c) $\frac{-345}{603} = \frac{\cancel{-345}^{115}}{\cancel{603}_{201}} = \frac{-115}{201}$

(d) $\frac{5670}{10395} = \frac{\cancel{5670}^{\cancel{1134}\,\cancel{378}\,\cancel{126}\,\cancel{42}\,6}}{\cancel{10395}_{\cancel{2079}\,\cancel{693}\,\cancel{231}\,\cancel{77}\,11}} = \frac{6}{11}$

3. Arrange in ascending order :

(a) $-\frac{1}{4}, \frac{5}{-12}, \frac{-7}{24}, \frac{-9}{8}$

or $-\frac{1}{4}, \frac{-5}{12}, \frac{-7}{24}, \frac{-9}{8}$

L.C.M. $= 4 \times 2 \times 3 = 24$

$= \frac{-1 \times 6, -5 \times 2, -7 \times 1, -9 \times 3}{24}$

$= \frac{-6, -10, -7, -27}{24}$

$\frac{-6}{24}, \frac{-10}{24}, \frac{-7}{24}, \frac{-27}{24}$

4	4, 12, 24, 8
2	1, 3, 6, 2
3	1, 3, 3, 1
	1, 1, 1, 1

so, Ascending order :

$\frac{-27}{24} < \frac{-10}{24} < \frac{-7}{24} < \frac{-6}{24}$

or $\frac{-9}{8} < \frac{5}{-12} < \frac{-7}{24} < \frac{-1}{4}$

(b) $\frac{-5}{6}, \frac{10}{3}, \frac{-7}{-2}, \frac{13}{8}$

or $\frac{-5}{6}, \frac{10}{3}, \frac{-7}{-2}, \frac{13}{8}$

2	6, 3, 2, 8
3	3, 3, 1, 4
4	1, 1, 1, 4
	1, 1, 1, 1

L.C.M. $= 2 \times 3 \times 4 = 24$

$\frac{-5 \times 4, 10 \times 8, 7 \times 12, 13 \times 3}{24}$

$= \frac{-20, 80, 84, 39}{24}$

$= \frac{-20}{24}, \frac{80}{24}, \frac{84}{24}, \frac{39}{24}$

so, ascending order :

$= \frac{-20}{24} < \frac{39}{24} < \frac{80}{24} < \frac{84}{24}$

or $\frac{-5}{6} < \frac{13}{8} < \frac{10}{3} < \frac{-7}{-2}$

4. Arrange in descending order :

(a) $\frac{-7}{10}, \frac{23}{-5}, \frac{-2}{15}, \frac{-11}{30}$

or $\frac{-7}{10}, \frac{23}{-5}, \frac{-2}{15}, \frac{-11}{30}$

2	10, 5, 15, 30
3	5, 5, 15, 15
5	5, 5, 5, 5
	1, 1, 1, 1

L.C.M. $= 2 \times 3 \times 5 = 30$

$= \frac{-7 \times 3, -23 \times 6, -2 \times 2, -11 \times 1}{30}$

$= \frac{-21, -138, -4, -11}{30}$

$= \frac{-21}{30}, \frac{-138}{30}, \frac{-4}{30}, \frac{-11}{30}$

Descending order :

$$\frac{-4}{30} > \frac{-11}{30} > \frac{-21}{30} > \frac{-138}{30}$$

or $$\frac{-2}{15} > \frac{-11}{30} > \frac{-7}{10} > \frac{23}{-5}$$

(b) $\frac{-11}{5}, \frac{13}{-8}, \frac{-7}{4}, \frac{17}{-10}$

or $\frac{-11}{5}, \frac{-13}{8}, \frac{-7}{4}, \frac{-17}{10}$

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

L.C.M. $= 2 \times 2 \times 2 \times 5 = 40$

$$= \frac{-11 \times 8, -13 \times 5, -7 \times 10, -17 \times 4}{40}$$

$$= \frac{-88, -65, -70, -68}{40}$$

$$= \frac{-88}{40}, \frac{-65}{40}, \frac{-70}{40}, \frac{-68}{40}$$

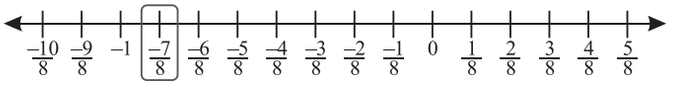
Descending order :

$$\frac{-65}{40} > \frac{-68}{40} > \frac{-70}{40} > \frac{-88}{40}$$

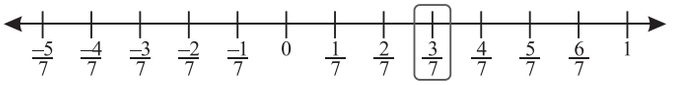
or $$\frac{13}{-8} > \frac{17}{-10} > \frac{-7}{4} > \frac{-11}{5}$$

5. Represent the following rational numbers on number line :

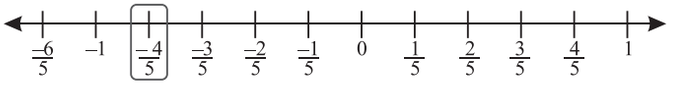
(a) $\frac{-7}{8}$



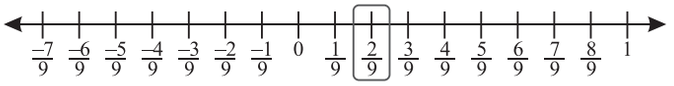
(b) $\frac{3}{7}$



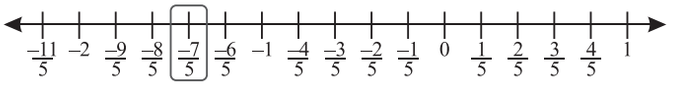
(c) $\frac{-4}{5}$



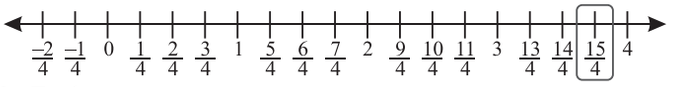
(d) $\frac{2}{9}$



(e) $\frac{-7}{5}$



(f) $\frac{15}{4}$



6. Evaluate :

(a) $\left|\frac{2}{3}\right| - \left|\frac{-7}{5}\right|$

$= \frac{2}{3} - \frac{7}{5}$

$= \frac{2 \times 5 - 3 \times 7}{15}$

$= \frac{10 - 21}{15}$

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

(b) $\left|\frac{8}{15}\right| + \left|\frac{-3}{16}\right|$

$= \frac{8}{15} + \frac{3}{16}$

$= \frac{8 \times 16 + 15 \times 3}{240}$

$= \frac{128 + 45}{240}$

$= \frac{173}{240}$

7. Replace $\square$ by $>$, $<$ or $=$ to make the statement true.

(a) $\left|\frac{-5}{6}\right| \square \left|\frac{6}{-8}\right|$

or $\frac{5}{6} \quad \frac{6}{8}$

by cross multiplication

$5 \times 8 \quad 6 \times 6$

$\because \quad 40 > 36$

So, $\left|\frac{-5}{6}\right| > \left|\frac{6}{-8}\right|$

(b) $\left|\frac{7}{5}\right| \square \left|\frac{-8}{5}\right|$

$\frac{7}{5} \quad \frac{8}{5}$

$\because \quad \frac{7}{5} < \frac{8}{5}$

So, $\left|\frac{7}{5}\right| < \left|\frac{-8}{5}\right|$

8. Verify that $|x| = |-x|$ for :

(a) $x = \frac{2}{3}$

$|x| = |-x|$

$\left|\frac{2}{3}\right| = \left|\frac{-2}{3}\right|$

or $\frac{2}{3} = \frac{2}{3}$

L.H.S. = R.H.S.

verified

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

$|x| = |-x|$

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

or $\left|\frac{-3}{4}\right| = \left|\frac{3}{4}\right|$

$\frac{3}{4} = \frac{3}{4}$

L.H.S. = R.H.S.

verified

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

$|x| = |-x|$

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

$\left|\frac{4}{3}\right| = \left|\frac{-4}{3}\right|$

or $\frac{4}{3} = \frac{4}{3}$

L.H.S. = R.H.S. verified

9. Verify that $|x + y| \le |x| + |y|$ for :

(a) $x = \frac{2}{5}, y = \frac{-1}{3}$

$|x + y| \le |x| + |y|$

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

$\left|\frac{2}{5} - \frac{1}{3}\right| \le \frac{2}{5} + \frac{1}{3}$

$\left|\frac{6 - 5}{15}\right| \le \frac{6 + 5}{15}$

$\frac{1}{15} \le \frac{11}{15}$

Proved

(b) $x=\frac{7}{-5},\ y=\frac{-5}{7}$

$$|x+y|\le|x|+|y|$$
$$\left|\frac{7}{-5}+\frac{-5}{7}\right|\le\left|\frac{7}{-5}\right|+\left|\frac{-5}{7}\right|$$
$$\left|\frac{-7}{5}-\frac{5}{7}\right|\le\frac{7}{5}+\frac{5}{7}$$
$$\left|\frac{-49-25}{35}\right|\le\frac{49+25}{35}$$
$$\left|\frac{-74}{35}\right|\le\frac{74}{35}$$
$$\frac{74}{35}\le\frac{74}{35}$$

Proved

10. (a) $x=-8,\ y=2$

$\therefore\quad |x+y|$
$|-8+2|$
$|-6|=6$

(b) $x=7,\ y=3$

$\therefore\quad |x-y|$ and $=|y-x|$
$=|7-3|$ $=|3-7|$
$=|4|$ $=|-4|$
$4=4$

Yes they are equal

Exercise 1.2

1. Find two rational numbers between :

(a) $-\frac{4}{5}$ and $-\frac{3}{7}$

$\because\quad \frac{-4}{5}=\frac{-4\times7}{5\times7}=\frac{-28}{35}$

And, $\frac{-3}{7}=\frac{-3\times5}{7\times5}=\frac{-15}{35}$

So, two rational numbers between $\frac{-4}{5}$ and $\frac{-3}{7}$ are $\frac{-20}{35}$ and $\frac{-25}{35}$.

(b) $-\frac{2}{3}$ and $-\frac{2}{5}$

$\because\quad \frac{-2}{3}=\frac{-2\times5}{3\times5}=\frac{-10}{15}$

And, $\frac{-2}{5}=\frac{-2\times3}{5\times3}=\frac{-6}{15}$

So, two rational numbers between $\frac{-2}{3}$ and $\frac{-2}{5}$ are $\frac{-7}{15}$ and $\frac{-8}{15}$.

2. Find five rational numbers between :

(a) $-\frac{3}{11}$ and $\frac{-1}{13}$

$\because\quad \frac{-3}{11}=\frac{-3\times13}{11\times13}=\frac{-39}{143}$

And, $\frac{-1}{13}=\frac{-1\times11}{13\times11}=\frac{-11}{143}$

So, five rational number between $-\frac{3}{11}$ and $\frac{-1}{13}$ are $\frac{-12}{143},\frac{-13}{143},\frac{-14}{143},\frac{-15}{143}$ and $\frac{-16}{143}$.

(b) $\frac{3}{8}$ and $\frac{-1}{2}$

$\because\quad \frac{3}{8}=\frac{3}{8}$ and $\frac{-1}{2}=\frac{-1\times4}{2\times4}=\frac{-4}{8}$

So, five rational number between $\frac{3}{8}$ and $\frac{-1}{2}$ are $\frac{2}{8},\frac{1}{8},\frac{-1}{8},\frac{-2}{8}$ and $\frac{-3}{8}$.

(c) $\frac{2}{3}$ and $\frac{3}{13}$

$\because\quad \frac{2}{3}=\frac{2\times13}{3\times13}=\frac{26}{39}$

And $\frac{3}{13}=\frac{3\times3}{13\times3}=\frac{9}{39}$

So, five rational numbers between $\frac{2}{3}$ and $\frac{3}{13}$ are $\frac{11}{39},\frac{12}{39},\frac{13}{39},\frac{14}{39}$ and $\frac{15}{39}$.

3. Find six rational numbers between :

(a) $\frac{7}{13}$ and $\frac{-4}{13}$

So, six rational numbers between $\frac{7}{13}$ and $\frac{-4}{13}$ are $\frac{6}{13},\frac{5}{13},\frac{4}{13},\frac{3}{13},\frac{2}{13}$ and $\frac{1}{13}$.

(b) $\frac{7}{11}$ and $\frac{8}{11}$

$\because\quad \frac{7}{11}=\frac{7\times10}{11\times10}=\frac{70}{110}$,

And $\frac{8}{11}=\frac{8\times10}{11\times10}=\frac{80}{110}$

So, six rational numbers between $\frac{7}{11}$ and $\frac{8}{11}$ are $\frac{71}{110},\frac{72}{110},\frac{73}{110},\frac{74}{110},\frac{75}{110}$ and $\frac{76}{110}$.

(c) $\frac{-10}{17}$ and $\frac{-11}{17}$

$\because\quad \frac{-10}{17}=\frac{-10\times10}{17\times10}=\frac{-100}{170}$

And $\frac{-11}{17}=\frac{-11\times10}{17\times10}=\frac{-110}{170}$

So, six rational numbers. between $\frac{-10}{17}$ and $\frac{-11}{17}$ are $\frac{-101}{170},\frac{-102}{170},\frac{-103}{170},\frac{-104}{170},\frac{-105}{170}$ and $\frac{-106}{170}$.

4. Find eight rational numbers between :

(a) $\frac{-3}{11}$ and $\frac{-2}{11}$

$\because\quad \frac{-3}{11}=\frac{-3\times10}{11\times10}=\frac{-30}{110}$

And, $\frac{-2}{11}=\frac{-2\times 10}{11\times 10}=\frac{-20}{110}$

So, eight rational numbers between $\frac{-3}{11}$ and $\frac{-2}{11}$ are $\frac{-29}{110},\frac{-28}{110},\frac{-27}{110},\frac{-26}{110},\frac{-25}{110},\frac{-24}{110},\frac{-23}{110}$ and $\frac{-22}{110}$.

(b) $\frac{10}{13}$ and $\frac{12}{13}$

$\because \quad \frac{10}{13}=\frac{10\times 5}{13\times 5}=\frac{50}{65}$

And, $\frac{12}{13}=\frac{12\times 5}{13\times 5}=\frac{60}{65}$

So, eight rational numbers between $\frac{10}{13}$ and $\frac{12}{13}$ are $\frac{51}{65},\frac{52}{65},\frac{53}{65},\frac{54}{65},\frac{55}{65},\frac{56}{65},\frac{57}{65}$ and $\frac{58}{65}$.

5. (a) Five rational numbers greater than -2 are $-1, 0, 1, 2, 3$

(b) Five rational numbers less than 2 are $1, 0, -1, -2, -3$

Exercise 1.3

1. Add.

(a) $\frac{7}{13}$ and $\frac{-9}{15}$

$\frac{7}{13}+\left(\frac{-9}{15}\right)$

$=\frac{7}{13}-\frac{9}{15}$

$=\frac{15\times 7-9\times 13}{195}$

$=\frac{105-117}{195}$

$=\frac{-\cancel{12}^{4}}{\cancel{195}_{65}}$

$=\frac{4}{65}$

(b) $\frac{-5}{19}$ and $\frac{-6}{57}$

$\frac{-5}{19}+\left(\frac{-6}{57}\right)$

$=\frac{-5}{19}-\frac{6}{57}$

$=\frac{-5\times 3-6\times 1}{57}$

$=\frac{-15-6}{57}$

$=\frac{-\cancel{21}^{7}}{\cancel{57}_{19}}$

$=\frac{-7}{19}$

(c) $\frac{4}{37}$ and $\frac{19}{105}$

$\frac{4}{37}+\frac{19}{105}$

$=\frac{4\times 105+19\times 37}{3885}$

$=\frac{420+703}{3885}$

$=\frac{1123}{3885}$

(d) $\frac{11}{17}$ and $\frac{6}{23}$

$\frac{11}{17}+\frac{6}{23}$

$=\frac{11\times 23+6\times 17}{391}$

$=\frac{253+102}{391}$

$=\frac{355}{391}$

2. Subtract :

(a) $\frac{-13}{14}$ from $\frac{-5}{7}$

$=\frac{-5}{7}-\left(\frac{-13}{14}\right)$

$=\frac{-5}{7}+\frac{13}{14}$

$=\frac{-5\times 2+13\times 1}{14}$

$=\frac{-10+13}{14}=\frac{3}{14}$

(b) $\frac{-8}{22}$ form $\frac{-3}{55}$

$=\frac{-3}{55}-\left(\frac{-8}{22}\right)$

$=\frac{-3}{55}+\frac{8}{22}$

$=\frac{-3\times 2+8\times 5}{110}$

$=\frac{-6+40}{110}$

$=\frac{34}{110}=\frac{17}{55}$

(c) $\frac{3}{5}$ from $\frac{1}{9}$

$\frac{1}{9}-\frac{3}{5}$

$=\frac{1\times 5-3\times 9}{45}$

$=\frac{5-27}{45}$

$=\frac{-22}{45}$

(d) $\frac{19}{15}$ from $\frac{7}{12}$

$\frac{7}{12}-\frac{19}{15}$

$=\frac{7\times 5-19\times 4}{60}$

$=\frac{35-76}{60}$

$=\frac{-41}{60}$

3. Simplify :

(a) $\frac{3}{8}-\left(\frac{-2}{7}\right)+\left(\frac{-4}{15}\right)$

$=\frac{3}{8}+\frac{2}{7}-\frac{4}{15}$

$=\frac{3\times 105+2\times 120-4\times 56}{840}$

$=\frac{315+240-224}{840}$

$=\frac{555-224}{840}$

$=\frac{331}{840}$

(b) $\frac{6}{19}+\left(\frac{-3}{57}\right)-\left(\frac{-12}{38}\right)$

$=\frac{6}{19}-\frac{3}{57}+\frac{12}{38}$

$=\frac{6\times 6-3\times 2+12\times 3}{114}$

$=\frac{36-6+36}{114}$

$=\frac{72-6}{114}$

$=\frac{66}{114}=\frac{11}{19}$

(c) $\frac{7}{12}+\frac{-5}{18}-\frac{13}{24}$

$=\frac{7}{12}-\frac{5}{18}-\frac{13}{24}$

$=\frac{7\times 6-5\times 4-13\times 3}{72}$

$=\frac{42-20-39}{72}$

$=\frac{42-59}{72}$

$=\frac{-17}{72}$

(d) $\frac{9}{4}-\frac{3}{7}-\left(\frac{-5}{6}\right)$

$=\frac{9}{4}-\frac{3}{7}+\frac{5}{6}$

$=\frac{9\times 21-3\times 12+5\times 14}{84}$

$=\frac{189-36+70}{84}$

$=\frac{259-36}{84}$

$=\frac{223}{84}=2\frac{55}{84}$

4. Find the product of :

(a) $\frac{-6}{17}\times\frac{34}{9}\times\left(\frac{-16}{-21}\right)$

$=\frac{-4}{3}\times\frac{-16}{-21}$

$=\frac{-64}{63}=-1\frac{1}{63}$

(b) $\frac{-13}{9}\times\frac{2}{7}\times\left(\frac{27}{-26}\right)$

$=\frac{2}{7}\times\frac{3}{2}$

$=\frac{3}{7}$

(c) $\frac{26}{19}\times\left(\frac{-51}{25}\right)\times\left(\frac{-125}{17}\right)$

$=\frac{26}{19}\times(-3)\times(-5)$

$=\frac{390}{19}$

$=20\frac{10}{19}$

(d) $\frac{3}{11}\times\frac{4}{3}\times\left(\frac{-121}{-12}\right)$

$=\frac{4}{11}\times\frac{-121}{-12}$

$=\frac{11}{3}$

$=3\frac{2}{3}$

5. Simplify :

(a) $\left(\frac{6}{11}\times\frac{4}{7}\right)-\left(\frac{9}{12}\times\frac{4}{3}\right)+\left(\frac{7}{8}\times\frac{64}{21}\right)$

$=\frac{24}{77}-\frac{1}{1}+\frac{8}{3}=\frac{24\times3-231\times1+8\times77}{231}$

$=\frac{72-231+616}{231}=\frac{688-231}{231}$

$=\frac{457}{231}=1\frac{226}{231}$

(b) $\left(-21\times\frac{5}{3}\right)-\left(-\frac{16}{9}\times\frac{21}{30}\right)$

$=\frac{-35}{1}-\left(\frac{-56}{45}\right)=\frac{-35}{1}+\frac{56}{45}=\frac{-35\times45+56\times1}{45}$

$=\frac{-1575+56}{45}=\frac{-1519}{45}=-33\frac{34}{45}$

(c) $\left(\frac{8}{5}\times\frac{-3}{2}\right)-\left(\frac{-3}{16}\times\frac{-11}{10}\right)$

$=\left(\frac{-12}{5}\right)-\left(\frac{33}{160}\right)=\frac{-12}{5}-\frac{33}{160}=\frac{-12\times32-33\times1}{160}$

$=\frac{-384-33}{160}=\frac{-417}{160}=-2\frac{97}{160}$

6. Divide :

(a) $\frac{26}{15}$ by $\frac{13}{5}$

$=\frac{26}{15}\div\frac{13}{5}$

$=\frac{26}{15}\times\frac{5}{13}$

$=\frac{2}{3}$

(b) -8 by $\frac{1}{2}$

$=-8\div\frac{1}{2}$

$=\frac{-8}{1}\times\frac{2}{1}$

$=-16$

(c) $\frac{60}{99}$ by -20

$=\frac{60}{99}\div\frac{-20}{1}$

$=\frac{60}{99}\times\frac{1}{-20}$

$=\frac{-3}{99}=\frac{-1}{33}$

(d) 0 by $\frac{-33}{53}$

$=0\div\frac{-33}{55}$

$=0\times\frac{55}{-33}$

$=\frac{0}{-33}=0$

(e) $\frac{-3}{4}$ by $\frac{-72}{-16}$

$=\frac{-3}{4}\div\frac{-72}{-16}$

$=\frac{-3}{4}\times\frac{-16}{-72}$

$=\frac{-4}{24}=\frac{-1}{6}$

(f) $\frac{8}{-4}$ by $\frac{90}{36}$

$=\frac{-8}{4}\div\frac{90}{36}$

$=\frac{-8}{4}\times\frac{36}{90}$

$=\frac{-72}{90}=\frac{-4}{5}$

7. Simplify :

(a) $\left(\frac{1}{3}\div\frac{1}{2}\right)+\frac{5}{6}$

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

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

$=\frac{2\times2+5\times1}{6}$

$=\frac{4+5}{6}=\frac{9}{6}$

$=\frac{3}{2}=1\frac{1}{2}$

(b) $\frac{2}{5}\div\left(\frac{-4}{5}\div\frac{3}{10}\right)$

$=\frac{2}{5}\div\left(\frac{-4}{5}\times\frac{10}{3}\right)$

$=\frac{2}{5}\div\left(\frac{-8}{3}\right)$

$=\frac{2}{5}\times\frac{3}{-8}$

$=\frac{6}{-40}$

$=\frac{-3}{20}$

8. Let x should be subtracted from $\frac{-5}{6}$ to get $\frac{-11}{9}$

So, $\frac{-5}{6}-x=\frac{-11}{9}$

or $\frac{-5}{6}+\frac{11}{9}=x$

or $x=\frac{11}{9}-\frac{5}{6}$

$=\frac{11\times2-5\times3}{18}=\frac{22-15}{18}=\frac{7}{18}$

So, $\frac{7}{18}$ should be subtracted from $\frac{-5}{6}$ to get $\frac{-11}{9}$.

9. Let x should be added to $\left(\frac{1}{3}+\frac{3}{5}\right)$ to get $\frac{-6}{20}$

so, $x+\frac{1}{3}+\frac{3}{5}=\frac{-6}{20}$

or $x=\frac{-6}{20}-\frac{1}{3}-\frac{3}{5}$

$x=\frac{-6\times3-1\times20-3\times12}{60}$

$x=\frac{-18-20-36}{60}$

$x=\frac{-74}{60}$

$x=\frac{-37}{30}$ or $-1\frac{7}{30}$

So, $-1\frac{7}{30}$ should be added.

10. Sum of two rational no. $=\frac{-5}{11}$

One No. $=\frac{3}{13}$

So, other No. $=\frac{-5}{11}-\frac{3}{13}$

$=\frac{-5\times13-3\times11}{143}$

$=\frac{-65-33}{143}=\frac{-98}{143}$

So, other no. will be $\frac{-98}{143}$.

11. Let x should be subtracted from $\left(\frac{5}{6}-\frac{2}{3}\right)$ to get $\frac{-7}{18}$.

So, $\left(\frac{5}{6}-\frac{2}{3}\right)-x=\frac{-7}{18}$

or $\frac{5}{6}-\frac{2}{3}+\frac{7}{18}=x$

or $x=\frac{5}{6}-\frac{2}{3}+\frac{7}{18}$

$$= \frac{5\times 3-2\times 6+7\times 1}{18} = \frac{15-12+7}{18}$$
$$= \frac{22-12}{18} = \frac{10}{18} = \frac{5}{9}$$

So, $\frac{5}{9}$ should be subtracts from $\left(\frac{5}{6}-\frac{2}{3}\right)$ to get $\frac{-7}{18}$.

12. Product of two no. $= \frac{-5}{16}$

One no.$= \frac{4}{18}$

other no. will be $= \frac{-5}{16} \div \frac{4}{18} = \frac{-5}{16} \times \frac{18}{4}$

$$= \frac{-45}{32} = -1\frac{13}{32}$$

so, the other No. will be $= -1\frac{13}{32}$.

13. Let x should be multiplied with $\frac{-1}{6}$ to get product $= \frac{-17}{9}$.

So, $x \times \frac{-1}{6} = \frac{-17}{9}$

or $x = \frac{-17}{9} \div \frac{-1}{6}$

or $x = \frac{-17}{9} \times \frac{-6}{1}$

$x = \frac{34}{3}$ or $11\frac{1}{3}$

So, $11\frac{1}{3}$ should be multiplied with $\frac{-1}{6}$ to get product $\frac{-17}{9}$.

4. Sum $\left(\frac{1}{3}+\frac{-2}{5}-\frac{4}{15}\right) = \frac{1}{3}-\frac{2}{5}-\frac{4}{15}$

$$= \frac{1\times 5-2\times 3-4\times 1}{15}$$
$$= \frac{5-6-4}{15} = \frac{5-10}{15}$$
$$= \frac{-5}{15} = \frac{-1}{3}$$

difference $= \frac{6}{7}-\frac{3}{5}$

$$= \frac{6\times 5-3\times 7}{35}$$
$$= \frac{30-21}{35} = \frac{9}{35}$$

Now, sum ÷ difference $= \frac{-1}{3} \div \frac{9}{35} = \frac{-1}{3} \times \frac{35}{9}$

$$= \frac{-35}{27} = -1\frac{8}{27}$$

15. Cost of $7\frac{1}{3}$ m of fabric $= ₹\ 30\frac{1}{4}$

or Cost of $\frac{22}{3}$ m of fabric $= ₹\ \frac{121}{4}$

or Cost of 1 m of fabric $= \frac{121}{4} \div \frac{22}{3}$

or Cost of 12 m of fabric $= \frac{121}{4} \div \frac{22}{3} \times 12$

$$= \frac{121}{4} \times \frac{3}{22} \times 12$$
$$= \frac{99}{2} = ₹\ 49\frac{1}{2}$$

So, the cost of 12 m of fabric is ₹ $49\frac{1}{2}$

16. A container of capacity $5\frac{1}{2}$ L fills in $= 20\frac{1}{3}$ sec.

or A container of capacity $\frac{11}{2}$ L fills in $= \frac{61}{3}$ sec

or A container of capacity 1 L fills in $= \frac{61}{3} \div \frac{11}{2}$ sec

or container of capacity $17\frac{1}{2}$ L fills in $= \frac{61}{3} \div \frac{11}{2} \times 17\frac{1}{2}$ sec

$$= \frac{61}{3} \div \frac{11}{2} \times \frac{35}{2} \text{ sec}$$
$$= \frac{61}{3} \times \frac{2}{11} \times \frac{35}{2} \text{ sec}$$
$$= \frac{2135}{33} = 64\frac{23}{33} \text{ sec.}$$

17. Speed of train $= 60\frac{1}{2}$ km/hr $= \frac{121}{2}$ km/hr

time $= 10\frac{1}{2}$ hour and $\frac{45}{2}$ min

or $= \frac{21}{2}$ hour $+ \frac{45}{2} \times \frac{1}{60}$ hr

$$= \frac{21}{2} + \frac{3}{8} \text{ hr} = \frac{21\times 4+3\times 1}{8}$$
$$= \frac{84+3}{8} = \frac{87}{8} \text{ hr}$$

So, distance $=$ speed $\times$ time

$$= \frac{121}{2} \times \frac{87}{8} = \frac{10527}{16} \text{ km}$$
$$= 657\frac{15}{16} \text{ km}$$

So, the train will travell $657\frac{15}{16}$ km in $10\frac{1}{2}$ hours and $\frac{45}{2}$ minutes.

18. Distance $= 1000$ km 400 m $= 1000.4$ km

time $= 15\frac{1}{2}$ hours $+ 30$ minutes

$$= \frac{31}{2} \text{ hours} + \frac{30}{60} \text{ hours}$$
$$= \frac{31}{2} + \frac{1}{2} \text{ hr} = \frac{31+1}{2} \text{ hr}$$
$$= \frac{32}{2} \text{ hr} = 16 \text{ hr}$$

Speed $= \frac{\text{distance}}{\text{time}}$

$$= \frac{1000.4 \text{ km}}{16 \text{ hr}}$$
$$= \frac{10004}{16\times 10}$$
$$= \frac{2501}{40} \text{ km/hr}$$

So, the speed of train is $62\frac{21}{40}$ km/hr.

19. cost of 12 shirts $= ₹\ 3600\frac{2}{5} = ₹\ \frac{18002}{5}$

Cost of 1 shirt $= ₹\ \frac{18002}{5\times 12} = \frac{9001}{30}$

cost of 4 shirt $= \frac{9001}{30}\times 4 = ₹\ \frac{18002}{15}$

cost of 6 pants $= ₹\ 3000\frac{3}{4} = ₹\ \frac{12003}{4}$

cost of 1 pants $= ₹\ \frac{12003}{4\times 6}$

cost of 4 paints $= ₹\ \frac{12003\times 4}{4\times 6}$

$= ₹\ \frac{4001}{2}$

So, total cost of 4 shirts and 4 paints

$= ₹\ \frac{18002}{15} + \frac{4001}{2}$

$= ₹\ \frac{18002\times 2 + 4001\times 15}{30}$

$= ₹\ \frac{36004 + 60015}{30}$

$= ₹\ \frac{96019}{30}$

$= ₹\ 3200\frac{19}{30}$

20. For I seller :

Price of 5 pens $= ₹\ 55\frac{1}{3}$

Price of 5 pens $= ₹\ \frac{166}{3}$

Price of 1 pens $= ₹\ \frac{166}{3\times 5} = ₹\ \frac{166}{15}$

Price of 7 pencils $= ₹\ 14\frac{2}{3} = ₹\ \frac{44}{3}$

Price of 1 pencil $= ₹\ \frac{44}{3\times 7} = ₹\ \frac{44}{21}$

For II seller :

Price of 7 pens $= ₹\ 78\frac{2}{5} = ₹\ \frac{392}{5}$

Price of 1 pen $= ₹\ \frac{392}{5\times 7} = ₹\ \frac{56}{5}$

Price of 5 pencils $= ₹\ 10\frac{3}{4} = ₹\ \frac{43}{4}$

Price of 1 pencil $= ₹\ \frac{43}{4\times 5} = ₹\ \frac{43}{20}$

Now, for I seller

cost of both items $= \frac{166}{15} + \frac{44}{21}$

$= \frac{166\times 7 + 44\times 5}{105}$

$= \frac{1162 + 220}{105} = ₹\ \frac{1382}{105}$

and for II seller

cost of both items $= \frac{56}{5} + \frac{43}{20}$

$= \frac{224 + 43}{20} = \frac{267}{20}$

On. comparing $\frac{1382}{105} \quad \frac{267}{20}$

$\because \quad 27640 < 28035$

So, we should buy from I seller.

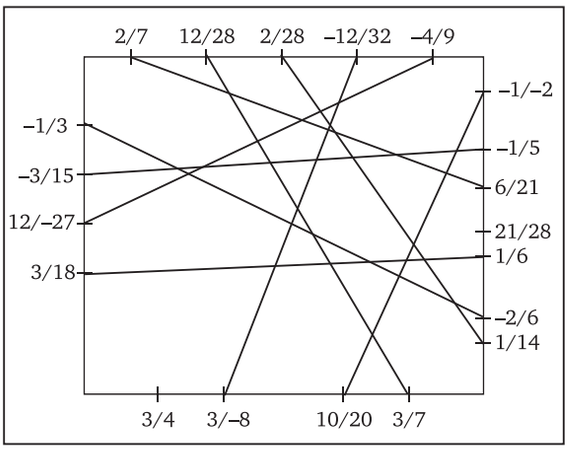
MCQ's

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

11. (b) **12. 13.** (d) **14.** (d) **15.** (d)

NEP Computational and Analytical Thinking

- **Join equivalent rational numbers given on the boundary of this rectangle, to win two stars.**



HOTS

- A lotus grows every day = double of its size

  $\because$ Lotus flower covers half of the pond = in five days.

  $\therefore$ Lotus grows double in 6th day.

  So, the lotus flowr will cover the full pond in six days.

- Let, the weight of the empty glass be x kg.

  And, the weight of full glass juice be y kg.

  $\because$ The weight of a glass full of juice = 1 kg.

  $\therefore \quad x + y = 1 \qquad \ldots(1)$

  And, the weight of half glass of juice $= \frac{3}{4}$ kg

  $\therefore \quad x + \frac{y}{2} = \frac{3}{4}$

  $\frac{2x + y}{2} = \frac{3}{4}$

  $2x + y = \frac{3}{4}$

  By equation (1) and equation (2)

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

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

  $x = \frac{1}{2}$

  Hence, the weight of the empty glass is $\frac{1}{2}$ kg.

Chapter 2

Powers

Exercise 2.1

1. Simplify and write the answer in power notation with positive exponents.

(a) $(2)^5 \times (-6)^{-5}$

$= (2)^5 \times \left(\frac{1}{-6}\right)^5$

$= \left(\frac{2\times 1}{-2\times 6}\right)^5$

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

(b) $\left\{\left(\frac{3}{2}\right)^4\right\}^{-2}$

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

$= \left(\frac{3}{2}\right)^{-8}$

$= \left(\frac{2}{3}\right)^8$

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

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

$= (-3)^4$

(d) $(5^{-7} \div 5^{-10}) \times 5^{-3}$

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

$= 5^{-7+10-3}$

$= 5^0 = 1$

(e) $(-3)^7 \div (-3)^9$

$= (-3)^{7-9} = (-3)^{-2}$

$= \left(\frac{1}{-3}\right)^2$ or $\left(\frac{-1}{3}\right)^2$

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

$= \frac{1}{4^{3\times 2}}$

$= \frac{1}{4^6} = \left(\frac{1}{4}\right)^6$

2. Simplify :

(a) $\{6^{-1} - 5^{-1}\} \div 3^{-1}$

$= \left\{\frac{1}{6} - \frac{1}{5}\right\} \div \frac{1}{3}$

$= \left\{\frac{5-6}{30}\right\} \div \frac{1}{3}$

$= \frac{-1}{30} \div \frac{1}{3}$

$= \frac{-1}{30} \times \frac{3}{1} = \frac{-1}{10}$

(b) $\{(3^{-1} \times 4^{-1})\}^{-1} \times 5^{-1}$

$= \left\{\frac{1}{3} \times \frac{1}{4}\right\}^{-1} \times 5^{-1}$

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

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

$= \frac{12}{5}$

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

$= \{27-8\} \div 64 = \frac{19}{64}$

(d) $\left\{\left(\frac{1}{3}\right)^{-1} \times (-9)^{-1}\right\}^{-1} = \left\{\left(\frac{3}{1}\right)^1 \times \left(\frac{-1}{9}\right)\right\}^{-1} = \left(\frac{-1}{3}\right)^{-1}$

$= (-3)^1 = -3$

3. Evaluate :

(a) $\{(2^0 + 3^{-1}) \times 9^2\}$

$= \left\{\left(1+\frac{1}{3}\right) \times 81\right\}$

$= \left\{\frac{4}{3} \times 81\right\} = 4 \times 27 = 108$

(b) $(2^{-1} + 3^{-1} + 4^{-1})^0$

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

$= \left(\frac{6+4+3}{12}\right)^\circ$

$= \left(\frac{13}{12}\right)^\circ = 1$

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

$= 9 + 4 + 16 = 29$

(d) $(3^2 + 4^2)^{-1/2} = (9+16)^{-\frac{1}{2}} = (25)^{-\frac{1}{2}}$

$= (5^2)^{-\frac{1}{2}}$

$= 5^{2\times\frac{-1}{2}}$

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

(e) $\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}} = \frac{3^{-5} \times (2\times 5)^{-5} \times 5^3}{5^{-7} \times (2\times 3)^{-5}}$

$= 5^3 \times 5^2$

$= 5\times 5\times 5\times 5\times 5 = 3125$

(f) $(1^3 + 2^3 + 3^3)^{-5/2} = (1+8+27)^{-\frac{5}{2}}$

$= (36)^{-\frac{5}{2}}$

$= (6^2)^{-\frac{5}{2}} = 6^{-5}$

$= \left(\frac{1}{6}\right)^5 = \frac{1}{7776}$

4. Let x should be multiplied by $(-5)^{-1}$ so that product is equal to $(11)^{-1}$

$x \times (-5)^{-1} = (11)^{-1}$

$x = \frac{(11)^{-1}}{(-5)^{-1}}$

$x = \frac{-5}{11}$

Hence, the required number is $\frac{-5}{11}$.

5. Let $(-12)^{-1}$ should be divided by x so that quotient is equal to $(-4)^{-1}$.

So, $(-12)^{-1} \div x = (-4)^{-1}$

$(-12^{-1}) \div (-4)^{-1} = x$

$x = \dfrac{(-12)^{-1}}{(-4)^{-1}}$

$x = \dfrac{1}{-12} \times \dfrac{-4}{1} = \dfrac{1}{3}$

Hence, the required number is $\dfrac{1}{3}$.

6. Let x should be multiplied by $\left(\dfrac{2}{7}\right)^{-2}$ so that the product is equal to $\left(\dfrac{5}{7}\right)^{-1}$.

So, $x \times \left(\dfrac{2}{7}\right)^{-2} = \left(\dfrac{5}{7}\right)^{-1}$

$x \times \left(\dfrac{7}{2}\right)^{2} = \left(\dfrac{7}{5}\right)^{1}$

or $x = \dfrac{7 \times 2 \times 2}{7 \times 7 \times 5}$

$x = \dfrac{4}{35}$

Hence, the required number is $\dfrac{4}{35}$.

7. Find the value of x in each of the following.

(a) $\left(\dfrac{4}{5}\right)^{3x+1} \times \left(\dfrac{4}{5}\right)^{-15} = \left(\dfrac{4}{5}\right)^{x}$

or $\left(\dfrac{4}{5}\right)^{3x+1+(-15)} = \left(\dfrac{4}{5}\right)^{x}$

$\left(\dfrac{4}{5}\right)^{3x+1-15} = \left(\dfrac{4}{5}\right)^{x}$

$\therefore \quad 3x + 1 - 15 = x$

$3x - x = 15 - 1$

$2x = 14$

$x = \dfrac{14}{2}$

So, $x = 7$

(b) $\left(\dfrac{3}{5}\right)^{-3} \times \left(\dfrac{3}{5}\right)^{10} = \left(\dfrac{3}{5}\right)^{3x+1}$

or $\left(\dfrac{3}{5}\right)^{-3+10} = \left(\dfrac{3}{5}\right)^{3x+1}$

or $\left(\dfrac{3}{5}\right)^{7} = \left(\dfrac{3}{5}\right)^{3x+1}$

$\therefore \quad 3x + 1 = 7$

$3x = 7 - 1$

$3x = 6$

$x = \dfrac{6}{3}$

So, $x = 2$

(c) $\left(\dfrac{2}{3}\right)^{-4} \times \left(\dfrac{2}{3}\right)^{-8} = \left(\dfrac{2}{3}\right)^{4x}$

or $\left(\dfrac{2}{3}\right)^{-4+(-8)} = \left(\dfrac{2}{3}\right)^{4x}$

$\left(\dfrac{2}{3}\right)^{-4-8} = \left(\dfrac{2}{3}\right)^{4x}$

$\left(\dfrac{2}{3}\right)^{-12} = \left(\dfrac{2}{3}\right)^{4x}$

$\therefore \quad 4x = -12$

$x = \dfrac{-12}{4}$

So, $x = -3$

(d) $\left(\dfrac{2}{7}\right)^{-17} \div \left(\dfrac{2}{7}\right)^{8} = \left(\dfrac{2}{7}\right)^{2x+1}$

$\left(\dfrac{2}{7}\right)^{-17-8} = \left(\dfrac{2}{7}\right)^{2x+1}$

$\left(\dfrac{2}{7}\right)^{-25} = \left(\dfrac{2}{7}\right)^{2x+1}$

$\therefore \quad 2x + 1 = -25$

$2x = -25 - 1$

$2x = -26$

$x = \dfrac{-26}{2}$

So, $x = -13$

Exercise 2.2

1. (a) Speed of light = 300,000,000 m/sec

or 3.0×10^{8} m/sec

(b) Thickness of normal paper = 0.007 cm

or 7.0×10^{-3} cm

(c) Size of bacteria = 0.0000005 m

or 5.0×10^{-7} m

(d) 1. micron is equal to = 0.000001 m

or 1.0×10^{-6} m

(e) The population of a certain country = 885396000

or 8.85396×10^{8}

(f) Diameter of a wire = 0.000003 m

$= 3.0 \times 10^{-6}$ m

(g) The distance of the moon from the earth

= 384,460,000 m

or 3.8446×10^{8} m

(h) size of plant cell = 0.00000001275 km

$= 1.275 \times 10^{-8}$ km

(i) Distance of the sun from the earth = 149,600,000 km

$= 1.496 \times 10^{8}$ km

(j) Radius of the earth = 63780000 m

$= 6.378 \times 10^{7}$ m

2. Express the following in the usual form.

(a) 1.732×10^{8} or 173200000

(b) 9.7137×10^{13} or 97137000000000

(c) 4.01853×10^{7} or 40185300

(d) 1.31×10^{-9} or 0.00000000131

(e) 5.3×10^{-13} or 0.00000000000053

(f) 8.37×10^{-6} or 0.00000837

3. Express the following numbers in standard form.

(a) 2,43,00,00,00,000 $= 2.43 \times 10^{11}$

(b) 89,00,00,00,000 $= 8.9 \times 10^{10}$

(c) 16,70,000 $= 1.67 \times 1000000$ or $= 1.67 \times 10^{6}$

(d) 0.0000000029 or $= 2.9 \times 10^{-9}$

(e) 0.00000000007 or 7.0×10^{-11}

(f) 0.00000037 or 3.7×10^{-7}

4. Diameter of sun $= 1.4 \times 10^{9}$ m

Diameter of earth $= 1.275 \times 10^{7}$ m

$\therefore$ Sum : earth $= 1.4 \times 10^{9} : 1.275 \times 10^{7}$

$= 1400000000 : 12750000$

$= 5600 : 51$

5. Thickness of each page $= 0.000075$ m

Thickness of 500 pages $= 500 \times 0.000075$ m

$= 0.0375$ m

So, thickness of stack of 7 books

$= 7 \times 0.0375$ m

$= 0.2625$ m

6. Size of plant cell $= 0.00001275$ m

Size of red blood cell $= 0.000007$ m

So, plant cell : red blood cell $= \dfrac{0.00001275M \times 100000000}{0.000007M \times 100000000}$

$= \dfrac{1275}{700} = 51 : 28$

MCQs

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

Mental Maths

1. $\dfrac{a}{b}$ **2.** 10 **3.** 1 **4.** 1 **5.** 0.0797355

HOTS

- $a^{-1} + b^{-1} = 2^{-1}$ and $a + b = 10$, find $a \times b$

we have $a^{-1} + b^{-1} = 2^{-1}$

or $\dfrac{1}{a} + \dfrac{1}{b} = \dfrac{1}{2}$

or $\dfrac{a+b}{ab} = \dfrac{1}{2}$

or $ab = 2(a+b)$

or $ab = 2 \times 10$ $\because$ $(a+b=10)$

so $a \times b = 20$

LHS $= a^{x^2-y^2} \times a^{y^2-z^2} \times a^{z^2-x^2}$

or $a^{x^2-y^2+y^2-z^2+z^2-x^2}$

$a^{0} = 1$ R.H.S. **Proved**

Chapter 3

Square and Square Roots

Mental Maths

1.

$11^2 = 121$

$101^2 = 10201$

$1001^2 = 1002001$

$100001^2 = 10000200001$

$100001^2 = 100000020000001$

2. (a) $35^2 = 3 \times (3+1)$ hundreds $+ 25 = 1225$

(b) $75^2 = 7 \times (7+1)$ hundreds $+ 25 = 625$

(c) $115^2 = 11 \times (11+1)$ hundreds $+ 25 = 13225$

(d) $205^2 = 20 \times (20+1)$ hundreds $+ 25 = 42025$

Exercise 3.1

1. (a) false (b) false (c) false (d) false (e) true (f) true

2. (a) $(8+7) = 15$

(b) $(19+18) = 37$

(c) $(35+34) = 69$

(d) $(136+135) = 271$

3. Is 1764 a perfect square?

17642

By prime factorisation

$1764 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

Here, all the factors of 1764 are paired.

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

So, 1764 is a perfect square.

4. Is 1228 a perfect square?

By prime factorisation

2	1228
2	614
307	307
	1

$1228 = \underline{2 \times 2} \times 307$

Here, 307 is unpaired.

So, 1228 is not perfect square.

5. (a) (12, 5, 13)

Here, we have $a = 12$, $b = 5$, $c = 13$

or $c^2 = a^2 + b^2$

$13^2 = 12^2 + 5^2$

$13 \times 13 = 12 \times 12 + 5 \times 5$

$169 = 144 + 25$

$169 = 169$

So it is pythagorean triplet.

(b) (6, 7, 8)

Here, we have $a = 6$, $b = 7$, $c = 8$

or $c^2 = a^2 + b^2$

$8^2 = 6^2 + 7^2$

$64 = 36 + 49$

$\because$ $64 \neq 85$

So, it is not pythagorean triplet.

(c) (18, 80, 82)

Here, we have $a = 18, b = 80, c = 82$

or $c^2 = a^2 + b^2$

$= 82 \times 82$

$= 18 \times 18 + 80 \times 80$

$6724 = 324 + 6400$

$6724 = 6724$

So, it is pythagorean triplet.

6. (a) 4900

By prime factorisation

$4900 = \underline{2 \times 2} \times \underline{5 \times 5} \times \underline{7 \times 7}$

Here, all the factors of 4900 are paired.

So, 4900 is a perfect square.

2	4900
2	2450
5	1225
5	245
7	49
7	7
	1

(b) 6400

By prime factorisation

$6400 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5}$

Here, all the factors of 6400 are paired.

So, 6400 is a perfect square

2	6400
2	3200
2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

(c) 351

By prime factorisation

$351 = \underline{3 \times 3} \times 3 \times 13$

Here, 3 and 13 are unpaired.

So, 351 is not perfect square.

3	357
3	117
3	39
13	13
	1

(d) 160000

By prime factorisation

$160000 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5} \times \underline{5 \times 5}$

Here, all the factors of 160000 are paired.

So, 160000 is a perfect square.

2	160000
2	80000
2	40000
2	20000
2	10000
2	5000
2	2500
2	1250
5	625
5	125
5	25
5	5
	1

7. Check out which of the following perfect squares are squares of even numbers?

(a) 676

$\because$ It is an even no.

So, 676 is the perfect square of even no.

(b) 841

$\because$ It is an odd no.

So, 841 is not the perfect square of an even no.

(c) 333

$\because$ It is an odd no.

So, 333 is not the perfect Square of an even no.

(d) 225

$\because$ It is an odd no.

So, 225 is not the perfect Square of an even no.

8. Check out which of the following perfect squares are square of odd numbers?

(a) 841

$\because$ It is an odd no.

So, 841 is the perfect square of an odd no.

(b) 729

$\because$ It is an odd no.

So, 729 is the perfect square of an odd no.

(c) 484

$\because$ It is an even no.

So, 484 is not the perfect square of an odd no.

(d) 6400

$\because$ It is an even no.

So, 6400 is not the perfect square of an odd no.

9. Check out which of the following numbers are not perfect squares?

(a) 169000

By prime factorisation

$169000 = \underline{2 \times 2} \times 2 \times \underline{5 \times 5} \times 5 \times \underline{13 \times 13}$

Here 2 and 5 are 4 paired.

So, it is not a perfect square.

2	169000
2	84500
2	42250
5	21125
5	4225
5	845
13	169
13	13
	1

(b) 1000
By prime factorisation

$1000 = \underline{2\times 2}\times 2\times \underline{5\times 5}\times 5$

Here 2 and 5 are unpaired.
So, it is not a perfect square

2	1000
2	500
2	250
5	125
5	25
5	5
	1

(c) 625
By prime factorisation

$625 = \underline{5\times 5}\times \underline{5\times 5}$

Here, all the factors of 625 are paired.
So, 625 is a perfect square.

5	625
5	125
5	25
5	5
	1

(d) 1296
By prime factorisation

$1296 = \underline{2\times 2}\times \underline{2\times 2}\times \underline{3\times 3}\times \underline{3\times 3}$

Here, all the factors of 1296 are paired.
So, 1296 is a perfect square.

2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

10. (a) $1+3+5+7 = 4\times 4 = 16$

(b) $1+3+5+7+9+11 = 6\times 6 = 36$

(c) $1+3+5+7+9+11+13+15+17+19 = 10\times 10 = 100$

11. (a) $(52)^2 = (5^2+2)\text{ hundred} + (2)^2$
$= (25+2)\text{ hundred} + 4$
$= 27\times 100 + 4$
$= 2700 + 4 = 2704$

(b) $(57)^2 = (5^2+7)\text{ hundred} + (7)^2$
$= (25+7)\text{ hundred} + 49$
$= 32\times 100 + 49$
$= 3200 + 49$
$= 3249$

(c) $(51)^2 = (5^2+1)\text{ hundred} + (1)^2$
$= (25+1)\text{ hundred} + 1$
$= 26\times 100 + 1$
$= 2600 + 1$
$= 2601$

(d) $(58)^2 = (5^2+8)\text{ hundred} + (8)^2$
$= (25+8)\text{ hundred} + 64$
$= 33\times 100 + 64$
$= 3300 + 64$
$= 3364$

HOTS

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

81 $= 9^2 = 1+3+5+7+9+11+13+15+17$

Exercise 3.2

1. (a) $\sqrt{81}$

$81-1=80,\quad 80-3=77,\quad 77-5=72$
$72-7=65,\quad 65-9=56,\quad 56-11=45$
$45-13=32,\quad 32-15=17,\quad 17-17=0$

This subtracting process is done in 9 times
So, $\sqrt{81}=9$

(b) $\sqrt{121}$

$121-1=120,\quad 120-3=117,\quad 117-5=112$
$112-7=105,\quad 105-9=96,\quad 96-11=85$
$85-13=72,\quad 72-15=57,\quad 57-17=40$
$40-19=21,\quad 21-21=0$

This subtracting process is done in 11 times.
So, $\sqrt{121}=11$

(c) $\sqrt{169}$

$169-1=168,\quad 168-3=165,\quad 165-5=160$
$160-7=153,\quad 153-9=144,\quad 144-11=133$
$133-13=120,\quad 120-15=105,\quad 105-17=88$
$88-19=69,\quad 69-21=48,\quad 48-23=25$
$25-25=0$

Here, this subtracting process is done in 13 times
So, $\sqrt{169}=13$

2. Find the square root of the following numbers by prime factorization method :

(a) $\sqrt{625}$
So, $\sqrt{625} = \sqrt{5\times 5\times 5\times 5}$
$= 5\times 5$
$= 25$

5	625
5	125
5	25
5	5
	1

(b) 729
So, $\sqrt{729} = \sqrt{3\times 3\times 3\times 3\times 3\times 3}$
$= 3\times 3\times 3$
$= 27$

3	729
3	243
3	81
3	27
3	9
3	3
	1

(c) $\sqrt{1296}$

So, $\sqrt{1296}$
$= \sqrt{\underline{2\times 2}\times \underline{2\times 2}\times \underline{3\times 3}\times \underline{3\times 3}}$
$= 2\times 2\times 3\times 3$
$= 36$

2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

(d) $\sqrt{4096}$

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

So, $\sqrt{4096} = \sqrt{\underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}}$

$= 2\times 2\times 2\times 2\times 2\times 2$

$= 64$

(e) $\sqrt{7744}$

2	7744
2	3872
2	1936
2	968
2	484
2	242
11	121
11	11
	1

So, $\sqrt{7744}$

$= \sqrt{\underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}\times\underline{11\times 11}}$

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

$= 88$

(f) $\sqrt{5929}$

7	5929
7	847
11	121
11	11
	1

So, $\sqrt{5929}$

$= \sqrt{\underline{7\times 7}\times\underline{11\times 11}}$

$= 7\times 11$

$= 77$

3. (a) $\sqrt{\frac{529}{841}}$

23	529
23	23
	1

29	841
29	29
	1

So, $\sqrt{\frac{529}{841}} = \sqrt{\frac{23\times 23}{29\times 29}} = \frac{23}{29}$

(b) $\sqrt{2\frac{14}{25}} = \sqrt{\frac{64}{25}}$

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

5	25
5	5
	1

So, $\sqrt{\frac{64}{25}} = \sqrt{\frac{\underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}}{5\times 5}}$

$= \frac{2\times 2\times 2}{5} = \frac{8}{5} = 1\frac{3}{5}$

(c) $\sqrt{23\frac{26}{121}} = \sqrt{\frac{2809}{121}}$

53	2809
53	53
	1

11	121
11	11
	1

$= \sqrt{\frac{53\times 53}{11\times 11}}$

$= \frac{53}{11} = 4\frac{9}{11}$

4. 1890

Prime factorisation of 1890 :

$1890 = 2\times\underline{3\times 3}\times 3\times 5\times 7$

Here 2, 3, 5 and 7 have no pair.

So, $2\times 3\times 5\times 7 = 210$ should be multiplied.

2	1890
3	945
3	315
3	105
5	35
7	7
	1

5. 9408

Prime factorisation of 1890 :

$9408 = \underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}\times 3\times\underline{7\times 7}$

Here, 3 has no. pair

So, 9408 should be divided by 3 to make a perfect square.

2	9408
2	4704
2	2352
2	1176
2	588
2	294
3	147
7	49
7	7
	1

6. 1200

Prime factorisation of 1890 :

$1200 = \underline{2\times 2}\times\underline{2\times 2}\times 3\times\underline{5\times 5}$

Here, 3 has no. pair

So, 1200 should be divided by 3 to become a perfect square.

2	1200
2	600
2	300
2	150
3	75
5	25
5	5
	1

7. 3645

Prime factorisation of 3645 :

$3645 = \underline{3\times 3}\times\underline{3\times 3}\times\underline{3\times 3}\times 5$

Here 5 has no. pair

So, 3645 must be divided by 5 to make a perfect square.

3	3645
3	1215
3	405
3	135
3	45
3	15
5	5
	1

8. Let students in class $= x$

Each student donate $= x$

So total rupees $= x\times x = 5184$

or $x^2 = 5184$

$x = \sqrt{5184}$

$= \sqrt{\underline{2\times 2}\times\underline{2\times 2}\times\underline{2\times 2}\times\underline{3\times 3}\times\underline{3\times 3}}$

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

$= 72$

So, there are 72 students in the class.

2	5184
2	2592
2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

9. $8160-60=8100$ soldiers arranged.
Let's number of rows $=x$
And number of soldiers in each row $=x$
So, $x=\sqrt{8100}$
$=\sqrt{2\times2\times3\times3\times3\times3\times5\times5}$
$=2\times3\times3\times5$
$=90$
So, there are 90 soldiers arranged in each row.

2	8100
2	4050
3	2025
3	675
3	625
3	75
5	25
5	5
	1

10. Let No. of rows $=x$
No. of trees in each row $=x$
So, total Mango trees $=x\times x=2304$
$x^2=2304$
$x=\sqrt{2304}$
$=\sqrt{2\times2\times2\times2\times2\times2\times2\times2\times3\times3}$
$=2\times2\times2\times2\times3$
$=48$
So, there are 48 rows in the garten.

2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

11. Let's No. of team $=x$
No. of soldiers in each team $=x$
So, total soldiers
$x\times x=6561$
$x^2=6561$
$x=\sqrt{6561}$
$=\sqrt{3\times3\times3\times3\times3\times3\times3\times3}$
$=3\times3\times3\times3$
$=81$
So, there are 81 soldiers in each team.

3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

12. Let's No. of rows in the garden $=x$
No. of trees in each row $=x$
So, total no. of trees in the garden
$x\times x=1764$
or $x^2=1764$
or $x=\sqrt{1764}$
$x=\sqrt{2\times2\times3\times3\times7\times7}$
$=2\times3\times7$
$=42$
So, there are 42 rows in the garden.

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

13. Let's No. of soldiers in each row $=x$
No. of rows $=x$
So total soldiers $=x\times x=6400$
$x^2=6400$
$x=\sqrt{6400}$
$=\sqrt{2\times2\times2\times2\times2\times2\times2\times2\times5\times5}$
$=2\times2\times2\times2\times5$
$=80$
So, there are 80 soldiers in each row.

2	6400
2	3200
2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

Exercise 3.3

1. (a) $\sqrt{18225}$

	135
1	$\overline{1}\ \overline{82}\ \overline{25}$
	1
23	82
	69
265	1325
	1325
	×

So, $\sqrt{18225}=135$

(b) $\sqrt{390625}$

	625
6	$\overline{39}\ \overline{06}\ \overline{25}$
	36
122	3 06
	2 44
1245	62 25
	62 25
	×

So, $\sqrt{390625}=625$

(c) $\sqrt{291600}$

	540
5	$\overline{29}\ \overline{16}\ \overline{00}$
	25
104	4 16
	4 16
1080	00
	00
	×

So, $\sqrt{291600}=540$

2. (a) $\sqrt{\frac{324}{841}}$

	18
1	$\overline{3}\ \overline{24}$
	1
28	224
	224
	×

	29
2	$\overline{8}\ \overline{41}$
	4
49	441
	441
	×

So, $\sqrt{\frac{324}{841}}=\frac{18}{29}$

(b) $\sqrt{75\frac{46}{49}}=\sqrt{\frac{3721}{49}}$

	61
6	$\overline{37}\ \overline{21}$
	36
121	121
	121
	×

	7
7	$\overline{49}$
	49
	×

So, $\sqrt{\frac{3721}{49}}=\frac{61}{7}$
$=8\frac{5}{7}$

(c) $\sqrt{10\frac{151}{225}} = \sqrt{\frac{2401}{225}}$

So, $\sqrt{\frac{2401}{225}} = \frac{49}{15}$

$= 3\frac{4}{15}$

	49
4	$\overline{24}\,\overline{01}$
	16
89	8 01
	8 01
	×

	15
1	$\bar{2}\,\overline{25}$
	1
25	125
	125
	×

3. (a) $\sqrt{37.0881}$

So, $\sqrt{37.0881}$
$= 6.09$

	6.09
6	$\overline{37}.\overline{08}\,\overline{81}$
	36
120	1 08
	00
1209	1 0881
	1 0881
	×

(b) $\sqrt{0.00002025}$

So, $\sqrt{0.00002025}$
$= 0.0045$

	0.0045
0	$0.\overline{00}\,\overline{00}\,\overline{20}\,\overline{25}$
	0
0	00
	00
0	00
	00
4	20
	16
85	425
	425
	×

(c) $\sqrt{0.00038809}$

So, $\sqrt{0.00038809}$
$= 0.0197$

	0.0197
1	$0.\overline{00}\,\overline{03}\,\overline{88}\,\overline{09}$
	1
29	288
	261
387	2709
	2709
	×

4. (a) $\sqrt{7}$

So, $\sqrt{7} = 2.645$
or 2.65

	2.645
2	$\overline{7.00}\,\overline{00}\,\overline{00}$
	4
46	3 00
	2 76
524	2400
	2096
5285	30400
	26425
	3975

(b) $\sqrt{1.7}$

So, $\sqrt{1.7} = 1.303$
$= 1.30$

	1.303
1	$\overline{1.70}\,\overline{00}\,\overline{00}$
	1
23	70
	69
2603	10000
	7809
	2191

(c) $\sqrt{145.38}$

$= 12.057$
or 12.06

	12.057
1	$\overline{1}\;\overline{45.38}\;\overline{00}$
	$\overline{00}$
	-1
22	45
	44
240	138
	000
2405	13800
	12025
24107	177500
	-168749
	8751

5. Simplify :

(a) $\frac{\sqrt{59.29} - \sqrt{5.29}}{\sqrt{59.29} + \sqrt{5.29}}$

$= \frac{7.7 - 2.3}{7.7 + 2.3}$

$= \frac{5.4}{10.0} = 0.54$

	7.7
7	$\overline{59}.\overline{24}$
	49
147	10 29
	10 29
	×

	2.3
2	$\bar{5}.\overline{23}$
	4
43	1 29
	1 29
	×

(b) $\frac{\sqrt{0.2304} - \sqrt{0.1764}}{\sqrt{0.2304} + \sqrt{0.1764}}$

$= \frac{0.48 - 0.42}{0.48 + 0.42}$

$= \frac{0.06}{0.90}$

$= \frac{6}{90} = \frac{1}{15}$

	0.48
4	$0.\overline{23}\,\overline{04}$
	16
88	704
	704
	×

	0.42
0	$0.\overline{17}\,\overline{64}$
4	17
	16
82	164
	164
	×

6. $\sqrt{70225} = 265$

	265
2	$\overline{7}\ \overline{02}\ \overline{25}$
	4
46	302
	276
525	2625
	2625
	×

So, $\sqrt{702.25} + \sqrt{7.0225}$
$= 26.5 + 2.65$
$= 29.15$

7. $\sqrt{18496} = 136$

	136
1	$\overline{1}\ \overline{84}\ \overline{96}$
	1
23	84
	69
266	1596
	1596
	×

So, $\sqrt{1.8496} \times \sqrt{184.96}$
$= 1.36 \times 13.6$
$= 18.496$

8. $\sqrt{18496} = 136$
So, $\sqrt{1.8496} \times \sqrt{184.96}$
$= 1.36 \times 13.6 = 18.496$

9. $\sqrt{19044} = 138$
So, $\sqrt{190.44} \div \sqrt{1.9044}$
$= 13.8 \div 1.38$
$= \dfrac{13.8 \times 10}{1.38 \times 10}$
$= 10$

	138
1	$\overline{1}\ \overline{90}\ \overline{44}$
	1
23	90
	69
268	21 44
	21 44
	×

MCQs

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

HOTS

- 2220*

So, $\square = 1$
and no. is 22201
$\Rightarrow$ 13, 31
169, 961

	149
1	$\overline{2}\ \overline{22}\ \overline{0\square}$
	1
24	1 22
	96
289	$260\square$
	2601
	×

NEP Cross-Cultural Learning

$1^2 + 2^2 + 2^2 = 3^2$
$2^2 + 3^2 + 6^2 = 7^2$
$3^2 + 4^2 + 12^2 = 13^2$
$4^2 + 5^2 + 20^2 = 21^2$
$5^2 + 6^2 + 30^2 = 31^2$
$6^2 + 7^2 + 42^2 = 43^2$

Chapter 4

Cubes and Cube Roots

Exercise 4.1

1. Find the cubes of the following numbers :

(a) 12^3
$= 12 \times 12 \times 12$
$= 144 \times 12$
$= 1728$

(b) 40^3
$= 40 \times 40 \times 40$
$= 1600 \times 40$
$= 64000$

(c) 52^3
$= 52 \times 52 \times 52$
$= 2704 \times 52$
$= 140608$

(d) $(-13)^3$
$= (-13) \times (-13) \times (-13)$
$= 169 \times (-13)$
$= -2197$

(e) $(-27)^3$
$= (-27) \times (-27) \times (-27)$
$= (+729) \times (-27)$
$= -19683$

(f) 0.9^3
$= 0.9 \times 0.9 \times 0.9$
$= 0.81 \times 0.9$
$= 0.729$

(g) 3.5^3
$= 3.5 \times 3.5 \times 3.5$
$= 12.25 \times 3.5$
$= 42.875$

(h) 0.06^3
$= 0.06 \times 0.06 \times 0.06$
$= 0.0036 \times 0.06$
$= 0.000216$

(i) $\left(\dfrac{4}{5}\right)^3$
$= \left(\dfrac{1}{5}\right) \times \left(\dfrac{4}{5}\right) \times \left(\dfrac{4}{5}\right)$
$= \dfrac{4 \times 4 \times 4}{5 \times 5 \times 5}$
$= \dfrac{16 \times 4}{25 \times 5} = \dfrac{64}{125}$

(j) $\left(\dfrac{11}{12}\right)^3$
$= \left(\dfrac{11}{12}\right) \times \left(\dfrac{11}{12}\right) \times \left(\dfrac{11}{12}\right)$
$= \dfrac{11 \times 11 \times 11}{12 \times 12 \times 12}$
$= \dfrac{121 \times 11}{144 \times 12} = \dfrac{1331}{1728}$

(k) $\left(\dfrac{-2}{7}\right)^3$
$= \left(\dfrac{-2}{7}\right) \times \left(\dfrac{-2}{7}\right) \times \left(\dfrac{-2}{7}\right)$
$= \dfrac{-2 \times -2 \times -2}{7 \times 7 \times 7}$
$= \dfrac{+4 \times -2}{49 \times 7}$
$= \dfrac{-8}{343}$

(l) $\left(\dfrac{-5}{9}\right)^3$
$= \left(\dfrac{-5}{9}\right) \times \left(\dfrac{-5}{9}\right) \times \left(\dfrac{-5}{9}\right)$
$= \dfrac{-5 \times -5 \times -5}{9 \times 9 \times 9}$
$= \dfrac{+25 \times -5}{81 \times 9}$
$= \dfrac{-125}{729}$

2. Which of the following numbers are perfect cube?

(a) 16

$16 = \underline{2\times 2\times 2}\times 2$

Here the prime factors are not grouped in triplets.

$\therefore$ 16 is not a perfect cube.

2	16
2	8
2	4
2	2
	1

(b) 27

$27 = \underline{3\times 3\times 3}$

Here all the prime factors are grouped in triplets.

$\therefore$ 27 is a perfect cube.

3	27
3	9
3	3
	1

(c) 81

$81 = \underline{3\times 3\times 3}\times 3$

Here the prime factors are not grouped in triplets

$\therefore$ 81 is not a perfect cube.

3	81
3	27
3	9
3	3
	1

(d) 216

$= \underline{2\times 2\times 2}\times \underline{3\times 3\times 3} = 216$

Here all the prime factors are grouped in triplets.

$\therefore$ 216 is a perfect cube.

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

(e) 212

$212 = 2\times 2\times 53$

Here the prime factors are not grouped in triplets.

$\therefore$ 212 is not a perfect cube.

2	212
2	106
53	53
	1

(f) 729

$729 = \underline{3\times 3\times 3}\times \underline{3\times 3\times 3}$

Here all the prime factors are grouped in triplets.

$\therefore$ 729 is a perfect cube.

3	729
3	243
3	81
3	27
3	9
3	3
	1

(g) 1000

$1000 = \underline{2\times 2\times 2}\times \underline{5\times 5\times 5}$

Here all the prime factors are grouped in triplets.

So, 1000 is a perfect cube.

2	1000
2	500
2	250
5	125
5	25
5	5
	1

(h) 4608

$4608 = \underline{2\times 2\times 2}\times \underline{2\times 2\times 2}$

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

Here the prime factors are not grouped in triplets

So, 4608 is not a perfect cube.

2	4608
2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

3. Which of the following are the cubes of even integers?

(a) 216

$\because$ 216 is an even no. So, it is the cube of an even no.

(b) 125

$\because$ 125 is an odd no. So, it is not the cube of an even no.

(c) 512

$\because$ 512 is an even no. So, it is the cube of an even no.

(d) 343

$\because$ 343 is an odd no. So, it is not the cube of an even no.

(e) 1000

$\because$ 1000 is an even no. So, it is the cube of an even no.

(f) 13824

$\because$ 13824 is an even no. So, it is the cube of an even no.

4. Which of the following numbers are the cubes of odd integers?

(a) 8

$\because$ 8 is an even no. So, it is not the cube of an odd no.

(b) 27

$\because$ 27 is an odd no. So, it is the cube of an odd no.

(c) 729

$\because$ 729 is an odd no. So, it is the cube of an odd no.

(d) 1000

$\because$ 1000 is an even no. So, it is not cube of an odd no.

(e) 6859

$\because$ 6859 is an odd no. So, It is the cube of an odd no.

(f) 531441

$\because$ 531441 is an odd no. So, it is the cube of an odd no.

5. Prime factorisation of 43200

2	43200
2	21600
2	10800
2	5400
2	2700
2	1350
3	675
3	225
3	75

5	25
5	5
	1

$43200 = \underline{2\times 2\times 2}\times \underline{2\times 2\times 2}\times \underline{3\times 3\times 3}\times 5\times 5$

Thus, it is clear that to make 43200 a perfect cube it must be multiplied by 5.

6. Prime factorisation of 13122

2	13122
3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

$13122 = 2\times 3\times 3\times 3\times 3\times 3\times 3\times 3\times 3$

Thus, it is clear that to make 13122 a perfect cube it must be divided by $2\times 3\times 3 = 18$

7. Edge of cuboid = 1.8 m

$\therefore$ volume of cuboid $= (\text{edge})^3$

$= \text{edge}\times \text{edge}\times \text{edge}$

$= 1.8\times 1.8\times 1.8$

$= 3.24\times 1.8$

$= 5.832$

So, the volume of cuboid is $5.832\ \text{m}^3$

8. (a) $42^3 = (40+2)^3$

$= (40)^3 + 3\times (40)^2\times 2 + 3\times (2)^2\times 40 + (2)^3$

$= 64000 + 3\times 1600\times 2 + 3\times 4\times 40 + 8$

$= 64000 + 9600 + 480 + 8$

$= 74088$

(b) $87^3 = (80+7)^3$

$= (80)^3 + 3\times (80)^2\times 7 + 3\times (7)^2\times 80 + (7)^3$

$= 512000 + 3\times 6400\times 7 + 3\times 49\times 80 + 343$

$= 512000 + 134400 + 11760 + 343$

$= 658503$

(c) $56^3 = (50+6)^3$

$= (50)^3 + 3\times (50)^2\times 6 + 3\times (6)^2\times 50 + (6)^3$

$= 125000 + 3\times 2500\times 6 + 3\times 36\times 50 + 216$

$= 125000 + 45000 + 5400 + 216$

$= 175616$

(d) $92^3 = (90+2)^3$

$= (90)^3 + 3\times (90)^2\times 2 + 3\times (2)^2\times 90 + (2)^3$

$= 729000 + 3\times 8100\times 2 + 3\times 4\times 90 + 8$

$= 729000 + 48600 + 1080 + 8$

$= 778688$

Mental Maths

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

Exercise 4.2

1. (a) $\sqrt[3]{91125}$

So, $\sqrt[3]{91125}$

$= \sqrt[3]{\underline{3\times 3\times 3}\times \underline{3\times 3\times 3}\times \underline{5\times 5\times 5}}$

$= 3\times 3\times 5$

$= 45$

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

(b) $\sqrt[3]{531441}$

So, $\sqrt[3]{531441}$

$= \sqrt[3]{\underline{3\times 3\times 3}\times \underline{3\times 3\times 3}\times \underline{3\times 3\times 3}\times \underline{3\times 3\times 3}}$

$= 3\times 3\times 3\times 3$

$= 81$

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

(c) $\sqrt[3]{250047}$

So, $\sqrt[3]{250047}$

$= \sqrt[3]{\underline{3\times 3\times 3}\times \underline{3\times 3\times 3}\times \underline{7\times 7\times 7}}$

$= 3\times 3\times 7$

$= 63$

3	250047
3	83349
3	27783
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

(d) $\sqrt[3]{551368}$

So, $\sqrt[3]{551368}$

$= \sqrt[3]{\underline{2\times 2\times 2}\times \underline{41\times 41\times 41}}$

$= 2\times 41$

$= 82$

2	551368
2	275684
2	137842
41	68921
41	1681
41	41
	1

(e) $\sqrt[3]{-74088}$

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

So, $\sqrt[3]{-74088} = -\sqrt[3]{74088}$

$= -\sqrt[3]{2\times 2\times 2\times 3\times 3\times 3\times 7\times 7\times 7}$

$= -(2\times 3\times 7)$

$= -42$

(f) $\sqrt[3]{-175616}$

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

So, $\sqrt[3]{-175616} = -\sqrt[3]{175616}$

$= -\sqrt[3]{2\times 2\times 2\times 2\times 2\times 2 \times 2\times 2\times 2\times 7\times 7\times 7}$

$= -(2\times 2\times 2\times 7)$

$= -56$

2. (a) $\sqrt[3]{\frac{3375}{4913}}$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

17	4913
17	289
17	17
	1

$= \frac{\sqrt[3]{3375}}{\sqrt[3]{4913}}$

$= \frac{\sqrt[3]{3\times 3\times 3\times 5\times 5\times 5}}{\sqrt[3]{17\times 17\times 17}}$

$= \frac{3\times 5}{17}$

$= \frac{15}{17}$

(b) $\sqrt[3]{\frac{2197}{1331}}$

13	2197
13	169
13	13
	1

11	1331
11	121
11	11
	1

$= \frac{\sqrt[3]{2197}}{\sqrt[3]{1331}}$

$= \frac{\sqrt[3]{13\times 13\times 13}}{\sqrt[3]{11\times 11\times 11}}$

$= \frac{13}{11} = 1\frac{2}{11}$

(c) $\sqrt[3]{\frac{-343}{166375}}$

7	343
7	49
7	7
	1

5	166375
5	33275
5	6655
11	1331
11	121
11	11
	1

$= \frac{-\sqrt[3]{343}}{\sqrt[3]{166375}}$

$= \frac{\sqrt[3]{7\times 7\times 7}}{\sqrt[3]{5\times 5\times 5\times 11\times 11\times 11}}$

$= \frac{-7}{5\times 11} = \frac{-7}{35}$

(d) $\sqrt[3]{\frac{-9261}{42875}}$

3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

$= \frac{-\sqrt[3]{9261}}{\sqrt[3]{42875}}$

$= \frac{-\sqrt[3]{3\times 3\times 3\times 7\times 7\times 7}}{\sqrt{5\times 5\times 5\times 7\times 7\times 7}}$

$= \frac{-(3\times 7)}{(5\times 7)} = \frac{-21}{35}$

3. Find the cube root of the following numbers :

(a) $\sqrt[3]{0.000729}$

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	1000000
2	500000
2	250000
2	125000
2	62500
2	31250
5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$= \sqrt[3]{\frac{729}{1000000}}$

$= \frac{\sqrt[3]{729}}{\sqrt[3]{1000000}}$

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

$= \frac{(3\times 3)}{2\times 2\times 5\times 5}$

$= \frac{9}{100} = 0.09$

(b) $\sqrt[3]{0.085184}$

2	85184
2	42592
2	21296
2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

10	1000000
10	100000
10	10000
10	1000
10	100
10	10
	1

$= \sqrt[3]{\frac{85184}{1000000}}$

$= \frac{\sqrt[3]{85184}}{\sqrt[3]{1000000}}$

$= \frac{\sqrt[3]{2\times 2\times 2\times 2\times 2\times 2\times 11\times 11\times 11}}{\sqrt[3]{10\times 10\times 10\times 10\times 10\times 10}}$

$= \frac{(2\times 2\times 11)}{10\times 10} = \frac{44}{100} = 0.44$

(c) $\sqrt[3]{373.248} = \sqrt[3]{\frac{373.248}{1000}} = \frac{\sqrt[3]{373248}}{\sqrt[3]{1000}}$

2	373248
2	186624
2	93312
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

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$$= \frac{\sqrt[3]{2\times2\times2\times2\times2\times2\times2\times2\times2\times3\times3\times3\times3\times3\times3}}{\sqrt[3]{2\times2\times2\times5\times5\times5}}$$

$$= \frac{(2\times2\times2\times3\times3)}{(2\times5)} = \frac{72}{10} = 7.2$$

(d) $\sqrt[3]{0.003375}$

$$= \frac{\sqrt[3]{3375}}{\sqrt[3]{1000000}}$$

$$= \frac{\sqrt[3]{3\times3\times3\times5\times5\times5}}{\sqrt[3]{10\times10\times10\times10\times10\times10}}$$

$$= \frac{(3\times5)}{(10\times10)}$$

$$= \frac{15}{100} = 0.15$$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

10	1000000
10	100000
10	10000
10	1000
10	100
10	10
	1

4. (a) 43200

43200

$= 2\times2\times2\times2\times2\times2\times3\times3\times3\times5\times5$

Grouping the factors in triplets of equal factors and 5×5 become left.

Thus if we multiplied by 5 in the given no. the no. will become perfect cube.

So, the no. to be multiplied by 5.

Thus, the perfect cube no. $= 43200\times5$

$= 216000$

Now, $\sqrt[3]{216000}$

$= \sqrt[3]{2\times2\times2\times2\times2\times2\times3\times3\times3\times5\times5\times5}$

$= 2\times2\times3\times5 = 60$

2	43200
2	21600
2	10800
2	5400
2	2700
2	1350
3	675
3	225
3	75
5	25
5	5
	1

(b) 33275

$33275 = 5\times5\times11\times11\times11$

Grouping the factors in triplets of equal factors, and 5×5 become left.

Thus, if we multiplied by 5 in the given no. the no. will become perfect cube.

So, the no. to be multiplied by 5

Thus, the perfect cube no. $= 33275\times5$

$= 166375$

Now, $\sqrt[3]{166375} = \sqrt[3]{5\times5\times5\times11\times11\times11}$

$= 5\times11 = 55$

5	33275
5	6655
11	1331
11	121
11	11
	1

(c) 6750

$6750 = 2\times3\times3\times3\times5\times5\times5$

Grouping the factors in triplets of equal factors, and 2 become left.

Thus, if we multiplied by 2×2 in given no., the no. will become perfect cube.

So, the no. to be multiplied by $2\times2 = 4$

Thus, the perfect cube no.

$= 6750\times4$

$= 27000$

Now, $\sqrt[3]{27000}$

$= \sqrt[3]{2\times2\times2\times3\times3\times3\times5\times5\times5}$

$= 2\times3\times5$

$= 30$

2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

(d) 3087

$3087 = 3\times3\times7\times7\times7$

Grouping the factors in triplets of equal Factors, and 3×3 become left.

Thus, if we multiplied by 3 in the given no. the no. will become perfect cube.

So, the no. to be multiplied by 3

Thus, the perfect cube no.

$= 3087\times3$

$= 9261$

Now, $\sqrt[3]{9261}$ $= 3\times3\times3\times7\times7\times7$

$= 3\times7 = 21$

3	3087
3	1029
7	343
7	49
7	7
	1

5. (a) 15552

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

Grouping the factors in triplets of equal factors, and 3×3 become left.

Thus, if we divided by 3×3 in the given no., the no. will become perfect cube.

So, the no. to be divided by $3\times3 = 9$.

Thus, the perfect cube no.

$= 15552\div9$

$= 1728$

Now, $\sqrt[3]{1728}$

$= \sqrt[3]{2\times2\times2\times2\times2\times2\times3\times3\times3}$

$= 2\times2\times3$

$= 12$

2	15552
2	7776
2	3888
2	1944
2	972
2	486
3	243
3	81
3	27
3	9
3	3
	1

(b) 3087

$= 3 \times 3 \times 7 \times 7 \times 7$

Grouping the factors in triplets of equals, and 3×3 become left.

Thus, if we divided by 3×3 in the given no., the no. will become perfect cube.

So, the no. to be divided by $3 \times 3 = 9$

Thus, the perfect cube no.

$= 3087 \div 9 = 343$

Now, $\sqrt[3]{343} = \sqrt[3]{7 \times 7 \times 7} = 7$

3	3087
3	1029
7	343
7	49
7	7
	1

(c) 31250

$= 2 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$

Grouping the factors in triplets of equals, and 2 become left.

Thus, if we divided by 2 in the given no., the no. will become perfect cube.

So, the no. to be divided by 2.

Thus, the perfect cube no. $= 31250 \div 2$

$= 15625$

Now, $\sqrt[3]{15625} = \sqrt[3]{5 \times 5 \times 5 \times 5 \times 5 \times 5}$

$= 5 \times 5$

$= 25$

2	31250
5	15625
5	3125
5	625
5	125
5	25
5	5
	1

(d) 120393

$= 3 \times 3 \times 3 \times 7 \times 7 \times 7 \times 13$

Grouping the factors in triplets of equals, and 13 become left.

thus, if we divided by 13 is the given no., the no will become perfect cube.

So, the no. to be divided by 13.

Thus, the perfect cube no.

$= 120393 \div 13$

$= 9261$

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

$= 3 \times 7 = 21$

3	120393
3	40131
3	13377
7	4459
7	637
7	91
13	13
	1

MCQs

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

HOTS

- 10^{3^3} is bigger than 10^3.
- Volume of cube $= 216\,m^2$

$\therefore$ Length of cube $= \sqrt[3]{216}\,m$

$= \sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3}\,m$

$= (2 \times 3)\,m$

$= 6\,m$

Hence, the length of square cardboard is 6 m.

2	216
2	108
2	57
3	27
3	9
3	3
	1

- There is none of the digit which can not be the one's digit of a perfect cube.

Chapter 5

Algebraic Expression

Exercise 5.1

1. Identify which of the following expressions are polynomials. If the expression is not a polynomial. say why.

Ans. (a) Polynomial

(b) Not polynomial, because the degree of variable is negative.

(b) Polynomial

(d) Not polynomial, because the degree of variable is in fraction.

(e) Polynomial

2. Write the degree of each of the following polynomials.

(a) $x^3 - 3x^2 + 1 - x$

degree $= 3$

(b) $xy^2 - y^3 + y^4 + 6$

degree $= 4$

(c) $\frac{6a^3b}{7} + \frac{4a^2b^3}{5} - \frac{3ab^2}{4}$

degree $= 2 + 3 = 5$

(d) $2x^5 - 6x^3 + 7x - 9$

degree $= 5$

(e) $p^6q - p^5q^2 + 6p^4q^3 - 8pq^2 + pq$

degree $= 6 + 1 = 7$

3. Arrange each of the polynomials in : (a) ascending order of the first variable, and (b) in descending order of the second variable.

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

ascending order of first variable

$-2xy + 3x^2y^3 + x^3y^2 - x^4y$

descending order of the second variable.

$3x^2y^3 + x^3y^2 - x^4y - 2xy$

(b) $ab^5 - 6ab^3 + 5a^2b^4$

ascending order of first variable

$ab^5 - 6ab^3 + 5a^2b^4$

descending order of second variable

$ab^5 + 5a^2b^4 - 6ab^3$

(c) $1 - pq^3 + p^2q^4 - pq$

ascending order of first variable

$1 - pq - pq^3 + p^2q^4$

descending order of second variable

$p^2q^4 - pq^3 - pq + 1$

(d) $xy^3 + x^3y$

ascending order of first variable

$xy^3 + x^3y$

descending order of second variable

$xy^3 + x^3y$

(e) $x^6y^2 - 7x^5y + 8xy^4 - 9x^2y^3$

ascending order of first variable

$8xy^4 - 9x^2y^3 - 7x^5y + x^6y^2$

descending order of second variable

$8xy^4 - 9x^2y^3 + x^6y^2 - 7x^5y$

4. Add the polynomials.

(a) $3x^2 - 4x + 6x^3 - 5$ and $8x^3 - 4x^2 + 5x + 5$

$= 3x^2 - 4x + 6x^3 - 5 + 8x^3 - 4x^2 + 5x + 5$

$= 3x^2 - 4x^2 - 4x + 5x + 6x^3 + 8x^3 - 5 + 5$

$= -x^2 + x + 14x^3 + 0$

$= 14x^3 - x^2 + x$

(b) $7a^3b - 8a^2b^2 + 9ab$ and $1 - 6ab$

$= 7a^3b - 8a^2b^2 + 9ab + 1 - 6ab$

$= 7a^3b - 8a^2b^2 + 9ab - 6ab + 1$

$= 7a^3b - 8a^2b^2 + 3ab + 1$

(c) $5pq^2 + 6p^2q - 9pq$ and $9pq - 6p^2q - 5pq^2$

$= 5pq^2 + 6p^2q - 9pq + 9pq - 6p^2q - 5pq^2$

$= 5pq^2 - 5pq^2 + 6p^2q - 6p^2q - 9pq + 9pq$

$= 0 + 0 + 0 = 0$

(d) $3 - abc + abc^2$ and $-2abc^2 + abc$

$= 3 - abc + abc^2 - 2abc^2 + abc$

$= 3 - abc + abc + abc^2 - 2abc^2$

$= 3 + 0 - abc^2$

$= 3 - abc^2$

(e) $\frac{-2xy}{3} + \frac{3x^2y}{4} + \frac{4xy^2}{5}$ and $\frac{xy}{3} + \frac{-2x^2y}{5} + \frac{3xy^2}{5}$

$= \frac{-2xy}{3} + \frac{3x^2y}{4} + \frac{4xy^2}{5} + \frac{xy}{3} - \frac{2x^2y}{5} + \frac{2xy^2}{5}$

$= \frac{-2xy}{3} + \frac{xy}{3} + \frac{3x^2y}{4} - \frac{2x^2y}{5} + \frac{4xy^2}{5} + \frac{3xy^2}{5}$

$= \frac{-xy}{3} + \left(\frac{15x^2y - 8x^2y}{20}\right) + \frac{7xy^2}{5}$

$= \frac{-xy}{3} + \frac{7x^2y}{20} + \frac{7xy^2}{5}$

5. Subtract the first polynomial from the second.

(a) $(6x^2 + 5x - 1)$ from $(-5x + 7x^2 + 9)$

$= (-5x + 7x^2 + 9) - (6x^2 + 5x - 1)$

$= -5x + 7x^2 + 9 - 6x^2 - 5x + 1$

$= -5x - 5x + 7x^2 - 6x^2 + 9 + 1$

$= -10x + x^2 + 10$

$= x^2 - 10x + 10$

(b) $(6x^2 - 15x + 4)$ from $(12 - x^2)$

$= (12 - x^2) - (6x^2 - 15x + 4)$

$= 12 - x^2 - 6x^2 + 15x - 4$

$= 12 - 4 - x^2 - 6x^2 + 15x$

$= 8 - 7x^2 + 15x$

$= -7x^2 + 15x + 8$

(c) $(a^2 - 5a + 6)$ from $(a^3 - 4a^2 + 5 - a)$

$= (a^3 - 4a^2 + 5 - a) - (a^2 - 5a + 6)$

$= a^3 - 4a^2 + 5 - a - a^2 + 5a - 6$

$= a^3 - 4a^2 - a^2 + 5 - 6 - a + 5a$

$= a^3 - 5a^2 - 1 + 4a$

$= a^3 - 5a^2 + 4a - 1$

6. Multiply :

(a) $-5a^2b^2$ by $-6ab$

$= (-5a^2b^2) \times (-6ab) = +30a^3b^3$

(b) xyz by $-3x^3y^2z$

$= (xyz) \times (-3x^3y^2z)$

$= -3x^4y^3z^2$

(c) $\frac{-2}{3}xy$ by $\frac{3}{2}x^2y^2z$

$= \left(\frac{-2}{3}xy\right) \times \left(\frac{3}{2}x^2y^2z\right)$

$= \frac{-2}{3} \times \frac{3}{2}x^3y^3z$

$= -x^3y^3z$

(d) $(2x^2 - 4x + 1)$ by $(3x - 1)$

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

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

$= 6x^3 - 12x^2 + 3x - 2x^2 + 4x - 1$

$= 6x^3 - 12x^2 - 2x^2 + 3x + 4x - 1$

$= 6x^3 - 14x^2 + 7x - 1$

(e) $(3x^3 - 6x^2y + xy^2 + 2)$ by $(3 - x)$

$= (3x^3 - 6x^2y + xy^2 + 2) \times (3 - x)$

$= 3(3x^3 - 6x^2y + xy^2 + 2) - x(3x^3 - 6x^2y + xy^2 + 2)$

$= 9x^3 - 18x^2y + 3xy^2 + 6 - 3x^4 + 6x^3y - x^2y^2 - 2x$

$= -3x^4 + 9x^3 + 6x^3y - x^2y^2 + 18x^2y + 3xy^2 - 2x + 6$

(f) $(x^3 - y^3)$ by $(x - y)$

$= (x^3 - y^3) \times (x - y)$

$= x(x^3 - y^3) - y(x^3 - y^3)$

$= x^4 - xy^3 - yx^3 + y^4$

$= x^4 - x^3y - xy^3 + y^4$

(g) $(x^2 - 7x + 6)$ by $(2x - y)$

$= (x^2 - 7x + 6)(2x - y)$

$= 2x(x^2 - 7x + 6) - y(x^2 - 7x + 6)$

$= 2x^3 - 14x^2 + 12x - yx^2 + 7xy - 6y$

$= 2x^3 - x^2y - 14x^2 + 7xy + 12x - 6y$

(h) $(x + y - xy)$ by $(1 - xy)$

$= (x + y - xy) \times (1 - xy)$

$= 1(x + y - xy) - xy(x + y - xy)$

$= x + y - xy - x^2y - xy^2 + x^2y^2$

$= x^2y^2 - x^2y - xy^2 - xy + x + y$

(i) $(3a^3 - 7b^3)$ by $(2a^2b + ab^2)$

$= (3a^3 - 7b^3) \times (2a^2b + ab^2)$

$= 2a^2b(3a^3 - 7b^3) + ab^2(3a^3 - 7b^3)$

$= 6a^5b - 14a^2b^4 + 3a^4b^2 - 7ab^5$

$= 6a^5b + 3a^4b^2 - 14a^2b^4 - 7ab^5$

(j) $(y^2 + 2y + 3)$ by $(y^2 + 2y - 3)$

$= y^2(y^2 + 2y + 3) + 2y(y^2 + 2y + 3) - 3(y^2 + 2y + 3)$

$= y^4 + 2y^3 + 3y^2 + 2y^3 + 4y^2 + 6y - 3y^2 - 6y - 9$

$= y^4 + 2y^3 + 2y^3 + 3y^2 + 4y^2 - 3y^2 + 6y - 6y - 9$

$= y^4 + 4y^3 + 4y^2 - 9$

7. Indicate whether true or false. Correct the mistakes.

(a) $2 + a = 2a$ (incorrect)
It will be $(2 + a)$

(b) $3a + b = 3ab$ (incorrect)
It will be $(3a + b)$

(c) $4a \times 3b = 12ab$ (correct)

(d) $a \times a = 2a$ (incorrect)
It will be $a \times a = a^2$

Exercise 5.2

1. Divide :

(a) $26a^2$ by $13a$

$= \frac{26a^2}{13a} = 2a$

(b) $4x$ by $\frac{4x}{3}$

$= \frac{4x}{4x/3} = \frac{4x \times 3}{4x} = 3$

2. Divide :

(a) $6a^2b + 3ab^2 + 12ab$ by $2a$

$= \frac{6a^2b + 3ab^2 + 12ab}{2a}$

$= \frac{6a^2b}{2a} + \frac{3ab^2}{2a} + \frac{12ab}{2a}$

$= 3ab + \frac{3b^2}{2} + 6b$

(b) $18a^3 - 12a^2c + 9ac^2$ by $3ac$

$= \frac{18a^3 - 12a^2c + 9ac^2}{3ac}$

$= \frac{18a^3}{3ac} - \frac{12a^2c}{3ac} + \frac{9ac^2}{3ac}$

$= \frac{6a^2}{c} - 4a + 3c$

3. Use the given information, to find the dividend.

(a) divisor $= x + 1$; quotient $= x - 1$;
remainder $= 3$; dividend $= ?$

Dividend $=$ Divisor $\times$ quotient + remainder

$= (x + 1) \times (x - 1) + 3$

$= x(x - 1) + 1(x - 1) + 3$

$= x^2 - x + x - 1 + 3 = x^2 + 2$

(b) divisor $= x^2 + 1$, quotient $= 2x$;
remainder $= 7x + 5$; dividend $= ?$

Dividend $=$ Divisor $\times$ quotient + remainder

$= (x^2 + 1) \times 2x + 7x + 5$

$= 2x^3 + 2x + 7x + 5 = 2x^3 + 9x + 5$

4. Divide :

(a) $x^5 + 3x^4 - 5x^3 + 4x^2 + 39x - 11$ by $4x + x^2 - 2$

or $x^5 + 3x^4 - 5x^3 + 4x^2 + 39x - 11$ by $x^2 + 4x - 2$

$$
\begin{array}{r}
x^3 - x^2 + x - 2 \\
x^2 + 4x - 2 \overline{)\, x^5 + 3x^4 - 5x^3 + 4x^2 + 39x - 11} \\
x^5 + 4x^4 - 2x^3 \\
\hline
-x^4 - 3x^3 + 4x^2 + 39x - 11 \\
-x^4 - 4x^3 + 2x^2 \\
\hline
x^3 + 2x^2 + 39x - 11 \\
x^3 + 4x^2 - 2x \\
\hline
-2x^2 + 41x - 11 \\
-2x^2 - 8x + 4 \\
\hline
49x - 15
\end{array}
$$

So, Quotient $= (x^3 - x^2 + x - 2)$

Remainder $= (49x - 15)$

(b) $2y^4 + y^3 + 10y^2 + 8y - 4$ by $y^2 - y + 6$

$$
\begin{array}{r}
2y^2 + 3y + 1 \\
y^2 - y + 6 \overline{)\, 2y^4 + y^3 + 10y^2 + 8y - 4} \\
2y^4 - 2y^3 + 12y^2 \\
\hline
3y^3 - 2y^2 + 8y - 4 \\
3y^3 - 3y^2 + 18y \\
\hline
y^2 - 10y - 4 \\
y^2 - y + 6 \\
\hline
-9y - 10
\end{array}
$$

So, Quotient $= (2y^2 + 3y + 1)$; Remainder $= (-9y - 10)$

5. Divide and show that the divisor is a factor of the dividend.

(a) $x^4 - x^3 + 3x^2 - 2x + 2$ by $x^2 + 2$

$$
\begin{array}{r}
x^2 - x + 1 \\
x^2 + 2 \overline{)\, x^4 - x^3 + 3x^2 - 2x + 2} \\
x^4 + 2x^2 \\
\hline
-x^3 + x^2 - 2x + 2 \\
-x^3 - 2x \\
\hline
x^2 + 2 \\
x^2 + 2 \\
\hline
0
\end{array}
$$

Since the remainder is 0, both the divisor, as well as the quotient are the factors of the dividend. we can therefore write

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

(b) $12x^3 - 2x^2 + x + 1$ by $3x + 1$

$$
\begin{array}{r}
4x^2 - 2x + 1 \\
3x+1\,\overline{)\,12x^3 - 2x^2 + x + 1\,(} \\
12x^3 + 4x^2 \\
\hline
- 6x^2 + x \\
- 6x^2 - 2x \\
\hline
3x + 1 \\
3x + 1 \\
\hline
\times
\end{array}
$$

Since the remainder is 0, both the divisor, as well as the quotient are the factors of the dividend. We can therefore write,

$(12x^3 - 2x^2 + x + 1) = (3x + 1)(4x^2 - 2x + 1)$

6. Find the value of k, if the divisor is a factor of the dividend.

(a) $2x^3 - 14 + k$ by $(x + 3)$

$$
\begin{array}{r}
2x^2 - 6x + 18 \\
x+3\,\overline{)\,2x^3 - 14 + k\,(} \\
2x^3 + 6x^2 \\
\hline
- 6x^2 - 14 + k \\
- 6x^2 - 18x \\
\hline
18x - 14 + k \\
18x + 54 \\
\hline
\times
\end{array}
$$

For the remainder be zero

$-14 + k = 54$

$k = 54 + 14$

$k = 68$

So, the value of k is 68.

(b) $4x^3 - 12x^2 - 37x + k$ by $2x + 1$

$4x^3 - 12x^2 - 37x + k \div (2x + 1)$

$$
\begin{array}{r}
2x^2 - 7x - 15 \\
2x+1\,\overline{)\,4x^3 - 12x^2 - 37x + k\,(} \\
4x^3 + 2x^2 \\
\hline
- 14x^2 - 37x + k \\
- 14x^2 - 7x + 12 \\
\hline
- 30x + k \\
- 30x - 15 \\
\hline
0
\end{array}
$$

For the remainder to be zero.

$k = -15$

So, the value of k is –15.

7. Volume of rectangular solid $= 2x^3 + 7x^2 + 2x - 3$

length $= (2x - 1)$

width $= (x + 3)$

$\therefore$ length × width $= (2x - 1)(x + 3)$

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

$= 2x^2 + 6x - x - 3$

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

So, Height $=$ Volume $\div$ (length × width)

$= (2x^3 + 7x^2 + 2x - 3) \div (2x^2 + 5x - 3)$

$$
\begin{array}{r}
x + 1 \\
2x^2 + 5x - 3\,\overline{)\,2x^3 + 7x^2 + 2x - 3\,(} \\
2x^3 + 5x^2 - 3x \\
\hline
2x^2 + 5x - 3 \\
2x^2 + 5x - 3 \\
\hline
\times
\end{array}
$$

So, height $= (x + 1)$

8. Volume of cube $= x^3 + 3x^2 + 3x + k$

length of side $= (x + 1)$

$\therefore$ Volume of cube $= (\text{length})^3$

$= (x + 1)^3$

$= (x + 1)(x + 1)(x + 1)$

$= (x^2 + 2x + 1)(x + 1)$

$= x^3 + 2x^2 + x + x^2 + 2x + 1$

$= x^3 + 3x^2 + 3x + 1$

on comparing by volume we get $k = 1$.

9. Divide and write down the quotient and remainder for each. Also check to see if your division is correct using the rule: dividend = (divisor × quotient) + remainder.

(a) $(x^2 + 5x + 6)$ by $(x + 2)$

$$
\begin{array}{r}
x + 3 \\
x+2\,\overline{)\,x^2 + 5x + 6\,(} \\
x^2 + 2x \\
\hline
3x + 6 \\
3x + 6 \\
\hline
0
\end{array}
$$

So, $Q = (x + 3)$, divisor $= (x + 2)$, $R = 0$

Checking :

Dividend $=$ (divisor) × quotient + Remainder

$= (x + 2)(x + 3) + 0$

$= x(x + 3) + 2(x + 3) + 0$

$= x^2 + 3x + 2x + 6 + 0$

$= x^2 + 5x + 6 =$ Dividend **Hence Proved**

(b) $y^2 - 2y + 5$ by $y + 1$

$$
\begin{array}{r}
y - 3 \\
y+1\,\overline{)\,y^2 - 2y + 5\,(} \\
y^2 + y \\
\hline
- 3y + 5 \\
- 3y - 3 \\
\hline
+ 8
\end{array}
$$

Quotient $= y - 3$; Divisor $= y + 1$

Remainder $= -8$

Checking :

Dividend $=$ (divisor) × quotient + Remainder

$= (y + 1) \times (y - 3) + 8$

$= y(y-3)+1(y-3)+8$
$= y^2-3y+y-3+8$
$= y^2-2y+5 =$ Dividend **Hence proved**

(c) m^2-3m+7 by $(m-2)$

$$\begin{array}{r|l} & m-1 \\ \hline m-2 & m^2-3m+7 \\ & m^2-2m \\ & - \quad + \\ \hline & -m+7 \\ & -m+2 \\ & + \quad - \\ \hline & 5 \end{array}$$ Remainder

Quotient $= (m-1)$
Divisor $= (m-2)$, Remainder $= 5$

Checking :

Dividend = divisor × quotient + Remainder
$= (m-2)(m-1)+5$
$= m(m-1)-2(m-1)+5$
$= m^2-m-2m+2+5$
$= m^2-3m+7 =$ Dividend **Hence proved.**

(d) $x^2-8x-12$ by $(x+4)$

$(x^2-8x-12) \div (x+4)$

$$\begin{array}{r|l} & x-12 \\ \hline x+4 & x^2-8x-12 \\ & x^2+4x \\ & - \quad - \\ \hline & -12x-12 \\ & -12x-48 \\ & + \quad + \\ \hline & +36 \end{array}$$

Quotient $= (x-12)$; Remainder $= 36$
Dividend $= (x+4)$

Checking :

Dividend = divisor × quotient + Remainder
$= (x+4)(x-12)+36$
$= x(x-12)+4(x-12)+36$
$= x^2-12x+4x-48+36$
$= x^2-8x-12 =$ Dividend **Hence proved.**

(c) $3y^2+10y-9$ by $(3y-2)$

$(3y^2+10y-9) \div (3y-2)$

$$\begin{array}{r|l} & y+4 \\ \hline 3y-2 & 3y^2+10y-9 \\ & 3y^2-2y \\ & - \quad + \\ \hline & 12y-9 \\ & 12y-8 \\ & - \quad + \\ \hline & -1 \end{array}$$

Divisor $= (3y-2)$, Remainder $= -1$
Quotient $= (y+4)$

Checking :

Dividend = divisor × quotient + Remainder
$= (3y-2)\times(y+4)-1$
$= 3y(y+4)-2(y+4)-1$
$= 3y^2+12y-2y-8-1$
$= 3y^2+10y-9 =$ Dividend **Hence proved.**

Exercise 5.3

1. Expand :

(a) $(2x+3)^2 = (2x)^2+(3)^2+2\times(2x)\times 3$
$= 4x^2+9+12x$
$= 4x^2+12x+9$

(b) $(5a-3b)^2 = (5a)^2+(3b)^2-2\times(5a)\times(3b)$
$= 25a^2+9b^2-30ab$
$= 25a^2-30ab+9b^2$

(c) $(-3x+5y)^2 = (-3x)^2+(5y)^2+2\times(-3x)\times 5y$
$= 9x^2+25y^2-30xy$
$= 9x^2-30xy+25y^2$

(d) $[5x+(-3y)]^2 = (5x)^2+(-3y)^2+2\times(5x)\times(-3y)$
$= 25x^2+9y^2-30xy$
$= 25x^2-30xy+9y^2$

(e) $[(-4a)-(-2b)]^2$
$= (-4a)^2+(-2b)^2-2\times(-4a)\times(-2b)$
$= 16a^2+4b^2-16ab$
$= 16a^2-16ab+4b^2$

(f) $[9a+(-2b)]^2 = (9a)^2+(-2b)^2+2\times 9a\times(-2b)$
$= 81a^2+4b^2-36ab$
$= 81a^2-36ab+4b^2$

(g) $(\sqrt{2}x-5y)^2 = (\sqrt{2}x)^2+(5y)^2-2\times\sqrt{2}x\times 5y$
$= 2x^2+25y^2-10\sqrt{2}xy$
$= 2x^2-10\sqrt{2}xy+25y^2$

(h) $(\sqrt{3}a+\sqrt{2}b)^2$
$= (\sqrt{3}a)^2+(\sqrt{2}b)^2+2\times\sqrt{3}a\times\sqrt{2}b$
$= 3a^2+2b^2+2\sqrt{6}ab$

2. Find the product.

(a) $(2x-1)(2x+1) = (2x)^2-(1)^2$
$= 4x^2-1$

(b) $(-2x+y)(2x+y) = (y-2x)(y+2x)$
$= (y)^2-(2x)^2$
$= y^2-4x^2$

3. Using identities, find the values.

(a) $(105)^2 = (100+5)^2$
$= (100)^2+(5)^2+2\times 100\times 5$
$= 10000+25+1000 = 11025$

(b) $(298)^2 = (300-2)^2$
$= (300)^2+(2)^2-2\times 300\times 2$
$= 90000+4-1200$
$= 90004-1200$
$= 88804$

(c) $(1.05)^2 = (1+0.05)^2$
$= (1)^2+(0.05)^2+2\times 1\times(0.05)$
$= 1+0.0025+0.10$
$= 1.1025$

(d) $(2.98)^2 = (3.00 - 0.02)^2$

$= (3)^2 + (0.02)^2 - 2 \times 3 \times (0.02)$

$= 9 + 0.0004 - 0.12 = 8.8804$

(e) $102 \times 98 = (100+2) \times (100-2)$

$= (100)^2 - (2)^2$

$= 10000 - 4 = 9996$

(f) $210 \times 190 = (200+10) \times (200-10)$

$= (200)^2 - (10)^2$

$= 40000 - 100 = 39900$

(g) $151 \times 151 - 51 \times 51$

$= (151)^2 - (51)^2$

$= (151+51)(151-51)$

$= 202 \times 100 = 20200$

(h) $182 \times 182 - 2 \times 182 \times 62 + 62 \times 62$

$= (182)^2 - 2 \times 182 \times 62 + (62)^2$

$= (182-62)^2 = (120)^2$

$= 120 \times 120 = 14400$

4. If $x + \frac{1}{x} = 4$, find the value of :

(a) $x^2 + \frac{1}{x^2}$

we have $\left(x + \frac{1}{x}\right) = 4$

squaring on both sides :

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

$$x^2 + \left(\frac{1}{x}\right)^2 + 2 \times x \times \frac{1}{x} = 16$$

$$x^2 + \frac{1}{x^2} + 2 = 16$$

$$x^2 + \frac{1}{x^2} = 16 - 2$$

So, $x^2 + \frac{1}{x^2} = 14$

(b) $x^4 + \frac{1}{x^4}$

Now, we have

$$x^2 + \frac{1}{x^2} = 14$$

Again squaring on both sides

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (14)^2$$

$$(x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2 \times x^2 \times \frac{1}{x^2} = 196$$

$$x^4 + \frac{1}{x^4} + 2 = 196$$

$$x^4 + \frac{1}{x^4} = 196 - 2$$

So, $x^4 + \frac{1}{x^4} = 194$

5. If $x^2 + \frac{1}{x^2} = 62$, find the value of $\left(x + \frac{1}{x}\right)$.

Now, $x^2 + \frac{1}{x^2} = 62$

on adding 2 both sides

$$x^2 + \frac{1}{x^2} + 2 = 62 + 2$$

$$x^2 + \frac{1}{x^2} + 2 = 64$$

$$\left(x + \frac{1}{x}\right)^2 = (64)$$

$$\left(x + \frac{1}{x}\right)^2 = (8)^2$$

So, $x + \frac{1}{x} = 8$

6. If $x^2 + \frac{1}{x^2} = 102$, find the value of $x - \frac{1}{x}$.

We have, $x^2 + \frac{1}{x^2} = 102$

subtracting 2 from both sides

$$x^2 + \frac{1}{x^2} - 2 = 102 - 2$$

$$x^2 + \frac{1}{x^2} - 2 = 100$$

or $\left(x - \frac{1}{2}\right)^2 = (100)$

or $\left(x - \frac{1}{x}\right)^2 = (10)^2$

So, $\left(x - \frac{1}{x}\right) = 10$

7. If $x - \frac{1}{x} = 8$, find the values of

(a) $x^2 + \frac{1}{x^2}$

we have, $x - \frac{1}{x} = 8$

squaring on both sides

$$\left(x - \frac{1}{x}\right)^2 = (8)^2$$

$$x^2 + \left(\frac{1}{x}\right)^2 + 2 \times x \times \frac{1}{x} = 64$$

$$x^2 + \frac{1}{x^2} + 2 = 64$$

$$x^2 + \frac{1}{x^2} = 64 + 2$$

So, $x^2 + \frac{1}{x^2} = 66$

(b) $x^4 + \frac{1}{x^4}$

we have, $x^2 + \frac{1}{x^2} = 66$

again squarring on both sides

$$\left(x^2+\frac{1}{x^2}\right)^2=(66)^2$$

$$(x^2)^2+\left(\frac{1}{x^2}\right)^2+2\times x^2\times\frac{1}{x^2}=4356$$

$$x^4+\frac{1}{x^4}+2=4356$$

$$x^4+\frac{1}{x^4}=4356-2$$

So, $$x^4+\frac{1}{x^4}=4354$$

8. If $x+\frac{1}{x}=\sqrt{3}$, find the values of

(a) $x^2+\frac{1}{x^2}=?$

we have,

$$x+\frac{1}{x}=\sqrt{3}$$

squarring on both sides

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

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

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

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

So, $$x^2+\frac{1}{x^2}=1$$

(b) $x^4+\frac{1}{x^4}$

We have,

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

again squarring on both sides

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

$$(x^2)^2+\left(\frac{1}{x^2}\right)^2+2\times x^2\times\frac{1}{x^2}=1$$

$$x^4+\frac{1}{x^4}+2=1$$

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

So, $$x^4+\frac{1}{x^4}=-1$$

9. If $a+2b=5$, and $ab=2$, find a^2+4b^2.

We have

$$a+2b=5$$

on squarring both sides

$$(a+2b)^2=(5)^2$$

$$(a)^2+(2b)^2+2\times a\times 2b=(5)^2$$

$$a^2+4b^2+4ab=25$$

or $$a^2+4b^2+4\times 2=25 \qquad \{\because\ ab=2\}$$

$$a^2+4b^2+8=25$$

$$a^2+4b^2=25-8$$

So, $$a^2+4b^2=17$$

10. If $x^2+9y^2=9$ and $xy=1$, find $(2x+6y)^2$.

Now, $$(2x+6y)^2=(2x)^2+(6y)^2+2\times 2x\times 6y$$

$$=4x^2+36y^2+24xy$$

$$=4(x^2+9y^2)+24xy$$

or $$4\times 9+24\times 1=36+24$$

$$=60$$

11. If $x-y=12$ and $xy=6\frac{1}{4}$, find $x+y$.

We have, $$x-y=12$$

on squarring both sides

$$(x-y)^2=(12)^2$$

$$x^2+y^2-2\times x\times y=144$$

$$x^2+y^2-2\times 6\frac{1}{4}=144$$

$$x^2+y^2-2\times\frac{25}{4}=144$$

or $$x^2+y^2=144+\frac{25}{2}$$

$$x^2+y^2=\frac{288+25}{2}$$

$$x^2+y^2=\left(\frac{313}{2}\right)$$

on adding $2xy$ both sides

$$x^2+y^2+2xy=\frac{313}{2}+2xy$$

or $$x^2+y^2+2xy=\frac{313}{2}+2\times\frac{25}{4}$$

$$x^2+y^2+2xy=\frac{313+25}{2}$$

$$x^2+y^2+2xy=\frac{338}{2}$$

$$(x+y)^2=169$$

or $$x+y=\sqrt{169}$$

So, $$(x+y)=13$$

12. If $64x^2+y^2=72$ and $xy=2$, find $\left(4x+\frac{y}{2}\right)^2$.

$$\therefore\quad\left(4x+\frac{y}{2}\right)^2=\frac{1}{4}\times(8x+y)^2$$

$$=\frac{1}{4}[(8x)^2+(y)^2+2\times 8x\times y]$$

$$=\frac{1}{4}(64x^2+y^2+16xy)$$

$$=\frac{1}{4}(64x^2+y^2+16\times 2)$$

$$=\frac{1}{4}(72+32)$$

$$=\frac{1}{4}\times(104)=26$$

13. Expand and simplify :

(a) $(a+b)(a-b)(a^2+b^2)$
$=(a^2-b^2)(a^2+b^2)$
$=(a^2)^2-(b^2)^2$
$=a^4-b^4$

(b) $(a+b)^2-(a-b)^2$
$=(a^2+b^2+2ab)-(a^2+b^2-2ab)$
$=a^2+b^2+2ab-a^2-b^2+2ab$
$=4ab$

(c) $(a+b)^2-(a+b)(a-b)$
$=(a^2+b^2+2ab)-(a^2-b^2)$
$=a^2+b^2+2ab-a^2+b^2$
$=2b^2+2ab$ or $2b(a+b)$

Exercise 5.4

1. Find the highest common factor of the following monomials.

(a) x^4y^3, x^2y
Highest common factor $=x^2y$

(b) $14p^2qr^4, 49p^2q^2r, 35pqr$
Highest common factor $=7pqr$

(c) $-a^5, ab^3$
Highest common factor $=a$

(d) $6a^2, -18a^6, -12a^2$
Highest common factor $=6a^2$

(e) $3y^3z^2, 15y^4z^2, 18y^6z^3$
Highest common factor $=3y^3z^2$

2. Factorise the following expressions, taking out the highest common factor :

(a) $2x+8$
$=2(x+4)$

(b) $3a-9$
$=3(a-3)$

(c) $5a^2+15$
$=5(a^2+3)$

(d) $10p^2qr+15pq^2r$
$=5pqr(2p+3q)$

(e) $14x-28x^2$
$=14x(1-2x)$

(f) $6ab-a$
$=a(6b-1)$

(g) $3x^2+9x+12$
$=3(x^2+3x+4)$

(h) $8a^3-16a^2+4a$
$=4a(2a^2-4a+1)$

(i) $4x^2-12x^2y^2-8x$
$=4x(x-3xy^2-2)$

3. Factorise completely

(a) $a(b-c)+d(b-c)$
$=(b-c)(a+d)$

(b) $2x(x-1)+3y(x-1)$
$=(x-1)(2x+3y)$

(c) $(x-a)+3b(x-a)$
$=(x-a)(1+3b)$

(d) $3x^2(y-1)+2x(y-1)$
$=(y-1)(3x^2+2x)$
$=x(y-1)(3x+2)$

(e) $3q(p-q)+2r(p-q)+s(p-q)$
$=(p-q)(3q+2r+5)$

(f) $y(x-1)-x(x-1)$
$=(x-1)(y-x)$

(g) $x(x-y)^2+y(x-y)^2$
$=(x-y)^2(x+y)$

(h) $(a-b)^3+(a-b)^2$
$=(a-b)^2(a-b+1)$

(i) $ax^2+ay^2+bx^2+by^2$
$=a(x^2+y^2)+b(x^2+y^2)$
$=(x^2+y^2)(a+b)$

(j) $ax^2+ay^2-bx^2-by^2$
$=a(x^2+y^2)-b(x^2+y^2)$
$=(x^2+y^2)(a-b)$

(k) $ax-bx+ay-by$
$=x(a-b)+y(a-b)=(a-b)(x+y)$

(l) $ax-ay+bx-by$
$=a(x-y)+b(x-y)$
$=(x-y)(a+b)$

(m) $x^2-y^2+x^3-xy^2$
$=x^2+x^3-y^2-xy^2$
$=x^2(1+x)-y^2(1+x)=(1+x)(x^2-y^2)$

(n) $xy^2-yx^2-xy+x^2$
$=x(y^2-y-yx+x)$
$=x(-xy+y^2+x-y)$
$=x[-y(x-y)+1(x-y)]$
$=x(x-y)(1-y)$

Exercise 5.5

1. By inspection find which identity each one of the following represents and factorise accordingly.

(a) $25a^2+10a+1$
$=(5a)^2+2\times5a\times1+(1)^2=(5a+1)^2$

(b) $a^2-4ab+4b^2$
$=(a)^2-2\times a\times2b+(2b)^2=(a-2b)^2$

(c) $36x^2+84x+49$
$=(6x)^2+2\times6x\times7+(7)^2=(6x+7)^2$

(d) $25x^2-81y^2$
$=(5x)^2-(9y)^2=(5x+9y)(5x-9y)$

(e) $121x^2-1$
$=(11x)^2-(1)^2=(11x+1)(11x-1)$

(f) $x^4-18x^2y^2+81y^4$
$=(x^2)^2-2\times x^2\times9y^2+(9y^2)^2$
$=(x^2-9y^2)^2=(x^2-(3y)^2)^2$
$=[(x+3y)(x-3y)]^2$

(g) $49a^6-28a^3b^3+4b^6$
$=(7a^3)^2-2\times7a^3\times2b^3+(2b^3)^2$
$=(7a^3-2b^3)^2$

(h) $4-9x^4=(2)^2-(3x^2)^2$
$=(2+3x^2)(2-3x^2)$

2. The following expressions are supposed to be perfect squares. However, one term has been incorrectly written in each. Write the correct expression to make each a perfect square.

(a) $4x^2 + 10x + 25$

$= (2x)^2 + 2x \times 5 + (5)^2$

here, we have

$(a)^2 + ab + (b)^2$

to make this perfect square equation should be

$a^2 + 2ab + b^2$

so, $(2x)^2 + 2 \times 2x \times 5 + (5)^2$

or $(4x^2 + 20x + 25)$

(b) $9x^2 - 6x - 1$

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

Here we have

$= a^2 - 2ab - (1)^2$

to make this perfect square

equation should be $a^2 - 2ab + b^2$

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

or $(9x^2 - 6x + 1)$

(c) $4x^2 + 4x + \frac{1}{4}$

$4x^2 + 4x + \frac{1}{4}$

$(2x)^2 + 4 \times 2x \times \frac{1}{2} + \left(\frac{1}{2}\right)^2$

Here we have $a^2 + 4ab + b^2$

to make this perfect square equation should be

$= a^2 + 2ab + (b)^2$

$= (2x)^2 + 2 \times 2x \times \frac{1}{2} + \left(\frac{1}{2}\right)^2$

$= 4x^2 + 2x + \frac{1}{4}$

(d) $4 - 2x + \frac{x^2}{2}$

$= (2)^2 - 2 \times 2 \times \frac{x}{2} + \frac{(x)^2}{2}$

Here, we have

$= (2)^2 - 2 \times 2 \times \frac{x}{2} + \frac{x^2}{2}$

$= a^2 - 2ab + 2b^2$

To make this perfect square equation should be

$a^2 - 2ab + b^2$

$= (2)^2 - 2 \times 2 \times \frac{x}{2} + \left(\frac{x}{2}\right)^2$

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

$= 4 - 2x + \frac{x^2}{4}$

3. Factorise.

(a) $a^2 + 14a + 49 = (a)^2 + 2 \times a \times 7 + (7)^2$

$= (a + 7)^2$

(b) $4q^2 + 8q + 4 = 4(q^2 + 2q + 1)$

$= 4[(q)^2 + 2 \times q \times 1 + (1)^2]$

$= 4(q + 1)^2$

(c) $a^4 - 1 = (a^2)^2 - (1)^2$

$= (a^2 + 1)(a^2 - 1)$

$= (a^2 + 1)(a^2 - (1)^2)$

$= (a^2 + 1)(a + 1)(a - 1)$

(d) $a^4 - (a + b)^4$

$= (a^2)^2 - ((a + b)^2)^2$

$= [a^2 + (a + b)^2][a^2 - (a + b)^2]$

$= [a^2 + (a + b)^2](a + a + b)(a - a - b)$

$= [a^2 + (a + b)^2][(2a + b)(-b)]$

$= (-b)(2a + b)^2 [a^2 + (a + b)^2]$

(e) $p^2 - 256 = (p)^2 - (16)^2$

$= (p + 16)(p - 16)$

(f) $9x^2 - 24x + 16 = 9x^2 - 24x + 16$

$= (3x)^2 - 2 \times 3x \times 4 + (4)^2$

$= (3x - 4)^2$

(g) $[(x^2 - 4x + 4) - 81]$

$= (x^2 - 4x + 4) - 81$

$= [x^2 - 2 \times x \times 2 + (2)^2] - (9)^2$

$= (x - 2)^2 - (9)^2$

$= (x - 2 + 9)(x - 2 - 9)$

$= (x + 7)(x - 11)$

(h) $(a + b)^4 - b^4$

$= (a + b)^4 - (b)^4$

$= [(a + b)^2]^2 - (b^2)^2$

$= ((a + b)^2 + b^2)((a + b)^2 - b^2)$

$= ((a + b)^2 + b^2)[(a + b + b)(a + b - b)]$

$= [(a + b)^2 + b^2][(a + 2b)(a)]$

$= a(a + 2b)[(a + b)^2 + b^2]$

(i) $25 - (4a^2 + 12a + 9)$

$= (25) - (4a^2 + 12a + 9)$

$= (5)^2 - [(2a)^2 + 2 \times 2a \times 3 + (3)^2]$

$= 5^2 - (2a + 3)^2$

$= (5 + 2a + 3)(5 - 2a - 3)$

$= (2a + 8)(2 - 2a)$

$= 2(a + 4)2(1 - a)$

$= 4(a + 4)(1 - a)$

(j) $p^4 - 8p^2q^2 + 16q^4 - 121$

$= (p^2)^2 - 2 \times p^2 \times 4q^2 + (4q^2)^2 - (11)^2$

$= (p^2 - 4q^2)^2 - (11)^2$

$= (p^2 - 4q^2 + 11)(p^2 - 4q^2 - 11)$

(k) $9x^2 - 49 = (3x)^2 - (7)^2$

$= (3x + 7)(3x - 7)$

(l) $25 - 4y^2 = (5)^2 - (2y)^2$

$= (5 + 2y)(5 - 2y)$

(m) $4a^2 - b^2 = (2a)^2 - (b)^2$
$= (2a + b)(2a - b)$

(n) $x^2 - \frac{1}{36} = x^2 - \left(\frac{1}{6}\right)^2$
$= \left(x + \frac{1}{6}\right)\left(x - \frac{1}{6}\right)$

(o) $\frac{x^2}{36} - \frac{y^2}{25} = \left(\frac{x}{6}\right)^2 - \left(\frac{y}{5}\right)^2$
$= \left(\frac{x}{6} + \frac{y}{5}\right)\left(\frac{x}{6} - \frac{y}{5}\right)$

(p) $25a^2b^2 - 49x^2y^2 = (5ab)^2 - (7xy)^2$
$= (5ab + 7xy)(5ab - 7xy)$

(q) $(2p - 3q)^2 - (3p + 2q)^2$
$= (2p - 3q + 3p + 2q)(2p - 3q - 3p - 2q)$
$= (5p - q)(-p - 5q)$
$= (p + 5q)(q - 5p)$

(r) $a^2b^4c^6 - 1 = (ab^2c^3)^2 - (1)^2$
$= (ab^2c^3 + 1)(ab^2c^3 - 1)$

4. Factorise, after removing the HCF.

(a) $4a^2 + 24a + 36$
$= 4(a^2 + 6a + 9)$
$= 4[(a)^2 + 2 \times a \times 3 + (3)^2]$
$= 4(a + 3)^2$

(b) $a^4 - 4a^3 + 4a^2$
$= a^2(a^2 - 4a + 4)$
$= a^2[(a)^2 - 2 \times a \times 2 + (2)^2]$
$= a^2(a - 2)^2$

(c) $3y^4 - 36y^2 + 108$
$= 3(y^4 - 12y^2 + 36)$
$= 3[(y^2)^2 - 2 \times y^2 \times 6 + (6)^2]$
$= 3(y^2 - 6)^2$

(d) $10a^2 - 20ab + 10b^2$
$= 10(a^2 - 2ab + b^2)$
$= 10(a - b)^2$

(e) $2x^2 + 12x + 18$
$= 2(x^2 + 6x + 9)$
$= 2(x^2 + 2 \times x \times 3 + (3)^2]$
$= 2(x + 3)^2$

(f) $5a^3 - 30a^2 + 45a$
$= 5a(a^2 - 6a + 9)$
$= 5a[(a)^2 - 2 \times a \times 3 + (3)^2]$
$= 5a(a - 3)^2$

MCQs

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

Mental Maths

1. $\frac{1}{2} \times (4a^2bc^3) \times \frac{1}{8}ab^2c$
$= \frac{1}{2} \times 4a^2bc^3 \times \frac{1}{8}ab^2c = \frac{1}{4}a^3b^3c^4$

2. Divide $4x^2y^2z^2$ by xyz
$= 4x^2y^2z^2 \div xyz$
$= \frac{4x^2y^2z^2}{xyz} = 4xyz$

3. Let A should be added to $4x^2 + 8x + 16$ to get $-2x^2 + 6x - 3$.
$\therefore \quad A + 4x^2 + 8x + 16 = -2x^2 + 6x - 3$
$A = -2x^2 + 6x - 3 - 4x^2 - 8x - 16$
So, $A = -6x^2 - 2x - 19$

4. Let A should be subtracted from $4x^2 - 7x - 8$ to get $-3x^2 + 8$.
$\therefore \quad 4x^2 - 7x - 8 - A = -3x^2 + 8$
$4x^2 - 7x - 8 + 3x^2 + 8 = A$
$7x^2 - 7x = A$
So, $A = 7x^2 - 7x - 16$

5. $3x^2y \times (6x^2 + 4y^2) = 3x^2y(6x^2 + 4y^2)$
$= 18x^4y + 12x^2y^3$

6. $4x^3y^2$, when $x = 1$, and $y = 1$?
$= 4x^3y^3 = 4 \times (1)^3 \times (1)^3$
$= 4 \times 1 \times 1 = 4$

7. $3x^2 + 7xy + 8y^2$, when $x = 1$, and $y = 2$
$= 3x^2 + 7xy + 8y^2$
$= 3 \times (1)^2 + 7 \times (1) \times (2) + 8 \times (2)^2$
$= 3 \times 1 + 7 \times 1 \times 2 + 8 \times 4$
$= 3 + 14 + 32 = 49$

8. $\left(a^2 - \frac{1}{a^2}\right)^2 = (a^2)^2 + \left(\frac{1}{a^2}\right)^2 - 2 \times a^2 \times \frac{1}{a^2}$
$= a^4 + \frac{1}{a^4} - 2$

9. Side of square paper $= (a - 2)$
$\therefore$ Area of square paper $= (\text{side}) \times \text{side}$
$= (a - 2)(a - 2)$
$= a^2 - 2a - 2a + 4$
$= a^2 - 4a + 4$

10. $(x^6 - 1)$ by $(x^3 + 1)$
$= \frac{(x^6 - 1)}{(x^3 + 1)} = \frac{(x^3)^2 - (1)^2}{(x^3 + 1)}$
$= \frac{(x^3 + 1)(x^3 - 1)}{(x^3 + 1)} = x^3 - 1$

NEP Cross-Cultural Learning

- Cost of $5pq$ note books $= ₹\ (35p^2q + 10pq^2)$
$= 5pq(7p + 2q)$
$\therefore$ Cost of note book $= \frac{5pq(7p + 2q)}{5pq} = (7p + 2q)$
So, the cost of 2 note books $= 2 \times (7p + 2q) = (14p + 4q)$
- Distance covered by car $= (9a^2 + 27ab + 15b^3)$
time $= 3$ hr

$\therefore$ $\text{speed} = \dfrac{\text{distance}}{\text{time}}$

$\text{speed} = \dfrac{9a^2 + 27ab + 15b^3}{3}$

$= \dfrac{3(3a^2 + 9ab + 5b^3)}{3}$

$= 3a^2 + 9ab + 5b^3$

Chapter 6 Linear Equations in One Variable

Exercise 6.1

1. Solve, and check by substitution if your answer is correct.

(a) $2x - 9 = 11$

$2x = 11 + 9$

$2x = 20$

$x = \dfrac{20}{2}$

$x = 10$

Check :

$2x - 9 = 11$

$2 \times 10 - 9 = 11$

$20 - 9 = 11$

$11 = 11$

LHS = RHS

So, the answer is correct.

(b) $4x + 3 = 2x - 5$

$4x - 2x = -5 - 3$

$2x = -8$

$x = \dfrac{-8}{2}$

$x = -4$

Check :

$4x + 3 = 2x - 5$

$4 \times (-4) + 3 = 2 \times (-4) - 5$

$-16 + 3 = -8 - 5$

$-13 = -13$

LHS = RHS

So, the answer is correct.

(c) $-x + 24 = -3x - 20$

$-x + 3x = -20 - 24$

$2x = -44$

$x = \dfrac{-44}{2}$

$x = -22$

Check :

$-x + 24 = -3x - 20$

$-(-22) + 24 = -3 \times (-22) - 20$

$22 + 24 = 66 - 20$

$46 = 46$

LHS = RHS

So, the answer is correct.

(d) $\dfrac{x}{2} + 5 = x$

$\dfrac{x}{2} - x = -5$

$\dfrac{-x}{2} = -5$

$x = 5 \times 2$

$x = 10$

Check :

$\dfrac{x}{2} + 5 = x$

$\dfrac{10}{2} + 5 = 10$

$5 + 5 = 10$

$10 = 10$

LHS = RHS

So, the answer is correct.

(e) $3x + 4 - 2x = 6x - 8 - 3$

$3x - 2x - 6x = -8 - 3 - 4$

$-5x = -15$

$x = \dfrac{15}{3}$

$x = 3$

Check :

$3x + 4 - 2x = 6x - 8 - 3$

$3 \times 3 + 4 - 2 \times 3 = 6 \times 3 - 8 - 3$

$9 + 4 - 6 = 18 - 8 - 3$

$13 - 6 = 10 - 3$

$7 = 7$

LHS = RHS

So, the answer is correct.

(f) $4x - 3 = 2x - 1$

$4x - 2x = -1 + 3$

$2x = 2$

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

$x = 1$

Check :

$4x - 3 = 2x - 1$

$4 \times 1 - 3 = 2 \times 1 - 1$

$4 - 3 = 2 - 1$

$1 = 1$

LHS = RHS

So, the answer is correct.

(g) $\dfrac{x}{3} + 6 = \dfrac{1}{9}$

$\dfrac{x}{3} = \dfrac{1}{9} - 6$

$\dfrac{x}{3} = \dfrac{1 - 54}{9}$

$\dfrac{x}{3} = \dfrac{-53}{9}$

$x = \dfrac{-53 \times 3}{9}$

$x = \dfrac{-53}{3}$

Check :

$\dfrac{x}{3} + 6 = \dfrac{1}{9}$

$\dfrac{-53}{3 \times 3} + 6 = \dfrac{1}{9}$

$\dfrac{-53}{9} + 6 = \dfrac{1}{9}$

$\dfrac{-53 + 54}{9} = \dfrac{1}{9}$

$\dfrac{1}{9} = \dfrac{1}{9}$

LHS = RHS

So the answer is correct.

(h) $a = 8 - \dfrac{3}{2}$

$a = \dfrac{16 - 3}{2}$

$a = \dfrac{13}{2}$

Check :

$a = 8 - \dfrac{3}{2}$

$\dfrac{13}{2} = 8 - \dfrac{3}{2}$

$\dfrac{13}{2} = \dfrac{16 - 3}{2}$

$\dfrac{13}{2} = \dfrac{13}{2}$

LHS = RHS

So the answer is correct.

(i) $\dfrac{1}{3}x - \dfrac{2}{3} = \dfrac{5}{6}$

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

$\dfrac{x}{3} = \dfrac{5 + 4}{6}$

$\dfrac{x}{3} = \dfrac{9}{6}$

$x = \dfrac{9 \times 3}{6}$

$x = \dfrac{9}{2}$

Check :

(j) $4(1 - p) = 3(p - 2)$

$4 - 4p = 3p - 6$

$-4p - 3p = -6 - 4$

$-7p = -10$

$p = \dfrac{10}{7}$

Check :

$\frac{1}{3}x-\frac{2}{3}=\frac{5}{6}$

$\frac{1}{3}\times\frac{9}{2}-\frac{2}{3}=\frac{5}{6}$

$\frac{9}{6}-\frac{2}{3}=\frac{5}{6}$

$\frac{9-4}{6}=\frac{5}{6}$

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

LHS = RHS

So, the answer is correct.

$4(1-p)=3(p-2)$

$4\left(1-\frac{10}{7}\right)=3\left(\frac{10}{7}-2\right)$

$4\left(\frac{7-10}{7}\right)=3\left(\frac{10-14}{7}\right)$

$4\times\frac{-3}{7}=3\times\frac{-4}{7}$

$\frac{-12}{7}=\frac{-12}{7}$

LHS = RHS

So, the answer is correct.

2. Solve :

(a) $4x-2(3x-5)+\frac{2}{3}(4x-7)=0$

$4x-6x+10+\frac{8}{3}x-\frac{14}{3}=0$

$\frac{4x}{1}-\frac{6x}{1}+\frac{8}{3}x=\frac{14}{3}-10$

$\frac{12x-18x+8x}{3}=\frac{14-30}{3}$

$\frac{2x}{3}=\frac{-16}{3}$

$x=\frac{-16}{2}$

So, $x=-8$

(b) $\frac{a-4}{7}-a=\frac{5-a}{3}+1$

$\frac{a-4-7a}{7}=\frac{5-a+3}{3}$

$\frac{-6a-4}{7}=\frac{8-a}{3}$

$3(-6a-4)=7(8-a)$

$-18a-12=56-7a$

$-18a+7a=56+12$

$-11a=68$

So, $a=\frac{-68}{11}$

(c) $7p-13=3(5p-4)$

$7p-13=15p-12$

$7p-15p=-12+13$

$-8p=+1$

$p=\frac{1}{-8}$

So, $p=\frac{-1}{8}$

(d) $q-\frac{q+1}{3}=\frac{q-1}{5}+q$

$q-\frac{(q+1)}{3}=\frac{q-1}{5}+q$

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

$\frac{2q-1}{3}=\frac{6q-1}{5}$

$5(2q-1)=3(6q-1)$

$10q-5=18q-3$

$10q-18q=-3+5$

$-8q=2$

$q=\frac{2}{-8}$

So, $q=\frac{-1}{4}$

(e) $\frac{3y-\frac{6}{7}}{4}+1=\frac{2y-\frac{1}{3}}{3}+5$

$\frac{\frac{21y-6}{7}}{4}+1=\frac{\frac{6y-1}{3}}{3}+5$

$\frac{21y-6}{7\times4}+1=\frac{6y-1}{3\times3}+5$

$\frac{21y-6}{28}+1=\frac{6y-1}{9}+5$

$\frac{21y-6+28}{28}=\frac{6y-1+45}{9}$

$\frac{21y+22}{28}=\frac{6y+44}{9}$

$9(21y+22)=28(6y+44)$

$189y+198=168y+1232$

$189y-168y=1232-198$

$21y=1034$

$y=\frac{1034}{21}$

3. Translate the following into mathematical sentences and solve them.

(a) Let no. be $=x$

So, according to question :

$\therefore\quad 3x-8=1$

$3x=1+8$

$3x=9$

$x=\frac{9}{3}$

$x=3$

So, equation $3x-8=1$; where $x=3$

(b) Let no. be $=x$

So, according to question :

$2x+5=x+10$

$2x-x=10-5$

$x=5$

So, equation $=2x+5=x+10$; where $x=5$

(c) Let no. be $=x$

So, according to question :

$\frac{x}{4}+11=\frac{3x}{4}$

or $\frac{x}{4}-\frac{3x}{4}=-11$

$\frac{x-3x}{4}=\frac{-11}{1}$

$\frac{-2x}{4}=\frac{-11}{1}$

$-2x=-44$

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

$x=22$

So, equation $= \frac{x}{4} + 11 = \frac{3x}{4}$; where $x = 22$

(d) Let no. be $= x$

So, according to question :

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

or $$x + \frac{2x}{3} - 4 = 1$$

$$x + \frac{2x}{3} = 1 + 4$$

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

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

$$x = 3 \times 1$$

$$x = 3$$

So, equation $= x + \left(\frac{2x}{3} - 4\right)$; where $x = 3$

4. Look these geometrical figures : Find x in each of them

(a) In ΔABC

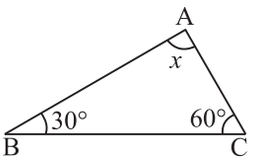
$\angle A + \angle B + \angle C = 180°$

$x + 30° + 60° = 180°$

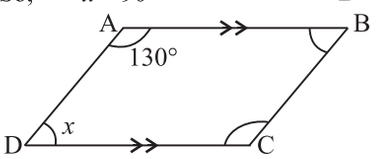
$x + 90° = 180°$

$x = 180° - 90°$

So, $x = 90°$



(b)



In parallelogram $ABCD$

$\angle A = \angle C = 130°$

and $\angle B = \angle D = x$

So, In $ABCD$

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

$130° + x° + 130° + x° = 360°$

$260° + 2x° = 360°$

$2x° = 360° - 260°$

$2x° = 100°$

$x° = \frac{100°}{2}$

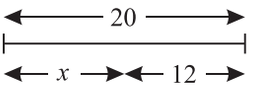
So, $x = 50°$

(c) In the given line

$x + 12 = 20$

$x = 20 - 12$

So, $x = 8$



(d) In the given figure

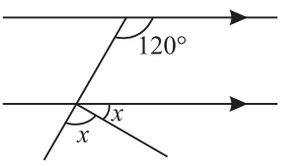
$x + x = 120°$

(corresponding angle)

$2x = 120°$

$x = \frac{120°}{2}$

So, $x = 60°$



Exercise 6.2

1. Let one no. be $= x$

So other no. be $= x + 10$

A.C.Q. : $x + x + 10 = 40$

$2x + 10 = 40$

$2x = 40 - 10$

$2x = 30$

$x = \frac{30}{2}$

$x = 15$

So, one no. be $= 15$

and other no. $= 15 + 10 = 25$

2. Let required no. be $= x$

A.C.Q. : $x - 8 = \frac{x}{3}$

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

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

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

$x = \frac{8 \times 3}{2}$

$x = 12$

Hence, the required number is 12.

3. Let other no. be $= x$

A.C.Q. : $x + 8 = 45$

$x = 45 - 8$

$x = 37$

So the other no. is 37.

4. Let the no. be $= x$

A.C.Q. : $3x + 12 = -6$

$3x = -6 - 12$

$3x = -18$

$x = \frac{-18}{3}$

$x = -6$

Hence the required number is -6.

5. Let the no. be $= x$

A.C.Q. : $\frac{7}{11} - \frac{x}{3} = \frac{24}{55}$

$\frac{7}{11} - \frac{24}{55} = \frac{x}{3}$

$\frac{35 - 24}{55} = \frac{x}{3}$

$\frac{11}{55} = \frac{x}{3}$

$\frac{1}{5} = \frac{x}{3}$

$x = \frac{1}{5} \times 3 = \frac{3}{5}$

Hence, the required number is $\frac{3}{5}$.

6. Let the no. be $= x$

A.C.Q. : $29 - 7x = 43$

$29 - 43 = 7x$

$7x = -14$

$x = \frac{-14}{7}$

$x = -2$

Hence, the required number is – 2.

7. Let the no. be $= x$

So, A.C.Q. : $x - 9 = \frac{21}{5}$

$x = \frac{21}{5} + 9$

$x = \frac{21 + 45}{5}$

$x = \frac{66}{5}$

Hence, the required number is $\frac{66}{5}$.

8. Let the no. be $= x$

So, A.C.Q. : $x - \frac{2}{3} \times 9 = \frac{1}{4}(x + 45)$

$x - 6 = \frac{1}{4}(x + 45)$

$4(x - 6) = x + 45$

$4x - 24 = x + 45$

$4x - x = 45 + 24$

$3x = 69$

$x = \frac{69}{3}$

$x = 23$

9. Let the no. be $= x$

So, A.C.Q. : $\frac{2}{3}(2x + 19) - 11 = 95$

$\frac{4x}{3} + \frac{38}{3} - 11 = 95$

$\frac{4x}{3} = \frac{95}{1} + \frac{11}{1} - \frac{38}{3}$

or $\frac{4x}{3} = \frac{285 + 33 - 38}{3}$

$\frac{4x}{3} = \frac{280}{3}$

$x = \frac{280 \times 3}{4 \times 3}$

$x = 70$

Hence, the required number is 70.

10. Let the no. be $= x$

So, A.C.Q. : $\frac{x}{4} + \frac{x}{9} + \frac{x}{3} = 25$

or $\frac{9x + 4x + 12x}{36} = 25$

$\frac{25x}{36} = \frac{25}{1}$

or $x = \frac{25 \times 36}{25}$

$x = 36$

Hence, the required number is 36.

11. Let fraction $= \frac{x - 1}{x}$

So, A.C.Q. : $\frac{x - 1 + 4}{x + 5} = \frac{4}{5}$

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

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

$5x + 15 = 4x + 20$

$5x - 4x = 20 - 15$

$x = 5$

so, the original fraction $= \frac{4}{5}$

12. Let the no. be $= x$

So, A.C.Q. : $\left[x + \frac{1}{3}\right] \times 2 = \frac{8}{3}$

$2x + \frac{2}{3} = \frac{8}{3}$

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

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

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

$x = 1$

Hence, the required number is 1.

13. Let, Kangna had sweets $= x$

She gave sweets to Rubi $= \frac{x}{2}$

A.C.Q. : $x - \frac{x}{2} = 7$

or $\frac{2x - x}{2} = 7$

$\frac{x}{2} = 7$

$x = 7 \times 2$

$x = 14$

So, sweets with Rubi $= \frac{14}{2} = 7$

14. Let the weight of the block of wood be x kg.

A.C.Q. : $\frac{x}{2} + 6 = x$

or $x - \frac{x}{2} = 6$

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

$x = 6 \times 2$

$x = 12$

So, the weight of the block of wood is 12 kg.

15. Let Female population of the town be x.

$\therefore$ Male population of town $= \frac{2}{3}x$

So, A.C.Q. $x + \frac{2}{3}x = 90000$

$\frac{3x + 2x}{3} = 90000$

$\frac{5x}{3} = 90000$

or $x = \frac{90000 \times 3}{5}$

$x = 54000$

So. no. of female $= 54000$

and no. of male $= 54000 \times \frac{2}{3} = 36000$

16. Let the fraction $= \frac{x-4}{x}$

A.C.Q. $\frac{x-4-1}{x} = \frac{2}{3}$

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

$3(x-5) = 2x$

$3x-15 = 2x$

$3x-2x = 15$

$x = 15$

So, the fraction $= \frac{15-4}{15} = \frac{11}{15}$

17. Let the fraction be $= \frac{x-2}{x}$

A.C.Q. $\frac{x-2+1}{x+1} = \frac{3}{4}$

or $\frac{x-1}{x+1} = \frac{3}{4}$

$4(x-1) = 3(x+1)$

$4x-4 = 3x+3$

$4x-3x = 3+4$

$x = 7$

so, fraction $= \frac{7-2}{7} = \frac{5}{7}$

18. Let the age of tony's father $= 2x$

So, the age of tony $= x$

A.C.Q. : $2x-10 = x-10+20$

$2x-10 = x+10$

or $2x-x = 10+10$

$x = 20$

so, the age of tony $= 20$ years

and age of tony's father $= 20 \times 2 = 40$ years.

19. Let the age of tuffy $= x$

So, the age of terry cat $= \frac{2}{3}x$

A.C.Q. : $x - \frac{2}{3}x = 4$

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

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

$x = 4 \times 3$

$x = 12$

So, the age of tuffy $= 12$ years

and the age of teffy cat $= 12 \times \frac{2}{3} = 8$ years.

20. Let the age of son $= x$

So, the age of father $= 2x$

A.C.Q. $x + 2x = 99$

$3x = 99$

$x = \frac{99}{3}$

$x = 33$

So, the age of son $= 33$ years

and the age of father $= 33 \times 2 = 66$ years.

21. Let the age of father be $= 4x$

so, age of the boy $= \frac{1}{4} \times 4x = x$

A.C.Q. $\frac{1}{2}(4x+24) = (x+24)$

or $2x+12 = x+24$

$2x-x = 24-12$

$x = 12$

So, the age of boy $= 12$ years

and the age of father $= 12 \times 4 = 48$ years.

22. Let the number of tickets of ₹ 2.50 $= x$

So, tickets of ₹ 5.00 $= 300-x$

A.C.Q. :

$x \times 2.50 + 5 \times (300-x) = 1250$

$2.50x + 1500 - 5x = 1250$

$-2.50x = 1250 - 1500$

$-2.50x = -250$

$x = \frac{250 \times 100}{2.50}$

$x = 100$

So, tickets of ₹ 2.50 $= 100$

and tickets of ₹ 5.00 $= 300-100 = 200$

23. Let No. of 50 paise coin $= x$

so, no. of 25 paise coin $= 76-x$

Total money $=$ ₹ 29 or 2900 paise

A.C.Q.

$50 \times x + 25(76-x) = 2900$

$50x + 1900 - 25x = 2900$

$25x = 2900 - 1900$

$25x = 1000$

$x = \frac{1000}{25}$

So, the number of 50-paise coins $= 40$

and the number of 25-paise coins $= 76-40 = 36$

24. 50-paise coins added up to a value $=$ ₹ 3.50

So the number of 50-paise coins $= \frac{3.50}{0.50} = \frac{35}{5} = 7$ paise

Let, The number of 10-paise coins $= x$

Thus, the number of 25-paise coins $= 2x$

$\because$ Total money $=$ ₹ 15.50

$= 15.50 \times 100$ p

$= 1550$ paise

$\therefore$ $x \times 10\text{ p} + 2x \times 25\text{ p} + 7 \times 50\text{ p} = 1550\text{ p}$

$10x + 50x + 350 = 1550$

$60x = 1550 - 350$

$60x = 1200$

$x = \frac{1200}{60}$

$x = 20$

Hence, the number of 10-paise coins $= 20$

the number of 25-paise coins $= 2 \times 20 = 40$

and the number of 50-paise coins $= 7$

25. Let the no. of 20 paise coins $= x$

so the no. of 5 paise coins $= 2x$

and the no. of 50 paise coins $= \frac{x}{5}$

$\because$ total money $=$ ₹ 2.00 or 200 paise

So, A.C.Q.

$20 \times x + 5 \times 2x + 50 \times \frac{x}{5} = 200$

$20x + 10x + 10x = 200$

$40x = 200$

$$x = \frac{200}{40}$$
$$x = 5$$

So, the number of 20 paise coins = 5
and the number of 5 paise coins = $2 \times 5 \Rightarrow 10$
and the number of 50 paise coins = $\frac{5}{5} = 1$

Mental Maths

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

MCQs

1. (c) **2.** (d) **3.** (c) **4.** (b) **5.** (b) **6.** (b) **7.** (c) **8**. (c)

NEP Life Skills

- Solution = 12 litre
  Alcohol in it = $33\frac{1}{3}\% = 4$ litre
  Let after mixing water solution = x litre
  Now $x \times 20\% = 4$
  $$x \times \frac{20}{100} = 4$$
  $$x = \frac{400}{20} = 20 \text{ litre}$$
  So, water is mixed = $20 - 12 = 8$ litre
- Let x kg of tea will be mixed.
  So, A.C.Q
  $$x \times 50 + 35 \times 60 = 57(35 + x)$$
  $$50x + 2100 = 1995 + 57x$$
  $$57x - 50x = 2100 - 1995$$
  $$7x = 105$$
  $$x = \frac{105}{7}$$
  $$x = 15$$

So, 15 kg tea of ₹ 50 per kg should be mixed.

Chapter 7

Comparing Quantities

Exercise 7.1

1. (a) Express 42% as a decimal.

$$42\% = \frac{42}{100} = 0.42$$

(b) Express $6\frac{1}{9}$ as a per cent.

$$6\frac{1}{9} = \frac{55}{9} = \frac{55 \times 100}{9 \times 100}$$
$$= \frac{5500}{9}\% \text{ or } 611\frac{1}{9}\%$$

(c) Express 81 : 9 as a per cent.

$$81 : 9 = \frac{81}{9}$$
$$= \frac{81}{9} \times \frac{100}{100} \text{ or } 900\%$$

2. Find x if :

(a) 40% of $x = 50$
$$x \times 40\% = 50$$
$$\frac{x \times 40}{100} = 50$$
$$x = \frac{50 \times 100}{40}$$
So, $x = 125$

(b) 10% of x is 4
$$x \times 10\% = 4$$
$$x \times \frac{10}{100} = 4$$
$$x = \frac{4 \times 100}{10}$$
So, $x = 40$

3. (a) What percent of 45 is 20?

Let x% of 45 is 20
So, $45 \times x\% = 20$
$$45 \times \frac{x}{100} = 20$$
$$x = \frac{100 \times 20}{45}$$
$$= \frac{400}{9}\% \text{ or } 44\frac{4}{9}\%$$

(b) What percent of ₹ 7.50 is ₹ 6
Let x percent of ₹ 7.50 = 6
$$7.50 \times x\% = 6$$
$$\frac{7.50 \times x}{100} = 6$$
$$x = \frac{6 \times 100}{7.50} \times 100$$
$$x = \frac{6 \times 100 \times 100}{750}$$
$$x = 80\%$$
So, 80% of ₹ 7.50 is ₹ 6.

4. men = 40%
women = 35%
so children $= 100 - (40 + 35)\%$
$= 100 - 75 = 25\%$

5. Let value of land = x
so, A.C.Q.
$$x + 20\% \text{ of } x = 18000$$
$$x + \frac{x \times 20}{100} = 18000$$
$$\frac{5x + x}{5} = 18000$$
$$\frac{6x}{5} = 18000$$

$$x = \frac{18000 \times 5}{6}$$
$$x = 15000$$

Hence, the price of land was ₹ 15000.

6. girls = 55%

so, boys = 100 − 55 = 45%

total students = 1800

so. No. of boys = 45% of 1800

$$= \frac{1800 \times 45}{100} = 810$$

Hence, the price of land was ₹ 15000.

7. Let C.P. = x, lost % = 10%

A.C.Q.

$$x - x \times 10\% = ₹\ 1200$$
$$x - \frac{x \times 10}{100} = 1200$$
$$\frac{10x - x}{10} = 1200$$
$$\frac{9x}{10} = 1200$$
$$x = \frac{1200 \times 10}{9}$$
$$x = 1333\frac{1}{3}$$

Now, gain = 10%

So, new selling price of article

$$= 1333\frac{1}{3} + \frac{12000}{9} \times 10\%$$
$$= 1333\frac{1}{3} + \frac{12000}{9} \times \frac{10}{100}$$
$$= 1333\frac{1}{3} + \frac{1200}{9}$$
$$= 1333\frac{1}{3} + 133\frac{1}{3} = ₹\ 1466\frac{2}{3}$$

8. Total trees = 320

apple trees = 25%

so, apple trees = $320 \times 25\%$

$$= 320 \times \frac{25}{100} = 80$$

lemon trees = 62.5%

so, lemon trees = $320 \times 62.5\%$

$$= 320 \times \frac{62.5}{100}$$
$$= \frac{32 \times 625}{100} = 200$$

So, mango trees = 320 − 80 − 200 = 40

9. Winner got vote = 53%

loser got vote = 100 − 53 = 47%

so, margin = 53% − 47% = 6%

Let total no. of voters = x

Now, 6% of x = 9600

$$x \times \frac{6}{100} = 9600$$
$$x = \frac{9600 \times 100}{6}$$
$$x = 160000$$

Hence, total 160000 votes pulled.

10. Let Sushil's income = 100

so, Ravi's income = 100 + 60 = 160

margin = 160 − 100 = 60

so, Sushil's income less than Ravi's income in percentage

$$= \frac{60}{160} \times 100 = \frac{600}{16} = \frac{150}{4}$$
$$= 37\frac{1}{2}\% \text{ or } 37.5\%$$

Hence, Sushil income is $37\frac{1}{2}\%$ less than that of Ravi's income.

11. Let population of town = 100

It increase 15% every year

so population after 1 year = 100 + 15 = 115

If population is 115 then population a year ago = 100

If population is 1 then population a year ago = $\frac{100}{115}$

If population is 20700 then population a year ago

$$= \frac{100}{115} \times 20700 = 18000$$

Hence, the population of the town a year age was 18000.

12. Let man's monthly income = ₹ 100

No saves 10% of his monthly incomes = ₹ 10

saving in a year = 10 × 12 = ₹ 120

If saving is ₹ 120, then monthly income = 100

If saving is ₹ 1 then monthly income = $\frac{100}{120}$

If saving is ₹ 16200, then monthly income

$$= ₹\ \frac{100}{120} \times 16200$$
$$= ₹\ 13500$$

Hence, the monthly income of man is ₹ 13500.

Exercise 7.2

1. M.P. = ₹ 1880

S.P. = ₹ 1504

Discount = 1880 − 1504 = ₹ 376

$\therefore$ Discount% = $\frac{\text{Discount}}{\text{M.P.}} \times 100$

$$= \frac{376}{1880} \times 100 = 20\%$$

2. M.P. = ₹ 35000

discount = 12%

$\therefore$ Discount = ₹ 35000 × 12%

$$= \frac{35000 \times 12}{100} = ₹\ 4200$$

So, S.P. = ₹ 35000 − ₹ 4200 = ₹ 30800

3. Let M.P. = 100

discount = 8% = 8

S.P. = 100 − 8 = 92

If S.P. 92, then M.P. = 100

If S.P. 1, then M.P. = $\frac{100}{92}$

If S.P. ₹ 4416, then M.P. = $\frac{100}{92} \times 4416 = ₹\ 4800$

So, the marked price of almirah is ₹ 4800.

4. Marks price = ₹ 1120

discount = 10%

so, discount $= 1120 \times 10\%$

$= \frac{1120 \times 10}{100} = ₹\ 112$

so, S.P. $= 1120 - 112 = ₹\ 1008$

Now, S.P. $= 1008$

profit $= 26\%$

C.P. $= ?$

$$\text{C.P.} = \frac{100 \times \text{S.P.}}{(100 + \text{profit }\%)}$$

$$= \frac{100 \times 1008}{126} = ₹\ 800$$

So, the cost price of shoes is ₹ 800.

5. C.P. $= ₹\ 1480$

Profit $= 10\%$

So, Profit $= \frac{1480 \times 10}{100} = ₹\ 148$

So, S.P. $= 1480 + 148 = ₹\ 1628$

Now, Let M.P. $= 100$

discount $= 12.5\% = 12.5$

S.P. $= 100 - 12.5 = 87.50$

Now, if S.P. $= 87.50$ then M.P. $= 100$

Now, if S.P. $= 1$ then M.P. $= \frac{100}{87.50}$

Now, if S.P. $= 1628$

then M.P. $= \frac{100 \times 1628 \times 101}{87.50}$

$= \frac{13024}{7} = 1860.57$

So, the market price of suit is ₹ 1860.57.

6. Cost price of saree $= ₹\ 2200$

gain $= 12\%$

so, gain $= ₹\ 2200 \times 12\%$

$= \frac{2200 \times 12}{100} = 264$

S.P. $= ₹\ 2200 + ₹\ 264$

$= ₹\ 2464$

Now, Let M.P. $= 100$

discount $= 26\% = 26$

S.P. $= 100 - 26 = 74$

Now, if S.P. $= 74$ then M.P. $= 100$

Now, if S.P. 1 then M.P. $= \frac{100}{74}$

Now, if S.P. 2464

then M.P. $= \frac{100}{74} \times 2464 = ₹\ 3329.73$

Hence, the market price of Saree is ₹ 3329.73.

7. M.P. $= ₹\ 3500$

discount $= 10\%$

so, discount $= ₹\ \frac{3500 \times 10}{100} = ₹\ 350$

So, S.P. $= ₹\ 3500 - ₹\ 350 = ₹\ 3150$

sale tax $= 10\%$

sale tax $= \frac{3510 \times 10}{100} = ₹\ 315$

So, customer had to pay $= ₹\ 3150 + ₹\ 315$

$= ₹\ 3465$

8. Let Marked price $= x$

discount $= 20\%$

discount $= \frac{x \times 20}{100} = \frac{x}{5}$

S.P. $= x - \frac{x}{5} = \frac{5x - x}{5} = \frac{4x}{5}$

$$\text{C.P.} = \frac{100 \times \text{S.P.}}{100 + 25\%}$$

$= \frac{100}{125} \times \frac{4x}{5} = \frac{16x}{25}$

profit S.P. – C.P.

$₹\ 150 = \frac{4x}{5} - \frac{16x}{25}$

$₹\ 150 = \frac{20x - 16x}{25}$

$₹\ 150 = \frac{4x}{25}$

$x = ₹\ \frac{150 \times 25}{4} = ₹\ 937.50$

Hence, the market price of the instrument is ₹ 937.50.

Exercise 7.3

1. Complete the following table :

Ans. (a) Principal $= ₹\ 3520$

Interest $= ₹\ 250$

Amount $= ₹\ 3520 + ₹\ 250 = ₹\ 3770$

(b) Principal $= ₹\ 5780$

Amount $= ₹\ 6240$

Interest $=$ Amount $-$ Principal

$= ₹\ 6240 - ₹\ 5780 = ₹\ 460$

(c) Principal $= ₹\ 2750$

Rate % $= ₹\ 10\%$

Time $= 2$ years

$$\text{S.I.} = \frac{\text{P} \times \text{R} \times \text{T}}{100}$$

$= \frac{2750 \times 10 \times 2}{100} = ₹\ 550$

Amount $= \text{P} + \text{S.I.}$

$= ₹\ 2750 + ₹\ 550 = ₹\ 3300$

(d) Principal $= ₹\ 9600$

Rate $= 8\%$

time $= 3$ months $= \frac{3}{12}$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$= \frac{9600 \times 8 \times 3}{100 \times 12} = ₹\ 192$

Amount $= \text{P} + \text{S.I.}$

$= ₹\ 9600 + ₹\ 192 = ₹\ 9792$

(e) $R = 5\%$, $T = 3$ years

S.I. $= ₹\ 1500$

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$1500 = \frac{P \times 5 \times 3}{100}$

$P = \frac{1500 \times 100}{5 \times 3}$

$P = ₹\ 10000$

Amount $= \text{P} + \text{S.I.}$

$= 10000 + 1500 = ₹\ 11500$

(f) $P = ₹\ 4750$

$R = 12\frac{1}{2}\% \Rightarrow \frac{25}{2}\%$

$T = 2$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= \frac{4750 \times 25 \times 2}{100 \times 2} = 1187.50$$

$$\text{Amount} = \text{P} + \text{S.I.}$$

$$= 4750 + 1187.50 = 5937.50$$

(g) $R = 10\%$

$T = 73$ days or $\frac{73}{365}$ years

S.I. = ₹ 500

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$500 = \frac{P \times 10 \times 73}{100 \times 365}$$

$$P = \frac{500 \times 100 \times 5}{10}$$

$P = ₹\ 25000$

$A = P + \text{S.I.}$

$= 25000 + 500$

$= ₹\ 25500$

(h) Principal = ₹ 5000

$R = 9\%$

S.I. = ₹ 2700

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$2700 = \frac{5000 \times 9 \times T}{100}$$

$$T = \frac{2700}{50 \times 9}$$

$T = 6$ year

$$\text{Amount} = P + \text{S.I.}$$

$= 5000 + 2700 = ₹\ 7700$

2. $P = ₹\ 30000$, $R = 9\%$ per annum, $T = 4$ years

(a) $$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= \frac{30000 \times 9 \times 4}{100} = ₹\ 10800$$

(b) $$\text{Amount} = \text{P} + \text{S.I.}$$

$= 30000 + 10800 = ₹\ 40800$

(c) Monthly payment $= ₹\ \frac{40800}{4 \times 12} = ₹\ 850$

3. $P = ₹\ 4000$, $T = 5$ years, $A = ₹\ 5400$

$$\text{S.I.} = A - P$$

$= 5400 - 4000 = ₹\ 1400$

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$1400 = \frac{4000 \times R \times 5}{100}$$

$$R = \frac{1400}{40 \times 5}$$

$R = 7\%$

Now, $R = 7\%$, $P = ₹\ 5600$, $T = 3$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= \frac{5600 \times 7 \times 3}{100} = ₹\ 1176$$

$$\text{Amount} = \text{P} + \text{S.I.}$$

$= 5600 + 1176 = ₹\ 6776$

4. $P = ₹\ 3650$, $R = 10\%$

$T = 3$ Jan, 2006 to 17 March, 2006 $= 73$ days or $\frac{73}{365}$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= \frac{3650 \times 10 \times 73}{100 \times 365} = ₹\ 73$$

5. $P = ?$, S.I. = ₹ 840

$R = 2\frac{1}{2}\% = \frac{5}{2}\%$, $T = 3$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$840 = \frac{P \times 5 \times 3}{100 \times 2}$$

$$P = \frac{840 \times 100 \times 2}{5 \times 3}$$

$P = ₹\ 11200$

6. $P = ₹\ 10000$, $R = 10\%$, $T = 3$ years

For compound interest

$$A = P\left[1 + \frac{R}{100}\right]^T$$

$$A = 10000\left[1 + \frac{10}{100}\right]^3$$

$$A = 10000\left(\frac{11}{10}\right)^3$$

$$= \frac{1000 \times 11 \times 11 \times 11}{10 \times 10 \times 10} = ₹\ 13310$$

$$\text{C.I.} = A - P$$

$= 13310 - 10000 = ₹\ 3310$

7. $P = ₹\ 8000$

$R = 12\frac{1}{2}\% \Rightarrow \frac{25}{2}\%$

$T = 2$ years

For compound interest

$$A = P\left[1 + \frac{R}{100}\right]^T$$

$$= 8000\left[1 + \frac{25}{2 \times 100}\right]^2$$

$$= 8000\left[1 + \frac{1}{8}\right]^2 = 8000\left[\frac{9}{8}\right]^2$$

$$= \frac{8000 \times 9}{8} \times \frac{9}{8} = ₹\ 10125$$

$$\text{C.I.} = A - P$$

$= ₹\ 662 - 8000$

$= ₹\ 2125$

8. $P = ₹\ 2000$, $R = 10\%$, $T = 3$ years

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 2000\left[1+\frac{10}{100}\right]^3 = 2000\left[\frac{11}{10}\right]^3$$

$$= 2000\times\frac{11}{10}\times\frac{11}{10}\times\frac{11}{10} = ₹2662$$

C.I. $= A - P$

$= ₹\ 2662 - 2000 = ₹\ 662$

9. $P = 2500$, $R = 20\%$, $T = 3$ years

S.I. $= \dfrac{P\times R\times T}{100}$

$= \dfrac{2500\times 20\times 3}{100} = ₹\ 1500$

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 2500\left[1+\frac{20}{100}\right]^3 = 2500\left[\frac{6}{5}\right]^3$$

$$= \frac{2500\times 6\times 6\times 6}{5\times 5\times 5} = ₹\ 4320$$

C.I. $= A - P$

$= 4320 - 2500 = ₹\ 1820$

difference $=$ C.I. $-$ S.I.

$= 1820 - 1500 = ₹\ 320$

10. Principle $= ₹\ 3500$, Rate $= 8\%$ p.a.; Time $= 2$ years

For compound interest,

$$A = P\left(1+\frac{R}{100}\right)^T$$

$$= ₹\ 3500\left(1+\frac{8}{100}\right)^2 = ₹\ 3500\times\left(\frac{27}{25}\right)^2$$

$$= ₹\ 3500\times\frac{27}{25}\times\frac{27}{25}$$

$$= ₹\ \frac{28\times 729}{5} = ₹\ \frac{20412}{5}$$

$= ₹\ 4082.40$

11. (a) $P = 93750$, $R = 9.6\%$, $T = 2$ years

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 93750\left[1+\frac{9.6}{100}\right]^2$$

$$A = 93750\left[\frac{1096}{1000}\right]^2$$

$$= \frac{93750\times 1096\times 1096}{1000\times 1000} = ₹\ 112614$$

(b) Now, $P = ₹\ 112614$, $R = 9.6\%$, $T = 1$ years

S.I. $= \dfrac{P\times R\times T}{100}$

$= \dfrac{112614\times 9.6\times 1}{100} = ₹\ 10810.94$

12. $P = ₹\ 1000$

$R = 8\%$ per annum or $\dfrac{8\%}{2} = 4\%$ half yearly

$T = 1\dfrac{1}{2}$ years $= \dfrac{3}{2}$ years or $\dfrac{3}{2}\times 2 = 3$ half years

For compound Interest

$$A = P\left[1+\frac{R}{100}\right]^T = 1000\left[1+\frac{4}{100}\right]^3$$

$$A = 1000\left[\frac{26}{25}\right]^3 = \frac{1000\times 26\times 26\times 26}{25\times 25\times 25}$$

$$= \frac{140608}{125} = 1124.864$$

C.I. $= A - P$

$= 1124.864 - 1000$

$= ₹\ 124.864$

13. $P = ₹\ 9600$, $R = 5\dfrac{1}{2}\% = \dfrac{11}{2}\%$, $T = 3$ years

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T = 9600\left[1+\frac{11}{200}\right]^3$$

$$= 9600\times\left(\frac{211}{200}\right)^3$$

$$= \frac{9600\times 211\times 211}{200\times 200}\times\frac{211}{200}$$

$= ₹\ 11272.72$

C.I. $= A - P$

$= ₹\ 11272.72 - ₹\ 9600$

$= ₹\ 1672.72$

Exercise 7.4

1. $P = ₹\ 6250$, $R = 4\%$, $T = 2$ years

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 6250\left[1+\frac{4}{100}\right]^2 = 6250\times\left(\frac{26}{25}\right)^2$$

$$= 6250\times\frac{26}{25}\times\frac{26}{25}$$

$= ₹\ 6760$

C.I. $= A - P$

$= ₹\ 6760 - ₹\ 6250 = ₹\ 510$

2. $P = ₹\ 20000$, $R = 7.5\%$, $T = 3$ years

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 20000\left[1+\frac{7.5}{100}\right]^3$$

$$= 20000\times\left(\frac{1075}{1000}\right)^3$$

$$= \frac{20000\times 43\times 43\times 43}{40\times 40\times 40}$$

$$= \frac{397535}{16}$$

$= ₹\ 24845.94$

3. Let $P = ₹\ x$, $T = 2$ years, $R = 10\%$

$$\text{S.I.} = \frac{P \times R \times T}{100}$$
$$= \frac{x \times 2 \times 10}{100} = ₹\ \frac{x}{5}$$

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$= x\left(1+\frac{10}{100}\right)^2 = x\left(\frac{11}{10}\right)^2$$
$$= x \times \frac{11}{10} \times \frac{11}{10} = \frac{121}{100}x$$
$$\text{C.I.} = A - P$$
$$= \frac{121x}{100} - x = \frac{121x - 100x}{100}$$
$$= \frac{21x}{100}$$

Now, difference $= \frac{21x}{100} - \frac{x}{5}$
$$= \frac{21x - 20x}{100} = \frac{x}{100}$$

So difference $\frac{x}{100} = ₹\ 300$

or $x = ₹\ 300 \times 100$

$x = ₹\ 30000$

so, principal $= ₹\ 30000$

4. $P = ₹\ 1000$

$R = 10\%$ per annum or $\frac{10}{2} = 5\%$ half yearly

$T = 18$ months $= \frac{18}{12}$ year $= \frac{3}{2}$ years or $\frac{3}{2} \times 2 = 3$ half years

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$A = P\left[1+\frac{5}{100}\right]^3$$
$$A = 1000\left[1+\frac{1}{20}\right]^3$$
$$= 1000 \times \left(\frac{21}{20}\right)^3$$
$$= 1000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$
$$= \frac{9261}{8} = 1157.625$$
$$\text{C.I.} = A - P$$
$$= ₹\ 1157.625 - ₹\ 1000$$
$$= ₹\ 157.625$$

5. $P = ₹\ 1600$

$R = 10\%$ per annum or $\frac{10}{4}\%$ per quarterly

$T = 6$ months or $\frac{6}{12}$ years or $\frac{6}{12} \times 4$ quarter $= 2$ quarter

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$A = 1600\left[1+\frac{10}{4 \times 100}\right]^T$$
$$= 1600\left(1+\frac{1}{40}\right)^T = 1600 \times \left(\frac{41}{40}\right)^2$$
$$= 1600 \times \left(\frac{41}{40} \times \frac{41}{40}\right) = 1681$$
$$\text{C.I.} = A - P$$
$$= 1681 - 1600 = ₹\ 81$$

6. $R = 5\%$ per annum $= \frac{5}{2}$ half yearly

$P = ₹\ 1000$

$T = 1$ years $=$ or 2 half years

For compound interest

$$A = P\left[1+\frac{R}{100}\right]^T = 1000\left[1+\frac{5}{2 \times 100}\right]^2$$
$$= 1000\left[1+\frac{1}{40}\right]^2 = 1000\left[\frac{41}{40}\right]^2$$
$$= 1000 \times \frac{41}{40} \times \frac{41}{40} = \frac{16810}{16}$$
$$= 1050.625$$
$$\text{C.I.} = A - P$$
$$= 1050.625 - 1000$$
$$= ₹\ 50.625$$

7. $A = ₹\ 10830$, $P = ?$, $R = -5\%$

$T = 2$ years

$$A = P\left[1+\frac{(R)}{100}\right]^T$$
$$10830 = P\left[1+\frac{(-5)}{100}\right]^2$$
$$\Rightarrow \quad 10830 = P\left(1-\frac{1}{20}\right)^2$$
$$10830 = P \times \left(\frac{19}{20}\right)^2$$
$$10830 = P \times \frac{19}{20} \times \frac{19}{20}$$
$$P = \frac{10830 \times 20 \times 20}{19 \times 19}$$
$$= ₹\ 12000$$

So, the cost of motor cycle before two years was $= ₹\ 12000$

8. $A = ₹\ 5832$, $T = 2$ years, $R = 8\%$, $P = ?$

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$5832 = P\left[1+\frac{8}{100}\right]^2$$
$$5832 = P \times \left(\frac{27}{25}\right)^2$$
$$5832 = P \times \frac{27}{25} \times \frac{27}{25}$$
$$P = \frac{5832 \times 25 \times 25}{27 \times 27}$$
$$P = ₹\ 5000$$

9. $P = ₹\ 1000,\ A = ₹\ 1102.50,\ T = 2$ years, $R = ?$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$1102.50 = 1000\left[1+\frac{R}{100}\right]^2$$

or $$\frac{1102.50}{1000\times 100} = \left[1+\frac{R}{100}\right]^2$$

$$\frac{110250}{100000} = \left[1+\frac{R}{100}\right]^2$$

$$\frac{441}{400} = \left[1+\frac{R}{100}\right]^2$$

$$\left(\frac{21}{20}\right)^2 = \left(1+\frac{R}{100}\right)^2$$

or $$1+\frac{R}{100} = \frac{21}{20}$$

$$\frac{R}{100} = \frac{21}{20} - 1$$

$$\frac{R}{100} = \frac{21-20}{20}$$

$$\frac{R}{100} = \frac{1}{20}$$

$$R = \frac{100}{20}$$

$R = 5\%$ per annum.

10. $P = ₹\ 1800,\ R = 10\%$,
C.I. $= ₹\ 378,\ T = ?$

$$A = P + \text{C.I.}$$
$$= 1800 + 378$$
$$= ₹\ 2178$$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$2178 = 1800\left[1+\frac{10}{100}\right]^T$$

$$\frac{2178}{1800} = \left(\frac{11}{10}\right)^T$$

$$\frac{2178}{1800} = \left(\frac{11}{10}\right)^T$$

$$\frac{121}{100} = \left(\frac{11}{10}\right)^T$$

or $$\left(\frac{11}{10}\right)^2 = \left(\frac{11}{10}\right)^T$$

or $T = 2$ years.

11. $P = 1000000,\ A = 1225043,\ T = 3$ years, $R = ?$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$1225043 = 1000000\left[1+\frac{R}{100}\right]^3$$

$$\frac{1225043}{1000000} = \left[1+\frac{R}{100}\right]^3$$

$$\left(\frac{107}{100}\right)^3 = \left[1+\frac{R}{100}\right]^3$$

or $$\left(1+\frac{R}{100}\right) = \frac{107}{100}$$

$$\frac{R}{100} = \frac{107}{100} - 1$$

$$\frac{R}{100} = \frac{107-100}{100}$$

$$\frac{R}{100} = \frac{7}{100}$$

$R = 7\%$ per annum.

12. $R = 10\%$, $P = 60000,\ A = 79860,\ T = ?$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$79860 = 60000\left[1+\frac{10}{100}\right]^T$$

$$\frac{79860}{60000} = \left[\frac{11}{10}\right]^T$$

or $$\frac{1331}{1000} = \left(\frac{11}{10}\right)^T$$

or $$\frac{11\times 11\times 11}{10\times 10\times 10} = \left(\frac{11}{10}\right)^T$$

$$\left(\frac{11}{10}\right)^3 = \left(\frac{11}{10}\right)^T$$

or $T = 3$ years.

13. $P = 800,\ A = 926.10$

$R = 10\%$ per annum or $\frac{10}{2} = 5\%$ per half yearly

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$926.10 = 800\left[1+\frac{5}{100}\right]^T$$

$$\frac{926.10}{800} = \left[1+\frac{5}{100}\right]$$

$$\frac{9261}{8000} = \left(\frac{21}{20}\right)^T$$

or $$\frac{21\times 21\times 21}{20\times 20\times 20} = \left(\frac{21}{20}\right)^T$$

$$\left(\frac{21}{20}\right)^3 = \left(\frac{21}{20}\right)^T$$

$T = 3$ or $T = 3$ half years

or $T = \frac{3}{2}$ years $= 1\frac{1}{2}$ years

14. $P = ₹\ 31250,\ A = ₹\ 35152$

$T = 1\frac{1}{2}$ years or $\frac{3}{2}$ years or 3 half years

$R = ?$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$35152 = 31250\left[1+\frac{R}{100}\right]^3$$

$$\frac{35152}{31250} = \left[1+\frac{R}{100}\right]^3$$

$$\frac{26\times26\times26}{25\times25\times25} = \left[1+\frac{R}{100}\right]^3$$

$$\left(\frac{26}{25}\right)^3 = \left[1+\frac{R}{100}\right]^3$$

or $$1+\frac{R}{100} = \frac{26}{25}$$

$$\frac{R}{100} = \frac{26}{25}-1$$

$$\frac{R}{100} = \frac{26-25}{25}$$

$$\frac{R}{100} = \frac{1}{25}$$

$$R = \frac{100}{25} = 4\%$$

$R = 4\%$ per half years

or $R = 4\times2 = 8\%$ per annum.

Exercise 7.5

1. $P = ?$, $A = ₹\ 7290$, $T = 2$ years, $R = 8\%$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$7290 = P\left[1+\frac{8}{100}\right]^2$$

$$7290 = P\left(\frac{27}{25}\right)^2$$

$$P = 7290\times\left(\frac{25}{27}\right)^2$$

$$P = \frac{7290\times25\times25}{27\times27}$$

$$P = ₹\ 6250$$

2. Find the amount, if :

(a) $P = ₹\ 2500$, $T = 4$ years, $R = 5\%$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 2500\left[1+\frac{5}{100}\right]^4$$

$$= 2500\times\left(\frac{21}{20}\right)^4$$

$$= \frac{2500\times21\times21\times21\times21}{20\times20\times20\times20}$$

$$= \frac{194481}{64}$$

$$= ₹\ 3038.77$$

(b) $P = ₹\ 9450$, $T = 2$ years, $R = 4\%$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$A = 9450\left[1+\frac{4}{100}\right]^2 = 9450\left[\frac{26}{25}\right]^2$$

$$= \frac{9450\times26\times26}{25\times25}$$

$$= \frac{255528}{25} = ₹\ 10221.12$$

(c) $P = ₹\ 9360$, $R = 6\%$, $T = 3$ years

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 9360\left[1+\frac{6}{100}\right]^3 = 9360\left[\frac{53}{50}\right]^3$$

$$= \frac{9360\times53\times53\times53}{50\times50\times50}$$

$$= ₹\ 11147.91$$

3. Find the compound interest on :

(a) $P = ₹\ 2500$, $R = 8\%$, $T = 2$ years

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$A = 2500\left[1+\frac{8}{100}\right]^2$$

$$A = 2500\left[\frac{27}{25}\right]^2$$

$$= \frac{2500\times27}{25}\times\frac{27}{25} = ₹\ 2916$$

C.I. $= A-P$

$= 2916-2500 = ₹\ 416$

(b) $P = ₹\ 4000$, $R = 5\%$ per annum, $T = 3$ years

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 4000\left[1+\frac{5}{100}\right]^3 = 4000\left[\frac{21}{20}\right]^3$$

$$= 4000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}$$

$$= \frac{9261}{2} = ₹\ 4630.5$$

C.I. $= A-P$

$= 4630.50-4000 = ₹\ 630.50$

(c) $P = ₹\ 10000$, $T = 3$ years, $R = 10\%$

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 10000\left[1+\frac{10}{100}\right]^3 = 10000\left(\frac{11}{10}\right)^3$$

$$= 10000\times\frac{11}{10}\times\frac{11}{10}\times\frac{11}{10} = ₹\ 13310$$

C.I. $= A-P$

$= 13310-10000 = ₹\ 3310$

(d) $P = ₹\ 8000$, $R = 12\%$ per annum, $T = 2$ years

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 8000\left[1+\frac{12}{100}\right]^2 = 8000\left[\frac{28}{25}\right]^2$$

$$= \frac{8000 \times 28 \times 28}{25 \times 25} = ₹\ 10035.20$$

$$\text{C.I.} = A - P$$
$$= 10035.20 - 8000 = ₹\ 2035.20$$

4. $P = ₹\ 10000,\ R = 5\%,\ T = 2\frac{1}{2}$ years

We will calculate it for 2 years only and then other 6 months later.

$$A = P\left[1 + \frac{R}{100}\right]^T$$
$$A = 10000\left[1 + \frac{5}{100}\right]^2$$
$$= 10000\left(\frac{21}{20}\right)^2$$
$$= \frac{10000 \times 21 \times 21}{20 \times 20} = ₹\ 11025$$
$$\text{C.I.} = A - P$$
$$= 11025 - 10000 = ₹\ 1025$$

Now, for 6 months $P = 11025$

$R = 5\%,\ T = 6\text{ months} = \frac{6}{12}$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$
$$= \frac{11025 \times 5 \times 6}{100 \times 12} = 275.625$$

So, total C.I. $= ₹\ 1025 + 275.625$
$= ₹\ 1300.625$

5. $P = ₹\ 50000,\ R = 8\%,\ T = 3$ years

$$A = P\left[1 + \frac{R}{100}\right]^T$$
$$= 50000\left[1 + \frac{8}{100}\right]^3$$
$$= 50000 \times \left(\frac{108}{100}\right)^3$$
$$= 50000 \times \frac{27}{25} \times \frac{27}{25} \times \frac{27}{25}$$
$$= \frac{314928}{5} = ₹\ 62985.60$$
$$\text{C.I.} = A - P$$
$$= 62985.60 - 50000 = ₹\ 12985.60$$

6. $R = 18\%,\ A = ₹\ 4177.20,\ T = 2$ years, $P = ?$

$$A = P\left[1 + \frac{R}{100}\right]^T$$
$$4177.20 = P\left[1 + \frac{18}{100}\right]^2$$
$$4177.20 = P\left[\frac{118}{100}\right]^2$$
$$4177.20 = P \times \frac{118}{100} \times \frac{118}{100}$$
$$P = \frac{4177.20 \times 100 \times 100}{118 \times 118}$$
$$P = ₹\ 3000$$

7. $P = ₹\ 40000,\ A = ₹\ 44100,\ R = 5\%,\ T = ?$

$$A = P\left[1 + \frac{R}{100}\right]^T$$
$$44100 = 40000\left[1 + \frac{5}{100}\right]^T$$
$$\frac{44100}{40000} = \left(\frac{21}{20}\right)^T$$
$$\frac{21 \times 21}{20 \times 20} = \left(\frac{21}{20}\right)^T$$
$$\left(\frac{21}{20}\right)^2 = \left(\frac{21}{20}\right)^T$$
$$T = 2\text{ years.}$$

8. $P = ₹\ 16000,\ R = 5\%,\ T = 3$ years

$$A = P\left[1 + \frac{R}{100}\right]^T$$
$$A = 16000\left[1 + \frac{5}{100}\right]^3$$
$$= 16000\left[\frac{21}{20}\right]^3$$
$$= \frac{16000 \times 21 \times 21 \times 21}{20 \times 20 \times 20}$$
$$= ₹\ 18522$$
$$\text{C.I.} = A - P$$
$$= 18522 - 16000 = ₹\ 2522$$

9. $P = ₹\ 6750,\ A = ₹\ 8192,\ R = 6\frac{2}{3}\% = \frac{20}{3}\%$

$$A = P\left[1 + \frac{R}{100}\right]^T$$
$$8192 = 6750\left[1 + \frac{20}{3 \times 100}\right]^T$$
$$\frac{8192}{6750} = \left[\frac{16}{15}\right]^T$$
$$\frac{16 \times 16 \times 16}{15 \times 15 \times 15} = \left(\frac{16}{15}\right)^T$$
$$\left(\frac{16}{15}\right)^3 = \left(\frac{16}{15}\right)^T$$

or $T = 3$ years.

10. $T = 2$ years, $R = 10\%$

S.I. $= ₹\ 1000,\ P = ?$

$$\text{S.I.} = \frac{P \times R \times T}{100}$$
$$1000 = \frac{P \times 10 \times 2}{100}$$
$$P = \frac{1000 \times 10}{2}$$
$$P = ₹\ 5000$$

Now, $P = ₹\ 5000,\ R = 8\%,\ T = 2$ years

$$A = P\left[1 + \frac{R}{100}\right]^T$$

$$A = 5000\left[1+\frac{8}{100}\right]^2$$
$$= 5000\times\left(\frac{27}{25}\right)^2$$
$$= \frac{5000\times 27\times 27}{25\times 25} = ₹\ 5832$$
$$\text{C.I.} = A - P$$
$$= 5832 - 5000 = ₹\ 832$$

11. $P = ₹\ 12000$

$R = 8\%$ per annum or $\frac{8}{2} = 4\%$ half year

$T = 1$ years or 2 half years

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$= 12000\left[1+\frac{4}{100}\right]^2 = 12000\left(\frac{26}{25}\right)^2$$
$$= \frac{12000\times 26\times 26}{25\times 25} = ₹\ 12979.20$$

So, $\text{C.I.} = A - P$
$$= 12979.20 - 12000 = ₹\ 979.20$$

12. $P = ₹\ 15000$

$R = 6\%$ per annum or $\frac{6}{2} = 3\%$ per half yearly

$T = 1\frac{1}{2}$ years or $\frac{3}{2}$ years or 3 half years

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$= 15000\left[1+\frac{3}{100}\right]^3 = 15000\times\left[\frac{103}{100}\right]^3$$
$$= \frac{15000\times 103\times 103\times 103}{100\times 100\times 100} = 16390.91$$
$$\text{C.I.} = A - P$$
$$= 16390.91 - 15000 = 1390.91$$

13. $A = ₹\ 12167$, $R = 15\%$, $T = 3$ years

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$12167 = P\left[1+\frac{15}{100}\right]^3$$
$$12167 = P\left[\frac{23}{20}\right]$$
$$12167 = \frac{P\times 23\times 23\times 23}{20\times 20\times 20}$$
$$P = \frac{12167\times 20\times 20\times 20}{23\times 23\times 23}$$
$$P = ₹\ 8000$$

14. $P = 6400$, $T = 2$ years

$R = 6\frac{1}{4}\% = \frac{25}{4}\%$

$$A = P\left[1+\frac{R}{100}\right]$$
$$A = 6400\left[1+\frac{25}{4\times 100}\right]^2$$
$$= 6400\left[1+\frac{1}{16}\right]^2 = 6400\left[\frac{17}{16}\right]^2$$
$$= \frac{6400\times 17\times 17}{16\times 16} = ₹\ 7225$$
$$\text{C.I.} = A - P$$
$$= 7225 - 6400 = ₹\ 825$$
$$\text{S.I.} = \frac{P\times R\times T}{100}$$
$$= \frac{6400\times 25\times 2}{100\times 4} = ₹\ 800$$
$$\text{difference} = 825 - 800 = ₹\ 25$$

15. Let $P = x$, $R = 5\%$, $T = 3$ years

$$\text{S.I.} = \frac{P\times R\times T}{100}$$
$$\text{S.I.} = \frac{x\times 5\times 3}{100} = \frac{3x}{20}$$

Now, for C.I. $P = x$, $R = 5\%$, $T = 3$ years

$$A = P\left[1+\frac{R}{100}\right]^T$$
$$A = x\left[1+\frac{5}{100}\right]^3 = x\left(\frac{21}{20}\right)^3$$
$$= \frac{x\times 21\times 21\times 21}{20\times 20\times 20} = \frac{9261}{8000}x$$
$$\text{C.I.} = A - P$$
$$= -\frac{9261x}{8000} - x$$
$$= \frac{9261x - 8000x}{8000} = \frac{1261x}{8000}$$

$\therefore$ $\text{difference} = \frac{1261x}{8000} - \frac{3x}{20}$

or $\frac{1261x}{8000} - \frac{3x}{20} = 183$

$$\frac{1261x - 1200x}{8000} = 183$$
$$\frac{61x}{8000} = 183$$
$$x = \frac{183\times 8000}{61}$$
$$x = 24000$$

so, $P = ₹\ 24000$

16. $P = 7396$ in two years

$A = 7950.70$ in three

So, $\text{S.I.} = 7950.70 - 7396.00$
$= 554.70$ for 1 years

Now, $P = 7396$, $\text{S.I.} = 554.70$

$T = 1$ years, $R = ?$

$$\text{S.I.} = \frac{P\times R\times T}{100}$$
$$554.70 = \frac{7396\times R\times 1}{100}$$
$$R = \frac{554.70\times 100}{1\times 7396}$$
$$R = \frac{55470}{7396}$$
$$= 7.5\%\ \text{per annum}$$

17. $P = ₹\ 15625$

$T = 9$ months or $\frac{9}{12}$ years or $\frac{9}{12} \times 4 = 3$ quarters

$R = 16\%$ per annum $= \frac{16}{4}\% = 4\%$ quarterly

$$A = P\left[1+\frac{R}{100}\right]^T$$

$$= 15625\left[1+\frac{4}{100}\right]^3 = 15625\left[\frac{26}{25}\right]^3$$

$$= \frac{15625 \times 26 \times 26 \times 26}{25 \times 25 \times 25} = ₹\ 17576$$

Exercise 7.6

1. Look at the following tables and point out in which cases do a and b vary directly ?

(a)

a	9	10	15	30	40	80	100
b	18	20	30	60	80	160	200

Here $\frac{{}^{1}9}{{}_{2}18} = \frac{10^{1}}{20_{2}} = \frac{15^{1}}{30_{2}} = \frac{{}^{1}30}{{}_{2}60} = \frac{40^{1}}{80_{2}} = \frac{80^{1}}{160_{2}}$

$= \frac{100^{1}}{200_{2}} = \frac{1}{2} = k$

so, this table vary directly

(b)

a	3	6	12	24	50	60	100
b	10	20	40	100	150	200	300

Here $\frac{3}{10} = \frac{{}^{1}6}{{}_{10}20} = \frac{12^{3}}{40_{10}} = \frac{24^{6}}{100_{25}} = \frac{50^{1}}{150_{3}}$

$= \frac{{}^{3}60}{{}_{10}200} = \frac{100^{1}}{300_{3}}$

Here $k =$ not same

So, this table not vary directly.

2. If a and b vary directly in each of the following, then complete the table :

(a)

a	2	6	7	8
b	5	15	17.5	20

(b)

a	2	3	7	25	120
b	24	36	84	300	1440

3. $x = ?,\ y = 400,\ k = 40$

We have,

$$\frac{x}{y} = k$$

$$\frac{x}{400} = 40$$

So, $x = 40 \times 400 = 16000$

4. $y \propto x$

if $x = 2,\ y = 8$ then $k = ?$

Here, $\frac{y}{x} = k$

$$\frac{8}{2} = k$$

So, $k = 4$

5. If $x \propto 5y$

$x_1 = 10,\ y_1 = 2,$ find $x_2 = ?$ when $y_2 = 7$

or $\frac{x_1}{y_1} = \frac{x_2}{y_2}$

$$\frac{10}{2} = \frac{x_2}{7}$$

$$x_2 = \frac{10 \times 7}{2}$$

$$x_2 = 5 \times 7$$

So, $x_2 = 35$

6. $p \propto q$

Here $p_1 = 282,\quad q_1 = 5.1$

$p_2 = ?,\quad q_2 = 6.8$

so, $\frac{p_1}{q_1} = \frac{p_2}{q_2}$

$$\frac{282}{5.1} = \frac{p_2}{6.8}$$

$$p_2 \times 5.1 = 282 \times 6.8$$

$$p_2 = \frac{282 \times 6.8 \times 10}{5.1 \times 10}$$

$$p_2 = 376$$

7.

Pencil	2	3	4	5	6	7	8
Cost	6	9	12	15	18	21	24

cost of 8 pencils $= ₹\ 24$

cost of 1 pencil $= ₹\ \frac{24}{3} = ₹\ 3$

cost of 2 pencils $= ₹\ 3 \times 2 = ₹\ 6$

cost of 3 pencils $= ₹\ 3 \times 3 = ₹\ 9$

cost of 4 pencils $= ₹\ 4 \times 3 = ₹\ 12$

cost of 5 pencils $= ₹\ 5 \times 3 = ₹\ 15$

cost of 6 pencils $= ₹\ 6 \times 3 = ₹\ 18$

cost of 7 pencils $= ₹\ 7 \times 3 = ₹\ 21$

8.

books	cartons
72	4
540 ↓	x ↓

$$\frac{x}{4} = \frac{540}{72}$$

$$x = \frac{540 \times 4}{72} = 30$$

Hence, 30 cartoons are required for 540 books.

9.

Cloths in metres	cost
8	₹ 250
5.8 ↓	x ↓

Here, $\frac{x}{250} = \frac{5.8}{8}$

$$x = \frac{5.8 \times 250}{8}$$

$$x = \frac{1450}{8} = ₹\ 181.25$$

Hence, the cost of 5.8 metre of cost is ₹ 181.25.

10. Money paid ₹ 1200 ↓ x ↓ Days 5 ↓ 24 ↓

$$\frac{x}{1200}=\frac{24}{5}$$

$$x=\frac{1200^{240}\times 24}{5_1}$$

$$x=₹\ 5760$$

Hence, the worker paid ₹ 5760 for 24 days.

11. fare ₹ 675 ↓ ₹ 1512 ↓ distance 150 km ↓ x ↓

Here, $$\frac{x}{150}=\frac{1512}{675}$$

$$x=\frac{^{6}150\times 1512^{6}}{675_{271}}$$

$$x=336\,\text{km}$$

Hence, the taxi travell 536 hm in ₹ 1512.

12. food 95 kg ↓ x ↓ person 5 ↓ 23 ↓

Here, $$\frac{x}{95}=\frac{23}{5}$$

$$x=\frac{23\times 95}{5}$$

$$x=437\,\text{kg}$$

Hence, 437 kg of food is required for ₹ 3 persons.

13. chairs 36 ↓ 27 ↓ days 8 ↓ x ↓

Here, $$\frac{x}{8}=\frac{27}{36}$$

$$x=\frac{27\times 8}{36}$$

$$x=6\,\text{days}$$

Hence, the carpenter prepares 27 chair in 6 days.

14. Runs 100 ↓ 180 ↓ Overs 25 ↓ x ↓

$$\frac{x}{25}=\frac{180}{100}$$

$$x=\frac{180\times 25}{100}$$

$$x=45\,\text{overs}$$

Hence, the batsman scored 180 runs in 45 overs.

15. wages ₹ 1209 ↓ ₹ 1953 ↓ days 13 ↓ x ↓

Here, $$\frac{x}{13}=\frac{1953}{1209}$$

$$x=\frac{1953\times 13}{1209}$$

$$x=21\,\text{days}$$

Hence, the worker paid ₹ 1953 for 21 days of work.

Exercise 7.7

1. In which of the following cases do the two quantities a and b vary inversely?

(a)

a	4	8	16	32	64
b	16	8	4	2	1

Here

$$a\times b=4\times 16=64=k$$
$$8\times 8=64=k$$
$$16\times 4=64=k$$
$$32\times 2=64=k$$
$$64\times 1=64=k$$

Here $a\times b=$ constant (k)

So, a and b are very inversely.

(b)

a	2	5	10	20	50
b	20	50	100	200	500

Here

$$a\times b=2\times 20=40$$
$$5\times 50=250$$
$$10\times 100=1000$$
$$20\times 200=4000$$
$$50\times 500=25000$$

$\because$ $a\times b=$ not a constant.

2.

a	8	**10**	4	2
b	15	12	**30**	60

a	**2**	3	4	**6**
b	18	12	**9**	6

3. Men 15 ↑ 9 ↑ days 24 ↓ x ↓

Here, $$\frac{x}{24}=\frac{15}{9}$$

$$x=\frac{^{5}15\times 24^{8}}{9_3}$$

$$x=40\,\text{days}$$

Hence, 9 men will repair the road in 40 days.

4. If 50 persons more come to join the camp then no. of persons will become $300+50=350$

person 300 ↑ 350 ↑ days 42 ↓ x ↓

$$\frac{x}{42}=\frac{300}{350}$$

$$x\times 350=300\times 42$$

$$x=\frac{300\times 42}{350}$$

$$x=36\,\text{days}$$

Hence, the will enough for 36 days.

5. men 800 ↑ 500 ↑ weeks 10 ↓ x ↓

$$\frac{x}{10}=\frac{800}{500}$$
$$x=\frac{800\times 10}{500}$$
$$x=16\text{ weeks}$$

Hence, the food will last for 16 weeks.

6.

men	days
16 ↓	30 ↑
x	24

$$\frac{x}{16}=\frac{30}{24}$$
$$x=\frac{^{10}30\times 16^{2}}{24_{3}}$$
$$x=20\text{ men}$$

Hence, 20 men will reap the field in 24 days.

7.

cows	days
33 ↓	12 ↑
x	9

$$\frac{x}{33}=\frac{12}{9}$$
$$x=\frac{12\times 33}{9}$$
$$x=44\text{ cows}$$

Hence, 44 cows will graze the field in 9 days.

8. Let, x soldiers were tranferred to another camp after 4 days.

soldiers	days
1200 ↓	$(28-4)$ ↑
$(1200-x)$	32

$$\frac{1200-x}{1200}=\frac{28-4}{32}$$
$$\frac{1200-x}{1200}=\frac{3}{4}$$
$$4(1200-x)=3\times 1200$$
$$4800-4x=3600$$
$$4x=4800-3600$$
$$4x=1200$$
$$x=\frac{1200}{4}$$
$$x=300$$

Hence, 300 soldiers were transferred to another camp.

9. According to question :

soldiers	days
105 ↑	21 ↓
$(105-42)$	x

$$\frac{x}{21}=\frac{105}{63}$$
$$x=\frac{105\times 21}{63}=35\text{ days}$$

Hence, the food will last in 35 days.

10.

time	speed
45 min ↑	40 km/hr ↓
25 min	x km/hr

$$\frac{x}{40}=\frac{45}{25}$$
$$x=\frac{45\times 40}{25}$$
$$x=72\text{ km/hr}$$

Hence, the speed of car should be 72 km/hr.

Exercise 7.8

1. Riya completes $\frac{1}{20}$ part of work in $=1$ day

Riya completes 1 part of work in $=1\times 20$ days
$=20$ days

So, she will take 20 days to complete the work.

2. Javed finishes a piece of work in $=8$ days

Javed's one day work $=\frac{1}{8}$ parts

Rajan finishes the same work in $=10$ days

Rajan's one day work $=\frac{1}{10}$ parts

$\therefore$ Together's one day work $=\frac{1}{8}+\frac{1}{10}$
$=\frac{5+4}{40}=\frac{9}{40}$

So, they will work together in $\frac{40}{9}$ days $=4\frac{4}{9}$ days to complete the work.

3. Rekha can reap field in $=20$ days

Rekha can reap field in one day $=\frac{1}{20}$ part

Pawan can reap field in $=30$ days

Pawan can reap field in one day $=\frac{1}{30}$ part

$\therefore$ Together they can reap in one day $=\frac{1}{20}+\frac{1}{30}$
$=\frac{3+2}{60}=\frac{5}{60}$

So, they will reap the field together in $=\frac{60}{5}$ days
$=12$ days.

4. Rubi and Rinki together can do a work in $=6$ days

Their one day's work $=\frac{1}{6}$

Rinki can do the same work in $=9$ days

Rinki's one day work $=\frac{1}{9}$

so Rubi's one day work $=\frac{1}{6}-\frac{1}{9}$
$=\frac{3-2}{18}=\frac{1}{18}$

So, Rubi can do the work in 18 days.

5. Tom and Peter together can do a piece of work in $=7\frac{1}{2}$ days
$=\frac{15}{2}$ days

Tom and Peter's one day work $=\frac{2}{15}$ part of while work

Tom alone can do the same work in $=20$ days

Tom's one day work $=\frac{1}{20}$ part of whole work.

$\therefore$ Peter's one day work $=\frac{2}{15}-\frac{1}{20}$
$=\frac{8-3}{60}=\frac{5}{60}$

So, Peter alone can do the work in $= \frac{60}{5} = 12$ days

6. laborer amount days

$12 \downarrow$ $3600 \downarrow$ $5 \downarrow$

$9 \downarrow$ $x \downarrow$ $8 \downarrow$

So, $\frac{x}{3600} = \frac{9}{12} \times \frac{8}{5}$

$$x = \frac{9 \times 8 \times 3600}{12 \times 5}$$

$$x = ₹\ 4320$$

So, 9 labours will earn ₹ 4320 in 8 days.

7. A alone can do a piece of work in $= 12$ days

A's one day work $= \frac{1}{12}$ part

B can do same work in $= 15$ days

B's one day work $= \frac{1}{15}$ part

(A and B)'s one day work $= \frac{1}{12} + \frac{1}{15}$

$$= \frac{5+4}{60} = \frac{9}{60}$$

They work together for 4 days

So, their 4 days work $= \frac{9 \times 4}{60} = \frac{3}{5}$ part

Left work $= 1 - \frac{3}{5} = \frac{5-3}{5} = \frac{2}{5}$ part

A can do 1 piece of work $= 12$ days

A can do $\frac{2}{5}$ piece of work $= 12 \times \frac{2}{5}$ days

$$= \frac{24}{5} = 4\frac{4}{5} \text{ days}$$

So, A alone completes the remaining work in $4\frac{4}{5}$ days.

8. A, B and C together do a piece of work in $= 6$ days

(A, B anc C)'s one day work $= \frac{1}{6}$ work

A and B together do the same work in $= 10$ days

(A and B)'s one day work $= \frac{1}{10}$ part

so C's one day work $= \frac{1}{6} - \frac{1}{10}$

$$= \frac{5-3}{30} = \frac{2}{30}$$

So, C can do alone same piece of work in $= \frac{30}{2}$ days

$= 15$ days.

9. Pipe A can fill a tank in $= 24$ minutes

Pipe A can fill tank in one minutes $= \frac{1}{24}$ part

Pipe B can fill the tank in $= 32$ minutes

Pipe B can fill tank in one minute $= \frac{1}{32}$ part

(A and B) together can fill tank in one minute $= \frac{1}{24} + \frac{1}{32}$

$$= \frac{4+3}{96} = \frac{7}{96}$$

pipe C can empty tank in $= 16$ minutes

Pipe C can empty tank in one min $= \frac{1}{16}$ part

if all pipes are open, then tank field in one minutes

$$= \frac{7}{96} - \frac{1}{16}$$

$$= \frac{7-6}{96} = \frac{1}{96}$$

So, the whole tank will be filled in 96 minutes.

10. Let x more people come to family.

people days

$8 \downarrow$ $30 \uparrow$

$8+x \downarrow$ $20 \uparrow$

$$\frac{x+8}{8} = \frac{30}{20}$$

$$(x+8) \times 20 = 30 \times 8$$

$$20x + 160 = 240$$

$$20x = 240 - 160$$

$$20x = 80$$

$$x = \frac{80}{20}$$

$$x = 4$$

So, 4 more relatives come to family.

11. men hours days

$120 \downarrow$ $9 \downarrow$ $40 \downarrow$

$150 \downarrow$ $6 \downarrow$ $x \downarrow$

so, $\frac{x}{40} = \frac{120}{150} \times \frac{9}{6}$

$$x = \frac{120 \times 9 \times 40}{150 \times 6}$$

$$x = 6 \times 8$$

$$x = 48 \text{ days}$$

Hence, 150 men can construct the road in 48 days working 6 hours a day.

12. 3 boys $= 5$ girls

1 boy $= \frac{5}{3}$ girl

Now, 2 boys + 2 girls

$$= 2 \times \frac{5}{3} \text{ girls} + 2 \text{ girls}$$

$$= \frac{10}{3} \text{ girls} + 2 \text{ girls}$$

$$= \frac{10 \text{girls} + 6 \text{ girls}}{3} = \frac{16}{3} \text{ girls}$$

girls hours

$5 \uparrow$ $8 \downarrow$

$\frac{16}{3} \uparrow$ $x \downarrow$

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

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

$$x = \frac{15}{2}$$

$$x = 7\frac{1}{2} \text{ days}$$

So, 2 boys and 2 girls together can clean the same compound in $7\frac{1}{2}$ days.

Exercise 7.9

1. Change the following :

(a) 30 m/s into km/h

$$= 30 \times \frac{18}{5} \text{ km/hr} = 108 \text{ km/hr}$$

(b) 27 km/hr into m/s

$$= 27 \times \frac{5}{18} \text{ m/s} = \frac{15}{2} \text{ m/s} = 7.5 \text{ m/s}$$

2. Express 36 km/hr as m/s

$$36 \text{ km/hr} = 36 \times \frac{5}{18} \text{ m/s} = 10 \text{ m/sec}$$

3. Speed of a train $= 15$ m/sec

$$= 15 \times \frac{18}{5} \text{ km/hr} = 54 \text{ km/hr}$$

4. Speed of a cycle $= 18$ km/hr

$$= 18 \times \frac{5}{18} \text{ m/sec} = 5 \text{ m/sec}$$

5. Speed of bullock-cart $= \frac{18}{5}$ km/hr

$$= \frac{18}{5} \times \frac{5}{18} \text{ m/sec} = 1 \text{ m/sec}$$

6. Speed of train $= 35$ m/sec

$$= 35 \times \frac{18}{5} \text{ m/sec} = 126 \text{ m/sec}$$

7. Speed $= 320$ km/hr

time $= 3$ hrs

$\therefore$ distance $=$ speed $\times$ time

$= 320 \times 3$

$= 960$ km or 960×1000 m

$= 960000$ metres

Hence, the aeroplane covered 960000 metres of distance.

8. Time $= 7$ sec

distance $=$ length of train $= 210$ m

$\therefore$ Speed $= \frac{\text{distance}}{\text{time}}$

$$= \frac{210}{7} = 30 \text{ m/sec}$$

Hence, the speed of train is 30 m/sec.

9. Speed $= 36$ km/hr

$$= 36 \times \frac{5}{18} \text{ m/sec} = 10 \text{ m/sec}$$

time $= 18$ sec

$\therefore$ distance $=$ speed $\times$ time

$= 10 \times 18 = 180$ m

Hence, the truck will cover 180 metres of distance.

10.

time		speed
10 hr	↓	40 km/hr
x	↑	50 km/hr

$$\frac{x}{10} = \frac{40}{50}$$

$$x = \frac{40 \times 10}{50}$$

$x = 8$ hours

Hence, the car will take 8 hours.

11. time $= 12$ hours + 20 minutes

$= 12 \times 60$ min + 20 min.

$= 720$ min + 20 min

$= 740$ min or 740×60 sec

$= 44400$ sec

Speed $= 25$ m/sec

distance $=$ speed $\times$ time

$= 44400 \times 25$

$= 1110000$ m or 1110 km

Hence, the distance between city A and city B is 1110 km.

12. distance $=$ length of train $= 225$ m

time $= 10$ sec

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{225}{10} = 22.5 \text{ m/sec}$$

So, the speed of train $= 22.5$ m/sec

and distance $=$ length of platform + length of train

$= (405 + 225)$

$= 630$ m

$$\text{time taken} = \frac{\text{distance}}{\text{speed}} = \frac{630}{22.5}$$

$$= \frac{6300}{225} = 28 \text{ sec}$$

Hence, the speed of train is 22.5 m/sec and the train will take 22 seconds 70 pass a plateform of 405 metres long.

NEP Multiple Intelligence

1. (c) **2.** (b) **3.** (c) **4.** (d) **5.** (a) **6.** (b)

Mental Maths

1. 10% of x is 20

or $x \times 10\% = 20$

$$\frac{x \times 10}{100} = 20$$

$x = 20 \times 10$

So, $x = 200$

2. 60% of 180

$$= \frac{180 \times 60}{100} = 108$$

So, required no. $= 180 + 108 = 288$

3. 50% of 130

$= 130 \times 50\%$

$$= \frac{130 \times 50}{100} = 65$$

So, required no. $= 130 - 65 = 65$

4. 5% of y is 4

$y \times 5\% = 4$

$$\frac{y \times 5}{100} = 4$$

$$y = \frac{4 \times 100}{5}$$

So, $y = 80$

5. Let the total no. of students $= x$

So, 30% of $x = 120$ boys

$$\frac{x \times 30}{100} = 120$$

$$x = \frac{120 \times 100}{30}$$

$x = 400$

So, there are 400 students in the school.

6. C.P. = ₹ 10 per dozen
S.P. = ₹ 15 per dozen
so, profit $= 15-10 =$ ₹ 5

$$\text{profit \%} = \frac{\text{profit}}{\text{C.P.}} \times 100$$

$$= \frac{5}{10} \times 100 = 50\%$$

HOTS

- Cost price $= x$

$$\text{Profit} = 20\% \text{ of } x$$

$$= \frac{x \times 20}{100} = \frac{x}{5}$$

so, S.P. of $A = x + \frac{x}{5} = \frac{6x}{5}$

So S.P. of A = C.P. of B

B's C.P. $= \frac{6x}{5}$

$$\text{loss} = 15\% \text{ of } \frac{65}{5}$$

$$= \frac{6x}{5} \times \frac{15}{100} = \frac{18x}{100}$$

$$\text{S.P. of } B = \frac{6x}{5} - \frac{18x}{100}$$

$$= \frac{120x - 18x}{100} = \frac{102x}{100}$$

So, C.P. of C = S.P. of $B = \frac{102x}{100}$

- Let C.P. of article $= x$

gain = 5%

so, $\text{gain} = \frac{x \times 5}{100} = \frac{x}{20}$

$$\text{S.P.} = \frac{x}{20} + x = \frac{x + 20x}{20} = \frac{21x}{20}$$

Loss = 5%

so, $\text{loss} = \frac{x \times 5}{100} = \frac{x}{20}$

So, $\text{S.P.} = x - \frac{x}{20} = \frac{20x - x}{20} = \frac{19x}{20}$

A.C.Q. $\frac{21x}{20} - 50 = \frac{19x}{20}$

$$\frac{21x}{20} - \frac{19x}{20} = 50$$

$$\frac{21x - 19x}{20} = 50$$

$$\frac{2x}{20} = 50$$

$$x = \frac{50 \times 20}{2}$$

$x =$ ₹ 500

$\text{gain} = \frac{x}{20} \Rightarrow \frac{500}{20}$

So, original selling price $= 500 + 25 =$ ₹ 525

Chapter 8 Quadrilaterals

Exercise 8.1

1. a, b, d are concave; Not all two points when joined lie wholly in the interior of the quadrilateral.

2. Here is a quadrilateral WXYZ, Name the following :

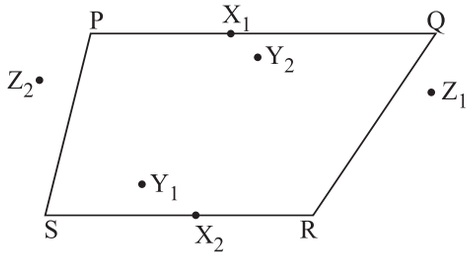
(a) two pairs of opposite sides
XY and WZ; XW and YZ

(b) Two pairs of opposite angles
$\angle X$ and $\angle Z$; $\angle W$ and $\angle Y$

(c) Two pairs of adjacent sides
XW and XY ; ZY and ZW

(d) Two pairs of adjacent angles
$\angle Y$ and Z ; $\angle X$ and $\angle W$.

3.



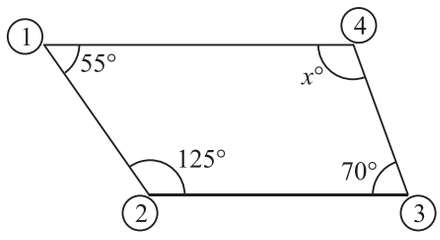
4. (a) False, three vertices of a quadrilateral never be collinear.
(b) False, A quadrilateral can have an obtuse angle.
(c) False, A quadrilateral can have more than one right angle.
(d) False, A sum of the four angles of a concave quadrilateral is 360°.
(e) False, A diagonal of a quadrilateral is a line segment Joining any two opposite vertices of the quadrilateral.
(f) True

5. In a quadrilateral

$\angle 1 = 55°$ $\angle 2 = 125°$ $\angle 3 = 70°$ $\angle 4 = ?$

We know that the sum of angles in a quadrilateral = 360°

$\therefore$ $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$



$55° + 125° + 70° + \angle 4 = 360°$

$250° + \angle 4 = 360°$

$\angle 4 = 360° - 250° = 110°$

So, the fourth angle of the quadrilateral is 110°.

6. The angles of a quadrilateral are in the following ratio. Find the measure of the four angles.

(a) Let $\angle 1 = x, \angle 2 = 2x, \angle 3 = 3x, \angle 4 = 4x$

We know that the sum of angles in a quadrilateral = 360°

So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$

$x + 2x + 3x + 4x = 360°$

$10x = 360°$

$x = \frac{360}{10}$

$x = 36°$

So, $\angle 1 = 36°$

$\angle 2 = 2 \times 36° = 72°$

$\angle 3 = 3 \times 36° = 108°$

$\angle 4 = 4 \times 36° = 144°$

(b) Let $\angle 1 = 2x, \angle 2 = 2x, \angle 3 = 3x, \angle 4 = 5x$

We know that the sum of angles in a quadrilateral = 360°

so, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$

$2x + 2x + 3x + 5x = 360°$

$12x = 360°$

$x = \frac{360°}{12}$

$x = 30°$

So, $\angle 1 = 2 \times 30° = 60°, \angle 2 = 2 \times 30° = 60°$

$\angle 3 = 3 \times 30° = 90°, \angle 4 = 5 \times 30° = 150°$

(c) Let $\angle 1 = 3x, \angle 2 = 5x, \angle 3 = 7x, \angle 4 = 9x$

We know that the sum of angles in a quadrilateral = 360°

So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$

$3x + 5x + 7x + 9x = 360°$

$24x = 360°$

$x = \frac{360}{24}$

$x = 15$

So, $\angle 1 = 3 \times 15° = 45°,$

$\angle 2 = 5 \times 15° = 75°$

$\angle 3 = 7 \times 15° = 105°,$

$\angle 4 = 9 \times 15° = 135°$

7. Let, $\angle 1 = x, \angle 2 = x, \angle 3 = x$ and $\angle 4 = 2x$

We know that the sum of angles in a quadrilateral = 360°

So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$

$x + x + x + 2x = 360°$

$5x = 360°$

$x = \frac{360°}{5} = 72°$

So, $\angle 1 = 72°,$

$\angle 2 = 72°$

$\angle 3 = 72°,$

$\angle 4 = 2 \times 72° = 144°$

8. Let $\angle B = x, \angle D = x, \angle A = 2x, \angle C = 2x$

We know that the sum of angles in a quadrilateral = 360°

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

$2x + x + 2x + x = 360°$

$6x = 360°$

$x = \frac{360°}{6}$

$x = 60°$

So, $\angle A = 2 \times 60° = 120°$

$\angle B = 60° = 60°$

$\angle C = 2 \times 60° = 120°$

$\angle D = 60° = 60°$

9. Let each angle of a quadrilateral = x

So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$

$x + x + x + x = 360°$

$4x = 360°$

$x = \frac{360}{4}$

$x = 90°$

So, each angle of the quadrilateral is 90°.

10. Let $\angle 1 = x, \angle 2 = x, \angle 3 = x, \angle 4 = 120°$

We know that the sum of angles in a quadrilateral = 360°

So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$

$x + x + x + 120° = 360°$

$3x + 120° = 360°$

$3x = 360° - 120°$

$3x = 240°$

$x = \frac{240}{3}$

$x = 80$

So, $\angle 1 = 80°, \angle 2 = 80°, \angle 3 = 80°$ and $\angle 4 = 120°$.

11. Sum of two angles of a quadrilateral = 180°

Let sum of another two angles of a quadrilateral = x

We know that sum of all four angles in quadrilateral = 360°

So, sum of two angles + sum of another two angles = 360°

$180° + x = 360°$

$x = 360° - 180°$

$x = 180°$

So, the sum of another two angle of the quadrilateral is 180°.

12. In quadrilateral $POQB$

$\angle P = 90°$

$\angle B = 65°$

$\angle Q = 90°$

$\angle O = ?$

We know that the sum of all four angles in a quadrilateral = 360°

$\therefore \quad \angle P + \angle B + \angle Q + \angle O = 360°$

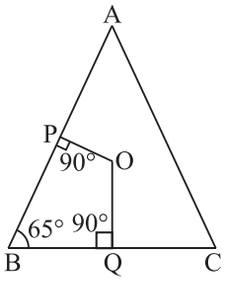
$90° + 65° + 90° + \angle O = 360°$

$\angle O = 360° - 90° - 65° - 90°$

$\angle O = 360° - 245$

$\angle O = 115°$

So, $\angle POQ = 115°$.



Exercise 8.2

1. length = 8 cm

breadth = 6 cm

Perimeter of parallelogram = $2[l + b]$ cm

$= 2[8 + 6]$ cm

$= 2 \times 14 = 28$ cm.

2. Let, length = x

and breadth = $2x$

perimeter = 24 cm

perimeter of parallelogram = $2[l + b]$

$24 = 2[x + 2x]$

$24 = 2 \times 3x$

$6x = 24$

$$x = \frac{24}{6} = 4 \text{ cm}$$

So, length of parallelogram $= 4$ cm

And, breadth $= 2 \times 4 = 8$ cm

3. Let $BC = x$ cm

and $AB = (x + 8)$ cm

perimeter $= 40$ cm

$$\text{perimeter} = 2(l + b)$$
$$40 = 2(x + x + 8)$$
$$40 = 2(2x + 8)$$
$$4x + 16 = 40$$
$$4x = 40 - 16$$
$$4x = 24$$
$$x = \frac{24}{4}$$
$$x = 6$$

So, $BC = AD = 6$ cm

And $AB = CD = 6 + 8 = 14$ cm

4. Let $\angle 1 = 40°, \angle 2 = x°, \angle 3 = 40°, \angle 4 = x$

Because in parallelogram opposite angles are equal.

In parallelogram

$$\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$$
$$40 + x + 40 + x = 360°$$
$$80 + 2x = 360°$$
$$2x = 360 - 80$$
$$2x = 280°$$
$$x = \frac{280°}{2} = 140°$$

So, angles are 40°, 140°, 40° and 140°.

5. Let $\angle 1 = x°, \angle 2 = x + 30°, \angle 3 = x, \angle 4 = x + 30°$

Because in parallelogram opposite angles are equal

In paralleogram

$$\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$$
$$x + x + 30° + x + x + 30° = 360°$$
$$4x + 60° = 360°$$
$$4x = 360 - 60°$$
$$4x = 300°$$
$$x = \frac{300}{4}$$
$$x = 75°$$

So, $\angle 1 = 75°$, $\angle 2 = 75 + 30° = 105°$

$\angle 3 = 75°$, $\angle 4 = 75° + 30° = 105°$

6. A table for parallelograms $ABCD$ is given here. Study it carefully. Correct the mistakes and say why the information given is wrong.

(a) $AB = 5.5$ cm, $BC = 8$ cm, $\angle ABC = 45°$.

$\angle BCD = 145°, \angle CDA = 45°, \angle DAB = 145°$

Here sum of adjacent angles

$$= \angle ABC + \angle ACD$$
$$= 45° + 145° = 190°$$

It is not possible

So, $\angle BCD = \angle DAB = 135°$

or $\angle ABC = \angle CDA = 35°$

(b) $AB = 6$ cm, $BC = 7.5$ cm

$\angle ABC = 25°$, $\angle BCD = 155°$

$\angle CDA = 35°$, $\angle DAB = 155°$

Here vertical opposite angles

$$\angle ABC = \angle CDA$$
$$25° \neq 35°$$

So, It is not possible

In parallelogram vertical opposite angles are equal

So, both are $= 25°$

Which suits the angle of parallelogram because it adjacent angle is 155°

So, $\angle CDA = 25°$

(c) $AB = 5$ cm, $BC = 5$ cm,. $\angle ABC = 90°$

$\angle BCD = 100°, \angle CDA = 90°, \angle DAB = 100°$

Here,

sum of all angles of parallelogram

$$\angle ABC + \angle BCD + \angle CDA + \angle DAB = 360°$$
$$90° + 100° + 90° + 100° = 360°$$
$$380° \neq 360°$$

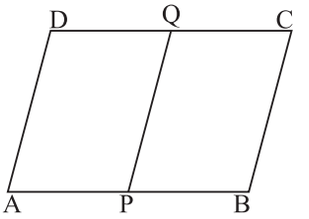
It is not possible because in a prallelogram sum of all the angles $= 360°$

So, $\angle BCD = \angle DAB = 90°$

or, $\angle ABC = \angle CDA = 80°$

7. $ABCD$ is a parallelogram (grm)

Now, In $APQD$



$$AP = \frac{1}{2} AB$$

$$DQ = \frac{1}{2} DC$$

we have $AB = DC$

so $\frac{1}{2} AB = \frac{1}{2} DC$

or $AP = DQ$

and $\angle DAP = \angle QPB$ (corresponding angle)

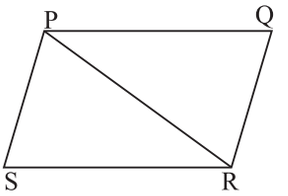
and $\angle DCB = \angle PQD$ (corresponding angle)

so, $\angle ADQ = \angle APQ$

or $\angle DAP = \angle PQD$ (opposite angles)

so $APQD$ is a parallelogram (proved)

8. In ΔPSR and PQR



$PS = QR$

(opposite sides of parallelogram)

$SR = PQ$

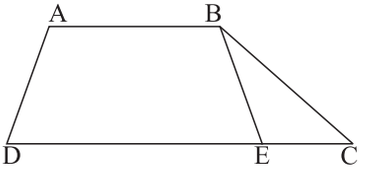
(opposite sides of parallelogram)

$PR = PR$ (common)

By SSS property

So, $\Delta PSR \cong PQR$ **Proved**

9. In trapezium $ABED$



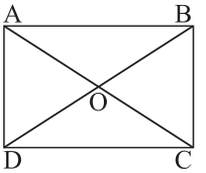
$\angle ADE = \angle BED$ (corresponding adzacent angles)

In ΔBEC $\angle BED = \angle EBC + \angle BCE$

($\because$ sum of two interior opposite angles is equal to third opposite exterior angle).

So we can say $\angle ADE = \angle EBC + \angle BCE$.

10. In ΔABC and ΔBAD



$AD = BC$ (opposite sides of rectangle)
$AC = BD$ (diagonal of the rectangle)
$AB = AB$ (common)

By SSS property

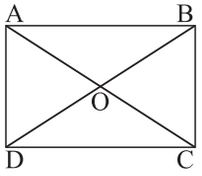
So, $\Delta ABC \cong \Delta BAD$ **Proved**

11. Let length of rectangle $= 3x$
and breadth of rectangle $= 2x$
perimeter $= 80$ cm
So, perimeter of rectangle $= 2[l + b]$

$$80 = 2[3x + 2x]$$
$$80 = 2 \times 5x$$
$$10x = 80$$
$$x = \frac{80}{10}$$
$$x = 8$$

So, length of rectangle $= 3 \times 8 = 24$ cm
breadth of rectangle $= 2 \times 8 = 16$ cm.

12. In ΔAOB and ΔCOD



$AB = CD$ (opposite sides of rectangle)
$AO = OC$
$BO = OD$

because diagonal in a rectangle bisect each other

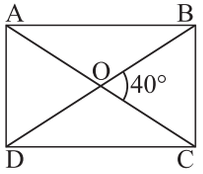
By SSS property

So, $\Delta AOB \cong \Delta COD$ **Proved**

13. In ΔOBC

ΔOBC is isoscles, triangle

So, let $\angle OBC = x = \angle OCB$



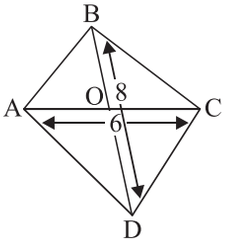
Now in ΔOBC

$$\angle BOC + \angle OCB + OBC = 180°$$
$$40° + x° + x = 180°$$
$$2x + 40 = 180°$$
$$2x = 180 - 40$$
$$2x = 140°$$
$$x = \frac{140}{2} = 70°$$

So, $\angle OBC = 70°$ and $\angle OCB = 70°$.

14. Let each side of rhombus be x.

So, In ΔABO



$$OB = OD = \frac{8}{2} = 4 \text{ cm}$$
$$OA = OC = \frac{6}{2} = 3 \text{ cm}$$
$$AB = x$$

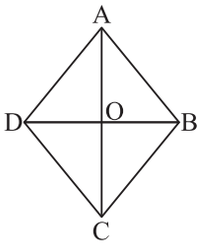
So, by pythagorus theorem

$$AB^2 = AO^2 + OB^2$$
$$x^2 = 3^2 + 4^2$$
$$= 9 + 16$$
$$x^2 = 25$$
$$x = \sqrt{25}$$
$$x = 5 \text{ cm}$$

So, the length of each side of rhombus is 5 cm.

15. In ΔAOD and COD

$AO = OC$ [because diagonal bisect each other in rhombus]
$AD = CD$ (side of rhombus)
$OD = OD$ (common)



By SSS property

So, $\Delta AOD \cong \Delta COD$

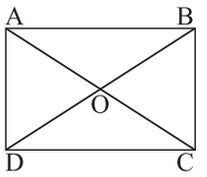
and $\angle ADO = \angle CDO$

similarly we can prove

$\angle DAO = \angle BAO$
$\angle ABO = \angle CBO$
$\angle BCO = \angle DCO$

So, it proved that each diagonal bisects the vertex angle.

16. ΔAOD and ΔBOC



$AD = BC$ (side of square)
$AO = OC$

[because diagonal bisect each other]

$DO = OB$

So, $\Delta AOD \cong \Delta BOC$

Now, In ΔAOD and COD

$AD = DC$ (sides of square)
$AO = OC$ (because diagonal bisect each other)
$OD = OD$ (common)

By SSS property

So, $\Delta AOD \cong \Delta BOC$

similarly, we can prove $AOD \cong AOB$

So, we can say that diagonals of square divide the square into four congruent triangles. proved

17. Write whether True or False.

(a) T (b) F (c) T (d) T (e) F (f) T (g) F

MCQs

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

Mental Maths

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

HOTS

- The kite is a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure.
- (a) $PQ = 6$ cm; $QR = 8.5$ cm; $\angle PQR = 55°$; $\angle QRS = 135°$; $\angle RSP = 55°$; $\angle SPQ = 135°$
  $\because$ Sum of Adjacent Angles $= 180°$
  $\therefore$ $\angle PQR + \angle QRS = 135° + 55° = 190° \neq 180°$
  So, $\angle PQR = \angle RSP = 45°$
  Or, $\angle QRS = \angle SPQ = 125°$
  (b) $PQ = 5$ cm; $QR = 6.5$ cm; $\angle PQR = 35°$; $\angle QRS = 45°$; $\angle RSP = 45°$; $\angle SPQ = 145°$
  $\because$ Sum of Adjacent Angles $= 180°$
  $\therefore$ $\angle PQR + \angle QRS = 35° + 145° = 180°$ (correct)
  and $\angle RSP = \angle PQR = 35°$
  or, $\angle RSP$ should be $35°$.
  (c) $PQ = 4$ cm; $QR = 4$ cm; $\angle PQR = 110°$; $\angle QRS = 70°$; $\angle RSP = 80°$; $\angle SPQ = 110°$
  $\because$ Sum of Adjacent Angles $= 180°$
  $\therefore$ $\angle PQR + \angle QRS = 110° + 70° = 180°$ (correct)

So, $\angle RSP = \angle PQR = 110°$
And, $\angle SPQ = \angle QRS = 70°$

So, $\angle SPQ = 110°$ and $\angle SPQ = 70°$

Chapter 9 Mensuration

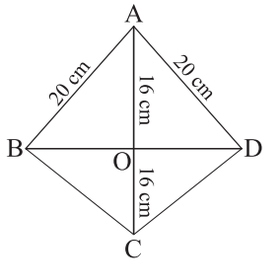
Exercise 9.1

1. diagonal $= 40$ cm
Length of perpendiculars
$h_1 = 12$ cm and $h_2 = 9$ cm
$\therefore$ Area of quadrilateral $= \frac{1}{2} \times$ diagonal $[h_1 + h_2]$
$= \frac{1}{2} \times 40 \times (12 + 9)$
$= \frac{1}{2} \times 40 \times 21 = 420\ \text{cm}^2$.

2. Area of quadrilateral $= 325\ \text{cm}^2$
diagonal $= 25$ cm
$h_1 = 14$ cm
$h_2 = ?$
$\therefore$ Area of quadrilateral $= \frac{1}{2} \times$ diagonal $\times [h_1 + h_2]$
$325 = \frac{1}{2} \times 25[14 + h_2]$
$14 + h_2 = \frac{325 \times 2}{25}$
$14 + h_2 = 26$
$h_2 = 26 - 14$
$h_2 = 12$ cm
Hence the length of perpendicular from D on AC is 12 cm.

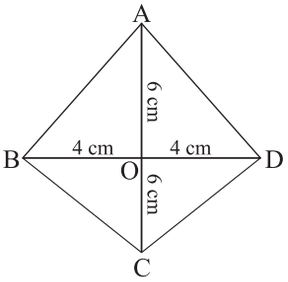
3. Area of rhombus $= 560\ \text{cm}^2$
$d_1 = 28$ cm
$d_2 = ?$
Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$
$560 = \frac{1}{2} \times 28 \times d_2$
$d_2 = \frac{560}{14}$
$d_2 = 40$ cm
Hence, the other diagonal of rhombus is 40 cm.

4. Side of rhombus $= 20$ cm
$d_1 = 32$ cm
In ΔABO
$AO = \frac{32}{2} = 16$ cm
$AB = 20$ cm
$BO = ?$



By pythagoras theorem :
$AB^2 = AO^2 + BO^2$
$(20)^2 = (16)^2 + (BO)^2$
$400 = 256 + BO^2$
$BO^2 = 400 - 256$
$BO^2 = 144$
$BO = \sqrt{144}$
$BO = 12$ cm
So, other diagonal $BD = 12 \times 2 = 24$ cm
Now, Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$
$= \frac{1}{2} \times 32 \times 24 = 384\ \text{cm}^2$.

5. Area of rhombus $= 48\ \text{cm}^2$
$d_1 = 12$ cm
$d_2 = ?$
$\because$ Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$
$48 = \frac{1}{2} \times 12 \times d_2$
$d_2 = \frac{48}{6}$
$d_2 = 8$ cm
Now, to get the side of rhombus
In ΔABO
$AO = 6$ cm
$BO = 4$ cm
$AB = ?$

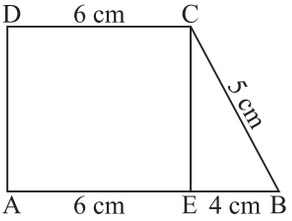


by pythagoras theorem :
$AB^2 = AO^2 + BO^2$
$AB^2 = 6^2 + 4^2$
$AB^2 = 36 + 16$
$AB^2 = 52$
$AB = \sqrt{52}$
$AB = 7.2$ cm
So, the side of rhombus is 7.2 cm.

6. $a = 3$ cm
$b = 4$ m $2d$ m $\Rightarrow 4.2$ m
$h = 2$m
$\therefore$ Area of trapezium $= \frac{1}{2} \times h(a + b)$
$= \frac{1}{2} \times 2 \times (3 + 4.2) = 7.2\ \text{m}^2$.

7. $a = 172.5$ cm
$b = 91.5$ cm
$h = 26$ cm
$\therefore$ Area of trapezium $= \frac{1}{2} \times h(a + b)$
$= \frac{1}{2} \times 26(172.5 + 91.5)$
$= 13 \times 264$
$= 3432\ \text{cm}^2$.

8. In ΔCEB



$BC = 5\,\text{cm}$

$BE = 4\,\text{cm}$

$CE = ?$

By pythageras theorem

$$BC^2 = CE^2 + BE^2$$
$$5^2 = CE^2 + 4^2$$
$$25 = CE^2 + 16$$
$$CE^2 = 25 - 16$$
$$CE^2 = 9$$
$$CE = \sqrt{9}$$
$$CE = 3\,\text{cm}$$

So, $a = 6\,\text{cm}$

$b = 6 + 4 = 10\,\text{cm}$

$h = 3\,\text{cm}$

$\therefore$ Area of trapezium $ABCD = \frac{1}{2} \times h[a + b]$

$$= \frac{1}{2} \times 3(6 + 10)$$
$$= \frac{1}{2} \times 3 \times 16 = 24\,\text{cm}^2$$

Exercise 9.2

1. diagonal $= 8.2$ cm

offset from $A = 3.4$ cm

offset from $C = 2.6$ cm

$\therefore$ Area of quadrilateral

$$= \frac{1}{2} \times \text{diagonal} \times [\text{sum of its offsets}]$$
$$= \frac{1}{2} \times 8.2\,[3.4 + 2.6]$$
$$= 4.1 \times 6 = 24.6\,\text{cm}^2.$$

2. diagonal $AC = 18\,\text{m}$

offset from $B = 11\,\text{m}$

offset from $D = 9\,\text{m}$

$\therefore$ Area of quadrilateral

$$= \frac{1}{2} \times \text{diagonal [sum of its offsets]}$$
$$= \frac{1}{2} \times 18[11 + 9]$$
$$= 9 \times 20 = 180\,\text{m}^2.$$

3. Here, diagonal $AC = 12\,\text{cm}$

offset from $B = 8\,\text{cm}$

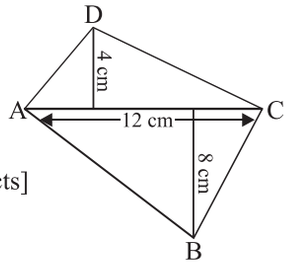
offset from $D = 4\,\text{cm}$

$\therefore$ Area of quadrilateral

$= \frac{1}{2} \times$ diagonal

[sum of its offsects]

$$= \frac{1}{2} \times 12[8 + 4]$$
$$= 6 \times 12 = 72\,\text{cm}^2.$$



4. Area of $\Delta EGD = \frac{1}{2} \times GD \times ED$

$$= \frac{1}{2} \times 20 \times 30$$
$$= 300\,\text{m}^2$$

Area of $\Delta AGD = \frac{1}{2} \times GD \times AD$

$$= \frac{1}{2} \times GD \times [AB + BC + CD]$$
$$= \frac{1}{2} \times 20 \times [40 + 30 + 30]$$
$$= \frac{1}{2} \times 20 \times 100 = 1000\,\text{m}^2$$

Area of ΔAHB

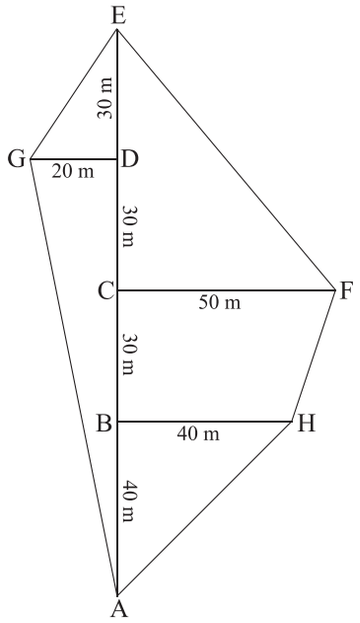
$$= \frac{1}{2} \times BH \times AB$$
$$= \frac{1}{2} \times 40 \times 40$$
$$= 800\,\text{m}^2$$

Area of $\square BCHF$

$$= \frac{1}{2} \times BC \times [CF + BH]$$
$$= \frac{1}{2} \times 30[40 + 50]$$
$$= \frac{1}{2} \times 30 \times 90$$
$$= 1350\,\text{m}^2$$

Area of ΔEFC

$$= \frac{1}{2} \times CF \times EC$$
$$= \frac{1}{2} \times CF\,[ED + DC]$$
$$= \frac{1}{2} \times 50[30 + 30]$$
$$= \frac{1}{2} \times 50 \times 60 = 1500\,\text{m}^2$$



So, Area of the field $= 300 + 1000 + 800 + 1350 + 1500$

$$= 4950\,\text{m}^2.$$

5. Area of ΔAFE

$$= \frac{1}{2} \times EF \times AF$$
$$= \frac{1}{2} \times 120 \times 200$$
$$= 12000\,\text{m}^2$$

Area of $\square ABDE = AB \times AE$

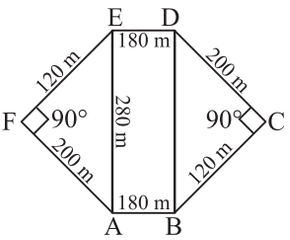
$$= 180 \times 280$$
$$= 50400\,\text{m}^2$$

Area of $\Delta BCD = \frac{1}{2} \times BC \times CD = \frac{1}{2} \times 120 \times 200$

$$= 12000\,\text{m}^2$$

So, area of field $= 12000 + 50400 + 12000$

$$= 74400\,\text{m}^2.$$



HOTS

$a = 25\,\text{cm}$, $b = 13\,\text{cm}$, $h = 10\,\text{cm}$

$\therefore$ Area of trapezium $= \frac{1}{2} \times h[a + b]$

$$= \frac{1}{2} \times 10 \times [25 + 13]$$
$$= \frac{1}{2} \times 10 \times 38 = 190\,\text{cm}^2.$$

Exercise 9.3

1. What is the volume of each of these cuboids?

(a) $l = 6\,\text{m}, b = 2\,\text{m}, h = 7\,\text{m}$

$\therefore$ volume of cuboid $= l \times b \times h$

$= 6 \times 2 \times 7 = 84\,\text{m}^3$

(b) $l = 8\,\text{m}, b = 3\,\text{m}, h = 7\,\text{m}$

$\therefore$ volume of cuboid $= l \times b \times h$

$= 8 \times 3 \times 7 = 168\,\text{m}^3$

(c) $l = 5\,\text{m}, b = 3\,\text{m}, h = 4\,\text{m}$

$\therefore$ volume of cuboid $= l \times b \times h$

$= 5 \times 3 \times 4 = 60\,\text{m}^3$

2. Find the volume of a cube whose side is :

(a) side $= 7.5$ cm

$\therefore$ volume of cube $= (\text{side})^3$

$= 7.5 \times 7.5 \times 7.5$

$= 421.875\,\text{cm}^3$

(b) side $= 3.8$ cm

$\therefore$ volume of cube $= (\text{side})^3$

$= \text{side} \times \text{side} \times \text{side}$

$= 3.8 \times 3.8 \times 3.8$

$= 54.872\,\text{cm}^3$

(c) side $= 43$ mm

$\therefore$ volume of cube $= (\text{side})^3$

$= \text{side} \times \text{side} \times \text{side}$

$= 43 \times 43 \times 43$

$= 1849 \times 43$

$= 79507\,\text{mm}^3$

3. $l = 3.8$ m, $b = 2.3$ m, $h = 2$ m

$\therefore$ volume of cuboid $= l \times b \times h$

$= 3.8 \times 2.3 \times 2$

$= 8.74 \times 2 = 17.48\,\text{m}^3$

So, there are 17.48 cubic metre wood in the stalk.

4. Volume $= 1440\,\text{cm}^3$

$l = 36$ cm, $b = 8$ cm, $h = ?$

volume of cuboid $= l \times b \times h$

$1440 = 36 \times 8 \times h$

$h = \dfrac{1440}{36 \times 8}$

$h = 5$ cm

So, the height of wooden block is 5 cm.

5. length of tea box $= 12$ m

$= 12 \times 100\,\text{cm} = 1200\,\text{cm}$

breadth of tea-box $= 9$ cm

height of tea-box $= 4$ cm

volume of tea-box $= l \times b \times h$

$= 1200 \times 9 \times 4$

$= 43200\,\text{cm}^3$

length of card board $= 0.6$ m

$= 6 \times 100 = 60$ cm

breadth of card board $= 0.45$ m

$= 0.45 \times 100 = 45\,\text{cm}$

height of card board $= 0.8$ m

$= 0.8 \times 100 = 80\,\text{cm}$

volume of cardboard $= l \times b \times h$

$= 60 \times 45 \times 80$

$= 216000\,\text{cm}^3$

So, no. of tea-boxes $= \dfrac{\text{volume of cardboard}}{\text{volume of tea-box}}$

$= \dfrac{216000}{43200}$

$= 5$ box

6. volume of metal block $= 60\,\text{cm} \times 48\,\text{cm} \times 36\,\text{cm}$

$= 103680\,\text{cm}^3$

weight of $1\,\text{cm}^3 = 9$ gm

weight of $103680\,\text{cm}^3 = 103680 \times 9\,\text{gm}$

$= 933120\,\text{gm}$

$= \dfrac{933120}{1000}\,\text{kg}$

$= 933.12$ kg

7. Volume of card board $= l \times b \times h$

$= 60\,\text{cm} \times 30\,\text{cm} \times 30\,\text{cm}$

$= 54000\,\text{cm}^3$

volume of cube $= (\text{side})^3$

$= \text{side} \times \text{side} \times \text{side}$

$= 5 \times 5 \times 5$

$= 125\,\text{cm}^3$

No. of cube can be placed inside the card board

$= \dfrac{\text{volume of card board}}{\text{volume of a cube}}$

$= \dfrac{54000}{125} = 432$ cubes.

8. Area of plot $= 950\,\text{m}^2$

Area of house $= 140\,\text{m}^2$

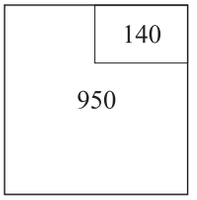
remaining area of plot $= 950 - 140$

$= 810\,\text{m}^2$

thicknets of soil $= 20\,\text{cm} = 0.20$ m

So volume of soil $= \text{Area} \times \text{thickness}$

$= 810 \times 0.2 = 162\,\text{m}^3$



9. volume of bath-tub $= 65\,\text{cm} \times 30\,\text{cm} \times 40\,\text{cm}$

$= 78000\,\text{cm}^3$

$= \dfrac{78000}{1000}$

$= 78$ litre

volume of water can $= 2l$

So No. of water can be emptied to fill the bath tub

$= \dfrac{78\,l}{2\,l} = 39$ times.

Exercise 9.4

1. $r = 4.2$ cm

$h = 12$ cm

$\therefore$ Volume of cylinder $= \pi r^2 h$

$= \dfrac{22}{7} \times 4.2 \times 4.2 \times 12$

$= \dfrac{132 \times 504}{10 \times 10} = \dfrac{66528}{100}$

$= 665.28\,\text{cm}^2$.

2. Diameter $= 2.8$ m

$r = \dfrac{2.8}{2} = 1.4$ m

$h = 8$ m

$\therefore$ Volume of cylinder $= \pi r^2 h$

$= \frac{22}{7} \times 1.4 \times 1.4 \times 8$

$= \frac{44 \times 112}{100} = \frac{4928}{100}$

$= 49.28 \text{ m}^3$

3. Circumference $= 44$ m

$2\pi r = 44$ m

$2 \times \frac{22}{7} \times r = 44$

$r = \frac{44 \times 7}{2 \times 22}$

$r = 7$ m

$h = 10$ m

$\therefore$ Volume of cylinder $= \pi r^2 h$

$= \frac{22}{7} \times 7 \times 7 \times 10$

$= 1540 \text{ m}^3$

4. $h = 30$ cm

$r = 2.8$ cm

Volume of talcum powder tin $= \pi r^2 h$

$= \frac{22}{7} \times 2.8 \times 2.8 \times 30$

$= \frac{88 \times 84}{10} = \frac{7392}{10}$

$= 739.2 \text{ cm}^3$

So, the tin can hold 739.2 cm^3 of powder

5. $h = 24.5$ m

$r = 3$ m

$\therefore$ Volume of well $= \pi r^2 h$

$= \frac{22}{7} \times 3 \times 3 \times 24.5 = 693 \text{ m}^3$

6. Area of base $= 9.63 \text{ m}^2$

$h = 4$ m

Volume of tank $=$ Area of base $\times$ height

$= 9.63 \text{ m}^2 \times 4 \text{ m}$

$= 38.52 \text{ m}^3$ $\{\because 1 \text{ kl} = 1 \text{ m}^3\}$

or $= 38.52$ kl

So, It can hold 38.52 kl of water.

7. Dimension of paper $= 22 \text{ cm} \times 10 \text{ cm}$

It can be wrapped exactly once around the curved surface of a cylinder of height 10 cm

So, circumference $= 22$ cm

or $2\pi r = 22$

$2 \times \frac{22}{7} \times r = 22$

or $r = \frac{22 \times 7}{22 \times 2} = 3.5$ cm

$r = 3.5$ cm

$h = 10$ cm

$\therefore$ Volume of cylinder $= \pi r^2 h$

$= \frac{22}{7} \times 3.5 \times 3.5 \times 10$

$= \frac{22 \times 5 \times 35}{10}$

$= 385 \text{ cm}^3$

8. Side of cube $= 14$ cm

Volume of cube $= (\text{side})^3$

$=$ side $\times$ side $\times$ side

$= 14 \times 14 \times 14$

$= 196 \times 14$

$= 2744 \text{ cm}^3$

A metal cube of 14 cm is melted and drawn into the shape of a cylindrical wire of diameter 0.84 cm

$d = 0.84$ cm

$r = 0.42$ cm

Now, volume of wire $=$ volume of cube

$\pi r^2 h = 2744$

$\frac{22}{7} \times 0.42 \times 0.42 \times h = 2744$

or $h = \frac{2744 \times 7 \times 100 \times 100}{22 \times 42 \times 42}$

$= \frac{490000}{99}$

$= 4949.49$ cm

So, the length of wire is 49.49 cm.

9. $d_1 = 7$ cm, $r_1 = \frac{7}{2}$ cm $\Rightarrow 3.5$ cm

$d_2 = 6$ cm, $r_2 = \frac{6}{2}$ cm $\Rightarrow 3$ cm

$h = 63$ cm

$\therefore$ Volume of pipe $= \pi (r_1^2 - r_2^2) h$

$= \frac{22}{7} \times ((3.5)^2 - (3)^2) \times 63$

$= \frac{22}{7} (3.5 + 3)(3.5 - 3) \times 63$

$= 198 \times 3.25$

$= 643.5 \text{ cm}^3$

So, the weight of pipe $= 643.5 \times 7.5$ g $= 4826.25$ gm

Exercise 9.5

1. $l = 18$ cm, $b = 8$ cm, $h = 1.8$ cm

$\therefore$ Surface area of geometric box

$= 2[lb + bh + hl]$

$= 2 \times [18 \times 8 + 8 \times 1.8 + 1.8 \times 18] \text{ cm}^2$

$= 2 \times [144 + 14.4 + 32.4] \text{ cm}^2$

$= 2 \times [190.8] \text{ cm}^2$

$= 381.6 \text{ cm}^2$.

2. $l = 10$ cm, $b = 8$ cm, $h = 6$ cm

$\therefore$ Surface area of card board

$= 2[lb + bh + hl]$

$= 2[10 \times 8 + 8 \times 6 + 6 \times 10] \text{ cm}^2$

$= 2[80 + 48 + 60] \text{ cm}^2$

$= 2 \times [188]$

$= 376 \text{ cm}^2$.

3. Find the surface area of a cube whose edge is :

(a) side $(a) = 6$ cm

$\therefore$ Surface area of cube $= 6a^2$

$= 6 \times 6 \times 6$

$= 36 \times 6$

$= 216 \text{ cm}^2$.

(b) side $(a) = 3.4$ cm

$\therefore$ Surface area of cube $= 6a^2$

$= 6 \times 3.4 \times 3.4$

$= 20.4 \times 3.4$

$= 69.36\ \text{cm}^2$.

(c) side $(a) = 1.2$ m

$\therefore$ Surface area of cube $= 6a^2$

$= 6 \times 1.2 \times 1.2$

$= 7.2 \times 1.2$

$= 8.64\ \text{m}^2$.

(d) side $(a) = 23$ cm

$\therefore$ Surface area of cube $= 6a^2$

$= 6 \times 23 \times 23$

$= 138 \times 23$

$= 3174\ \text{cm}^2$.

4. $l = 45$ cm, $b = 30$ cm, $h = 30$ cm

$\therefore$ Surface area of tin box

$= 2[lb + bh + hl]$

$= 2[45 \times 30 + 30 \times 30 + 30 \times 45]$

$= 2[1350 + 900 + 1350]$

$= 2 \times [3600]$

$= 7200\ \text{cm}^2$

Area of tin to make 25 such boxes $= 7200 \times 25$

$= 180000\ \text{cm}^2$

$= \dfrac{180000}{10000} = 18\ \text{m}^2$

So, 18 m^2 of tin sheet is required to make 25 such boxes.

5. $l = 3.8$ m, $b = 4.5$ m, $h = 3.5$ m

$\therefore$ Area of four walls $= 2[l + b] \times h$

$= 2[3.8 + 4.5] \times 3.5$

$= 2 \times 8.3 \times 3.5$

$= 16.6 \times 3.5$

$= 58.10\ \text{m}^2$

So, the cost of painting $= 58.10 \times$ ₹ 285

$=$ ₹16558.50

6. Surface area of a cuboidal box $= 486\ \text{cm}^2$

Let side of cube $= a$

So, surface area $= 6a^2$

$486 = 6a^2$

$a^2 = \dfrac{486}{6}$

$a^2 = 81$

$a = \sqrt{81}$

$a = 9$ cm

So, length of an edge of this box is 9 cm.

7. $l = 90$ cm, $b = 60$ cm, $h = 45$ cm

$\therefore$ Surface area of truck

$= 2[lb + bh + hl]$

$= 2 \times [90 \times 60 + 60 \times 45 + 45 \times 90]\ \text{cm}^2$

$= 2 \times [5400 + 2700 + 4050]\ \text{cm}^2$

$= 2 \times 12150 = 24300\ \text{cm}^2$

or $= \dfrac{24300}{10000}\ \text{m}^2 = 2.43\ \text{m}^2$

So, the cost of painting $= 2.43 \times 200 =$ ₹ 486

8. Perimeter of the floor $= 66$ m

height of room $= 5.2$ m

$\therefore$ Area of four walls $=$ perimeter $\times$ height

$= 66 \times 5.2$

$= 343.2\ \text{m}^2$.

9. Area of square base $= 49\ \text{cm}^2$

$(a)^2 = 49$

$a = \sqrt{49}$ cm

$a = 7$ cm

So, length $= 7$ cm

breadth $= 7$ cm

and height $= 10$ cm (given)

$\therefore$ Surface area of reservoir

$= 2[lb + bh + hl]$

$= 2 \times [7 \times 7 + 7 \times 10 + 10 \times 7]$

$= 2 \times [49 + 70 + 70]$

$= 2 \times [189]$

$= 378\ \text{cm}^2$.

10. $l = 22$ m, $b = 16$ m, $h = 10$ m

$\therefore$ Area of four walls $= 2[l + b] \times h$

$= 2 \times [22 + 16] \times 10\ \text{m}^2$

$= 2 \times 38 \times 10\ \text{m}^2$

$= 760\ \text{m}^2$

Area of floor $= l \times b$

$= 22 \times 16 = 352\ \text{m}^2$

$\therefore$ total area to be cemented $= 760 + 352 = 1112\ \text{m}^2$

So, the cost of cementing $=$ ₹ $1112 \times 19 =$ ₹ 21128

Exercise 9.6

1. Area of base $= 140\ \text{cm}^2$

height of cylinder $= 17$ cm

$\therefore$ volume of cylinder $=$ Area of base $\times$ height

$= 140 \times 17$

$= 2380\ \text{cm}^3$.

2. $r = 10$ cm

$h = 10.5$ cm

$\therefore$ lateral surface area $= 2\pi rh$

$= 2 \times \dfrac{22}{7} \times 10 \times 10.5$

$= 44 \times 15 = 660\ \text{cm}^2$.

3. Circumference of cylinder $= 154$ cm

height $(h) = 1.5$ m or 1.5×100 cm

$= 150$ cm

lateral surface area $=$ circumference $\times$ height

$= 154 \times 150\ \text{cm}^2$

$= 23100\ \text{cm}^2$

or $= \dfrac{23100}{10000}\ \text{m}^2 = 2.31\ \text{m}^2$.

4. $r = 3.5$ cm

$h = 6$ cm

$\therefore$ lateral surface area of cylinder $= 2\pi rh$

$= 2 \times \dfrac{22}{7} \times 3.5 \times 6$

$= 132\ \text{cm}^2$.

5. diameter $= 77$ cm

$r = \dfrac{77}{2}$ cm $= 38.5$ cm

$h = 105\,\text{cm}$

$\therefore$ Lateral surface area of roller $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 38.5 \times 105$

$= 25410\,\text{cm}^2$

or $= \frac{25410}{10000}\,\text{m}^2$

$= 2.541\,\text{m}^2$

So, total area covered by the roller in 600 revolutions

$= 2.541 \times 600 = 1524.60\,\text{m}^2$.

6. inner radius $(r) = 9\,\text{m}$

height $= 21\,\text{m}$

inner lateral surface area $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 9 \times 21$

$= 44 \times 27$

$= 1188\,\text{m}^2$

So, the cost of painting the tunnel $= ₹\ 1188 \times 8$

$= ₹\ 9504$

7. $h = 80\,\text{cm}$

$r = 63\,\text{cm}$

$\therefore$ Total surface area of cylindrical box

$= 2\pi r[h + r]$

$= 2 \times \frac{22}{7} \times 63[80 + 63]$

$= 396 \times 143$

$= 56628\,\text{cm}^2$

or $= \frac{56628}{10000}\,\text{m}^2$

$= 5.6628\,\text{m}^2$

So, the cost of tin required $= 5.6628 \times 5 = ₹\ 28.314$

8. Diameter $= 70\,\text{cm}$

So, radius $= \frac{70}{2} = 35\,\text{cm}$

$h = 4\,\text{m}$ or $400\,\text{cm}$

curved surface area of piller $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 35 \times 400$

$= 88000\,\text{cm}^2$

or $= \frac{88000}{10000}\,\text{m}^2 = 8.8\,\text{m}^2$

So, the cost of cementing the piller $= ₹\ 8.8 \times 32$

$= ₹\ 281.60$

9. $h = 14\,\text{m}$

inner radius $(r) = 2\,\text{m}$

Inner surface area $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 2 \times 14$

$= 176\,\text{m}^2$

So, the cost of plastering inner surface area of the wall

$= 176 \times 15$

$= ₹\ 2640$

10. diameter $= 140\,\text{cm}$

$\therefore \quad r = \frac{140}{2} = 70\,\text{cm}$

$= \frac{70}{100}\,\text{m} = 0.7\,\text{m}$

$h = 1.2\,\text{m}$

Lateral surface area of drum $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 0.7 \times 1.2$

$= \frac{44 \times 12}{100} = \frac{528}{100}$

$= 5.28\,\text{m}^2$

$\therefore$ Area of base $= \pi r^2$

$= \frac{22}{7} \times 0.7 \times 0.7$

$= \frac{154}{100} = 1.54\,\text{m}^2$

total area of drum to be electroplating $= 5.28 + 1.54$

$= 6.82\,\text{m}^2$

So, the cost of electroplating $= ₹\ 6.82 \times 7.50$

$= ₹\ 51.15$

MCQs

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

11. (b)

HOTS

Length of box $= 35\,\text{cm}$

Breadth of box $= 12\,\text{cm}$

And, height of box $= 4\,\text{cm}$

So, the length of the shortest path crowl by the ant

$= \sqrt{l^2 + g^2} + h$

$= \sqrt{(35)^2 + (12)^2}\,\text{cm} + 4\,\text{cm}$

$= \sqrt{1225 + 144}\,\text{cm} + 4\,\text{cm}$

$= \sqrt{1369}\,\text{cm} + 4\,\text{cm}$

$= (37 + 4)\,\text{cm}$

$= 41\,\text{cm}$

NEP Development of Traditional Knowledge

(i) Area of the shaded portion of the figure

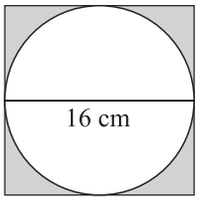
$=$ Area of square $-$ Area of circle

$= (\text{side})^2 - \pi r^2$

$= (16\,\text{cm})^2 - \frac{22}{7} \times \left(\frac{16}{2}\,\text{cm}\right)^2$

$= 256\,\text{cm}^2 - 201.14\,\text{cm}^2$

$= 54.86\,\text{cm}^2$.



(ii) Area of the shaded portion of the figure

$=$ Area of square $-$ Area of 16 circles

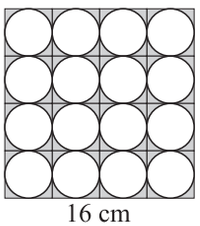
$= (\text{side})^2 - 16 \times \pi r^2$

$= (16\,\text{cm})^2 - 16 \times \frac{22}{7} \times \left(\frac{16}{8}\,\text{cm}\right)^2$

$= 256\,\text{cm}^2 - \frac{352}{7} \times 4\,\text{cm}^2$

$= 256\,\text{cm}^2 - 201.14\,\text{cm}^2$

$= 54.86\,\text{cm}^2$.


16 cm

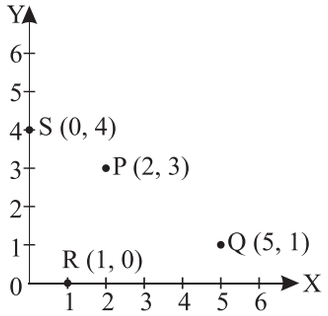
Chapter 10

Introduction to Graphs

Exercise 10.1

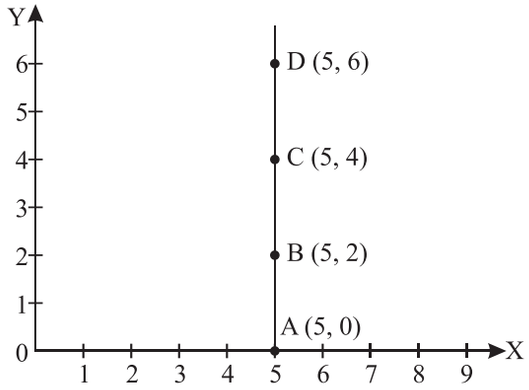
1. Co-ordinates of point $A = (2, 2)$
Co-ordinates of point $B = (1, -2)$
Co-ordinates of point $C = (-3, -2)$
Co-ordinates of point $D = (-3, 1)$

2.

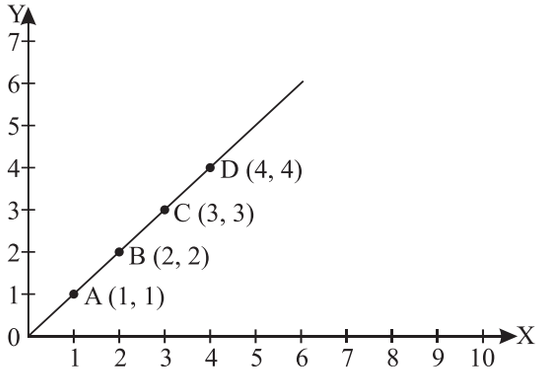


3. Co-ordinates of point $A = (0, 1)$
Co-ordinates of point $B = (1, 2)$
Co-ordinates of point $C = (3, 1)$
Co-ordinates of point $D = (4, 4)$
Co-ordinates of point $E = (2, 0)$

4. Plot the following on a graph sheet verify if they lie on a line.
(a) A (5, 0), B (5, 2), C (5, 4), D (5, 6)



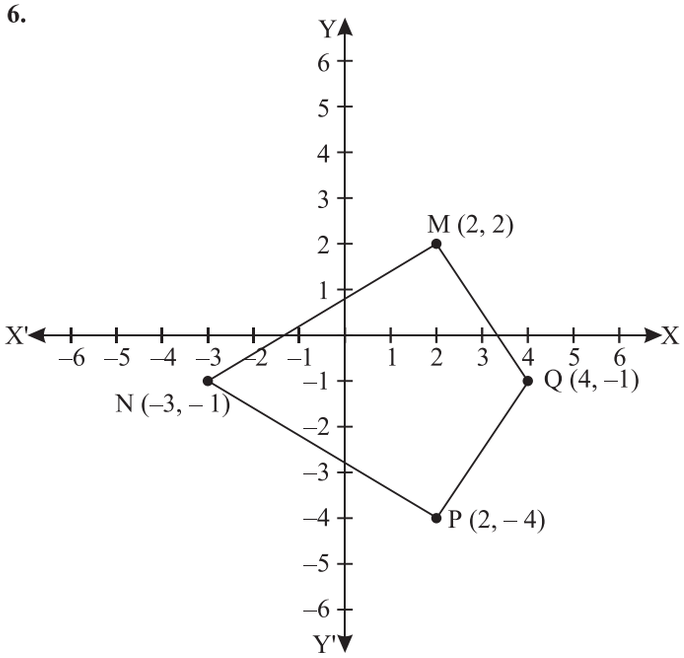
Yes, it is a line. All points lie on a line.
(b) P (1, 1), Q (2, 2), R (3, 3), S (4, 4)



Yes, It is a line. All points lie on a line.

5. Co-ordinates of vertex $A = (2, 3)$
Co-ordinates of vertex $B = (4, 4)$
Co-ordinates of vertex $C = (4, 2)$
Co-ordinates of vertex $D = (2, 1)$

6.



We get quadrilateral $MNPQ$ by joining these points
where M lies in Ist quadrant
N lies in IIIrd quadrant
P lies in IVth quadrant
Q lies in IVth quadrant
So, we got a kite $MNPQ$.

7. points $(-5, 4)$ and $(3, 2)$
here $x_1 = -5$, $x_2 = 3$,
$y_1 = 4$, $y_2 = 2$
So,co-ordinates of mid-point $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
$= \left(\frac{-5+3}{2}, \frac{4+2}{2}\right)$
$= \frac{-2}{2}, \frac{6}{2}$
$= (-1, 3)$

8. (a) G (–3, –10)
point G, (–3, –10) lies in IIIrd quadrant
(b) $L(-3, -10)$
point $\angle(-3, -10)$ lies in IIIrd quadrant
(c) R (3, 0)
point R (3, 0) lies on X-axis.
(d) Z (0, –11)
point Z (0, – 11) lies on Y-axis.

Exercise 10.2

1. The graph given below shows the number of Android mobiles sold by a shopkeeper from the month of July to December.

(a) The sale of Android mobiles was highest in month of October.

(b) The sale of Android mobiles was minimum in the month of December.

(c) 500 Android mobiles were sold in the month of September.

2. Following is a time temperature graph of a patient in a hospital recorded every hour.

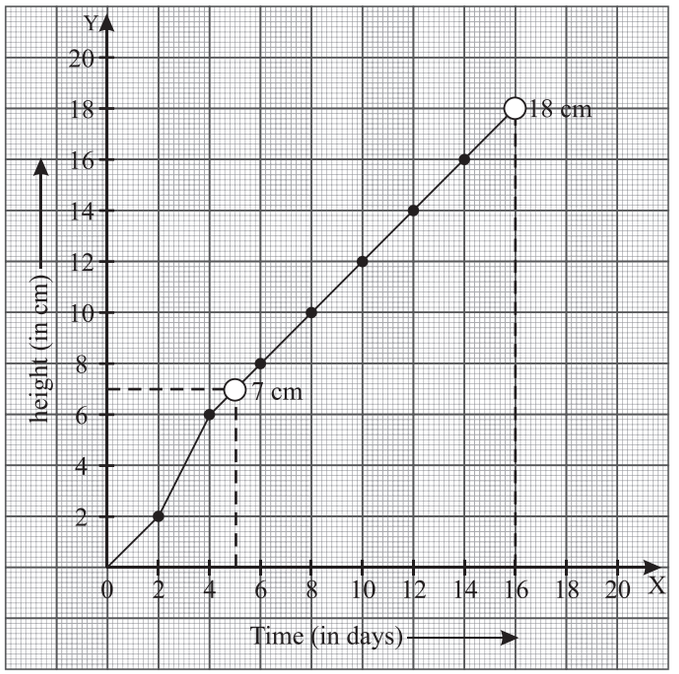
(a) The patient's temperature was 101° *F* at 10 : 00 am.

(b) The patient's temperature was 102°F at 12 : 00 noon and 2 : 00 pm

(c) The temperature of patient dropped from 101° F to 100°F between 10 : 00 am to 11 : 00 am

3. The height, in centimeters, measured every 2 days over a period of 2 weeks (14 days) of a plant grown from a seed is shown in the table.

Time (in days)	0	2	4	6	8	10	12	14
Height (in cm)	0	2	6	8	10	12	14	16

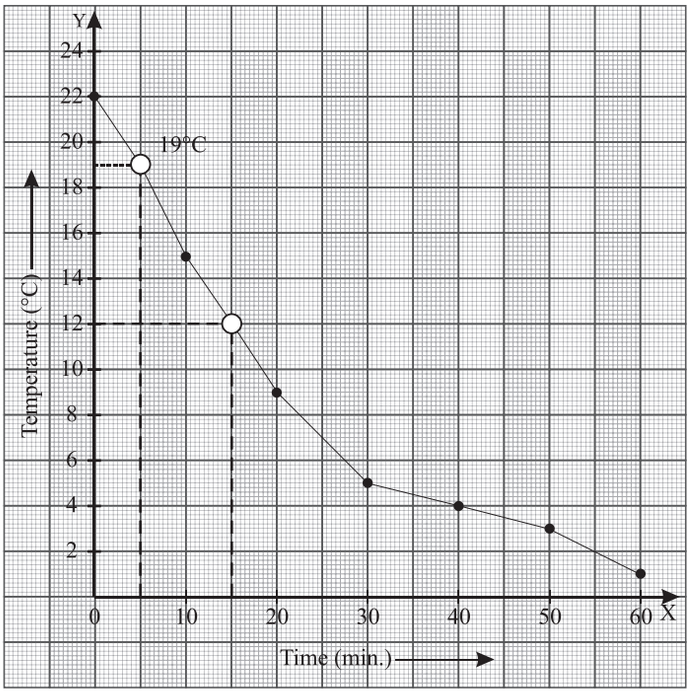


(a) height of plant is 7 cm after 5 days.

(b) height of plant is 18 cm after 16 days.

4. A bowl of water was placed in the freezer of a refrigerator. During the next hour its temperature in °C was measured every ten minutes. Draw a graph.

Time (min)	0	10	20	30	40	50	60
Temperature (°C)	22	15	9	5	4	3	1



(a) It is a curve

(b) The temperature after 5 minutes was 18.5°C

(c) After 15 min the temperature was 12°C.

5. Mrs. Verma drove from Shimla at 9 a.m. and reached Chandigarh by 1 p.m. She stayed there for 2 hours and then drove back. The graph shows the relation between the distance covered and time taken by her

(a) Mrs. Verma started back from Chandigarh at 3 : 00 pm.

(b) She stayed in Chandigarh between 1 : 00 pm to 3 : 00 pm.

(c) She travelled 180 + 180 = 360 km during her entire trip.

MCQs

1. (c) **2.** (b) **3.** (a) **4.** (a) **5.** (b) **6.** (b) **7.** (a) **8.** (a)

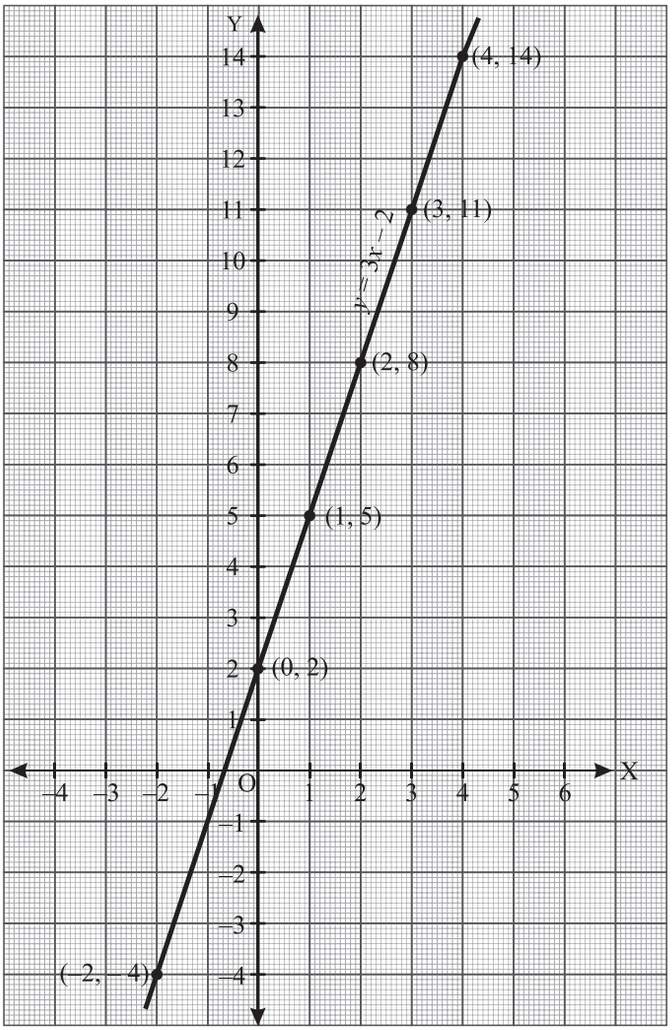
NEP Adaptive Education

1. four **2.** same **3.** ordered pair **4.** (0, 0) **5.** line

HOTS

1. $y = 3x + 2$

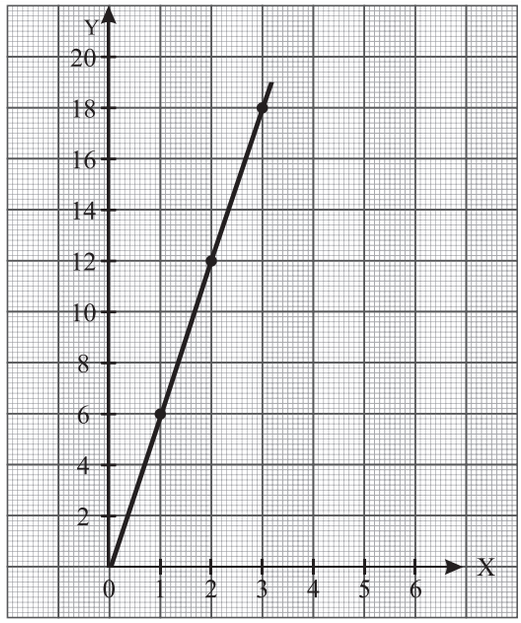
x	0	1	2	3	4
y	2	5	8	11	14



When $x = -2$, then $y = -4$

2. $y = 6x$

x	0	1	2	3
y	0	6	12	18



Chapter 11

Data Handling

Exercise 11.1

1. Read the bar graph and answer the following questions :

(a) The bar graph shows the production of watches by a factory from year 2001 to 2005.

(b) 30 million tonnes watches were manufactured in 2003.

(c) In year 2005

(d) Equal number of watches were manufactured in both years and it is equal to watches manufactured is 2005

So, In 2001 = 20 millions tonnes

In 2002 = 20 millions tonnes

Total = 40 millions tonnes

and In 2005 = 40 millions tonnes

(e) Production of watches increasing every years.

2. Read the bar shown in figure and answer the following questions :

(a) The bar graph in general gives the information about the number of students and subject preferred by them.

(b) Hindi

(c) English

(d) $60 - 20 = 40$ students

3. The bar graph below shows the six nations having population over 100 millions.

(a) India

(b) Japan

(c) $1100 + 700 + 300 + 250 + 150 = 2500$ millions.

4. Read the following bar graph and answer the questions that follow :

(a) The bar graph shows the result percentage of a certain school in 5 different years.

(b) In year 2012

(c) In year 2013

(d) Average marks $= \dfrac{80 + 95 + 70 + 85 + 90}{5}$

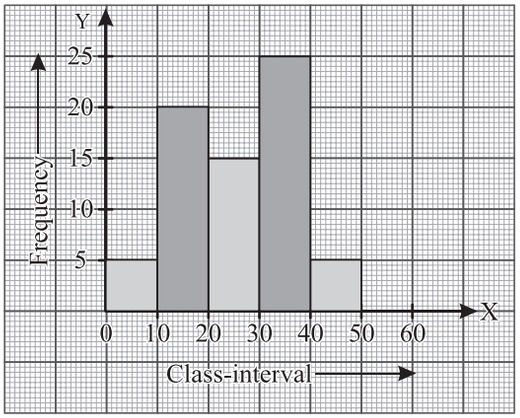
$= \dfrac{420}{5}$

$= 84\%$

5. Draw histogram for the following :

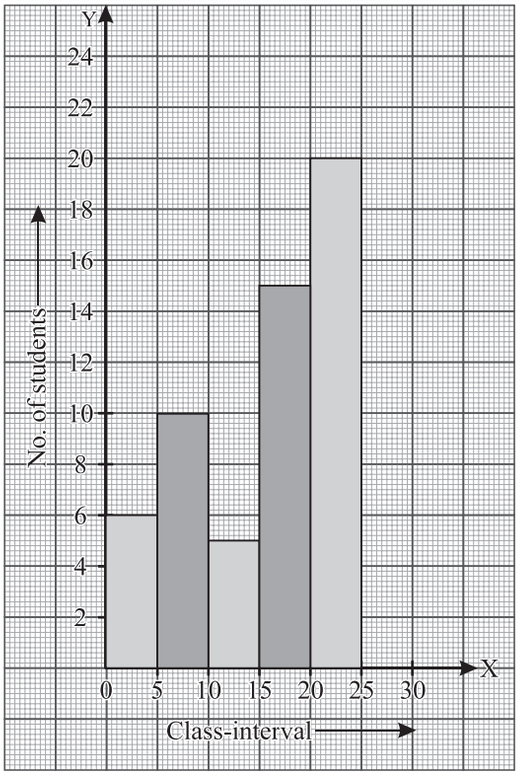
(a)

Class interval	0-10	10-20	20-30	30-40	40-50
Frequency	5	20	15	25	5



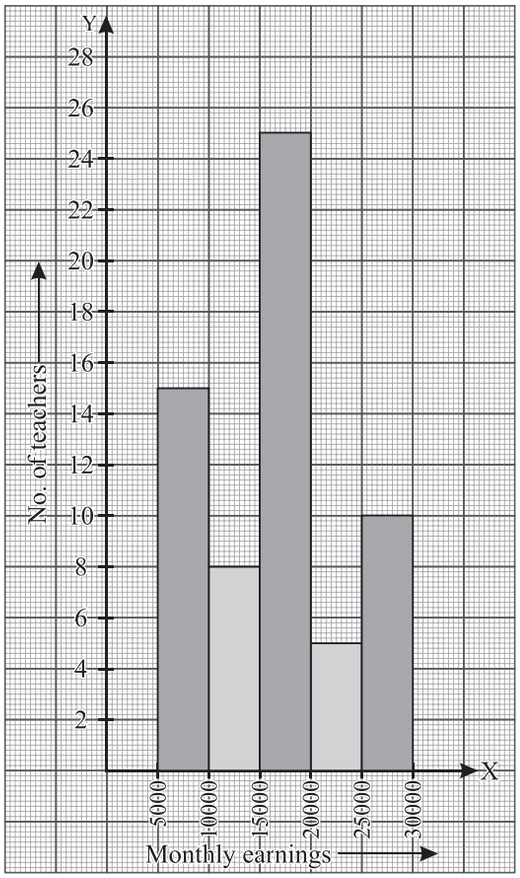
(b)

Class Interval	0-5	5-10	10-15	15-20	20-25
No. of students	6	10	5	15	20

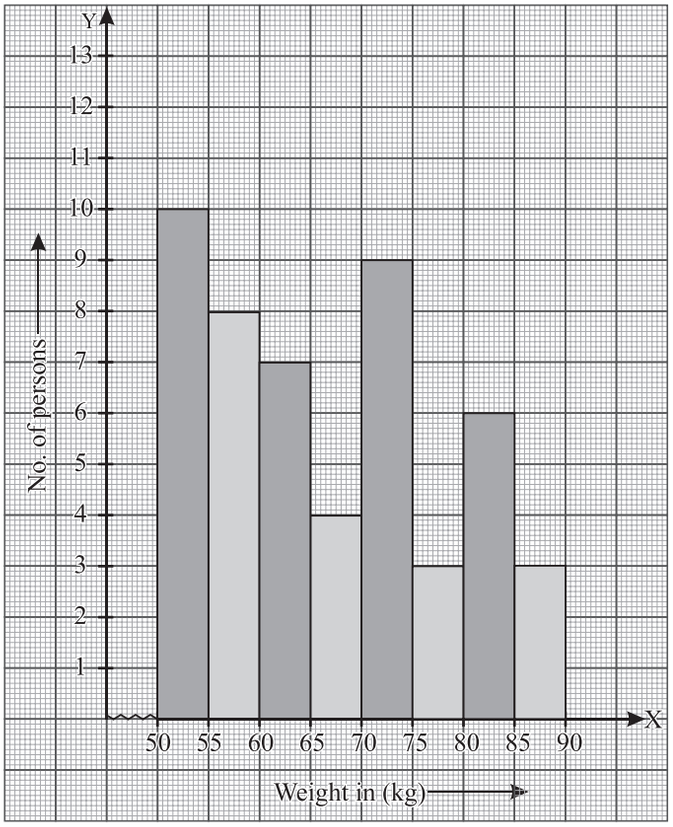


6. Draw a histogram to represent the following data of the salaries of teachers.

Monthly-earnings	No. of teachers
5000-10,000	15
10,000-15,000	8
15,000-20,000	25
20,000-25,000	5
25,000-30,000	10



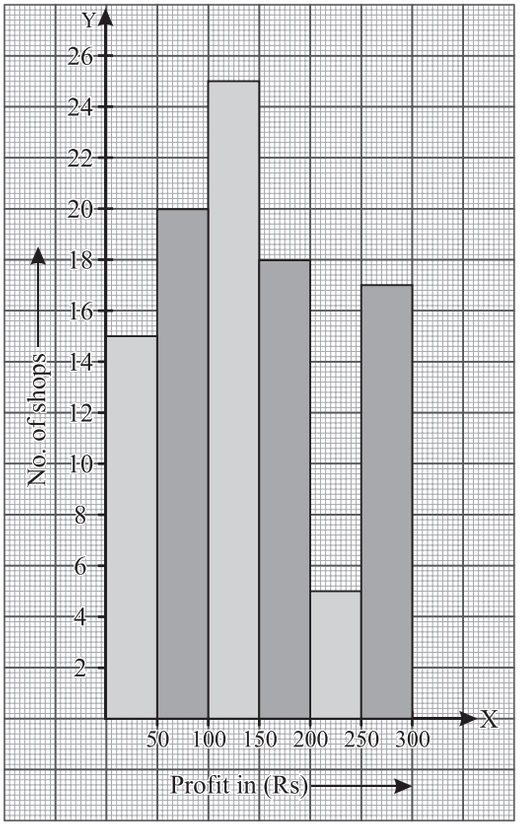
7. The following is the distribution of weights (in kg) of 50 persons.



weight (in kg)	Number of persons
50-55	10
55-60	8
60-65	7
65-70	4
70-75	9
75-80	3
80-85	6
85-90	3

8. The monthly profits (in ₹) of 100 shops are distributed as follows :

Profit of shop	0-50	50-100	100-150	150-200	200-250	250-300
No. of shops	15	20	25	18	5	17



9. Study the histogram and answer the following questions.

(a) Total number of families
$= 300 + 1000 + 800 + 700 + 400$
$= 3200$ families.

(b) Age group (15-20)

(c) Age group (10-15)

Exercise 11.2

1. A teacher gave a test of 50 marks to the students of her class. Following marks are obtained by the students :

Marks	Tally Marks	No. of students (frequency)
10-15	|	1
15-20	||	2
20-25	||	2
25-30	||	2
30-35	|||	3
35-40	𝍸 |	6
40-45	||	2
45-50	𝍸 ||	7

2. The number of runs scored by a cricket player in 25 innings are as follows :

Class-interval	Tally marks	Frequency
40-50	𝍸 |	6
50-60	𝍸	5
60-70	||	2
70-80	|||	3
80-90	||	2
90-100	|	1
100-110	||	2
110-120	|	1
120-130	|	1
130-140	|	1
140-150	|	1

3. The monthly wages of 30 workers in a factory are given below :

Class-interval	Tally-marks	Frequency
900-910	|||	3
910-920	|	1
920-930	|	1
930-940	𝍸	5
940-950	𝍸 ||	7
950-960	|	1
960-970	|||	3
970-980	|	1
980-990	||	2
990-1000	𝍸 |	6

4. The following table represents :

(a) Lower limit of class 31– 33 is 31.

(b) Upper limit of class 35 – 37 is 37.

(c) Frequency of class 29 - 31 is 6.

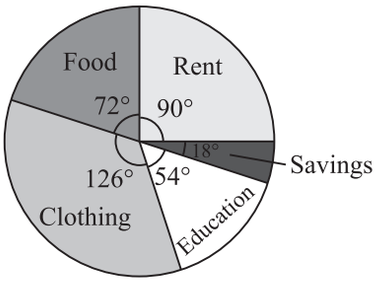
(d) Class mark of class $27 - 29 = \frac{27+29}{2} = \frac{56}{2} = 28$

Exercise 11.3

1. A teacher's monthly expenditure is given in the following table. Draw a pie graph to represent the data :

Items	Expenditure (in per cent)	Central angle
Rent	25%	$\frac{25}{100} \times 360° = 90°$
Food	20%	$\frac{20}{100} \times 360° = 72°$
Clothing	35%	$\frac{35}{100} \times 360° = 126°$
Education	15%	$\frac{15}{100} \times 360° = 54°$
Savings	5%	$\frac{5}{100} \times 360° = 18°$

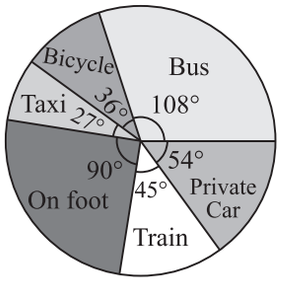
So, pie chart :



2. Draw a pie graph for the following data :

Mode of commuting	Number of children	center angle
Bus	60	$\frac{60}{200} \times 360° = 108°$
Bicycle	20	$\frac{20}{200} \times 360° = 36°$
Taxi	15	$\frac{15}{200} \times 360° = 27°$
On foot	50	$\frac{50}{200} \times 360° = 90°$
Train	25	$\frac{25}{200} \times 360° = 45°$
Private car	30	$\frac{30}{200} \times 360° = 54°$

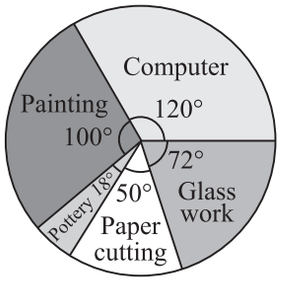
So, pie chart :



3. The table below shows the hobbies of students in a certain school :

Hobbies	No. of students	Center angle
Computer	180	$\frac{180}{540} \times 360° = 120°$
Painting	150	$\frac{150}{540} \times 360° = 100°$
Pottery	27	$\frac{27}{540} \times 360° = 18°$
Paper-cutting	75	$\frac{75}{540} \times 360° = 50°$
Class-work	108	$\frac{108}{540} \times 360° = 72°$

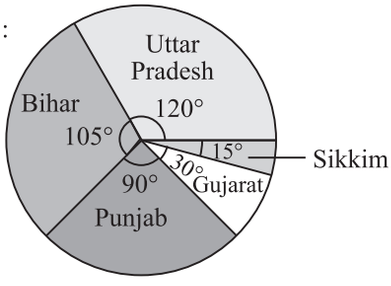
So, pie chart :



4. The number of people speaking Hindi in different states is given below :

States	No. of people	center angle
Uttar Pradesh	8000	$\frac{8000}{24000} \times 360° = 120°$
Bihar	7000	$\frac{7000}{24000} \times 360° = 105°$
Punjab	6000	$\frac{6000}{24000} \times 360° = 90°$
Gujarat	2000	$\frac{2000}{24000} \times 360° = 30°$
Sikkim	1000	$\frac{1000}{24000} \times 360° = 15°$

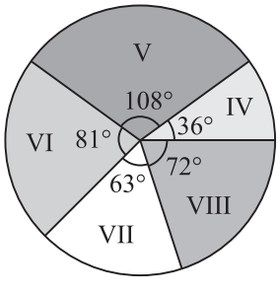
So, pie chart :



5. The data given below shows the number of students of a certain school reading Herry-Potter in different classes. Represent it by a pie graph.

Class	No. of students	Central angle
IV	40	$\frac{40}{400}\times 360^\circ = 36^\circ$
V	120	$\frac{120}{400}\times 360^\circ = 108^\circ$
VI	90	$\frac{90}{400}\times 360^\circ = 81^\circ$
VII	70	$\frac{70}{400}\times 360^\circ = 63^\circ$
VIII	80	$\frac{80}{400}\times 360^\circ = 72^\circ$

So, pic chart is



6. There are 1000 workers who travel from home to a factory they work. The pie graph shows the proportion of workers using various modes for travelling to work.

(a) (i) by bus $= \frac{90^\circ}{360^\circ}\times 1000$

$= 250$ workers

(ii) by train $= \frac{144^\circ}{360^\circ}\times 1000$

$= 400$ workers

(iii) by cycle $= \frac{72^\circ}{360^\circ}\times 1000$

$= 200$ workers

(iv) on foot $= \frac{54^\circ}{360^\circ}\times 1000$

$= 150$ workers

(b) workers go by bus $= 250$

$= \frac{250}{1000}\times 100\%$

$= 25\%$

(c) workers travel by train $= 400$

$= \frac{400}{1000}\times 100$

$= 40\%$

Now, workers travel by cycle $= 200$

$= \frac{200}{1000}\times 100 = 20\%$

So, Train : cycle $= 40\% : 20\%$

$= 2 : 1$

7. On the basis of information, answer the following question :

(a) Bihar

(b) No. of illiterate people in Uttar Pradesh $= \frac{110^\circ}{360^\circ}\times 108000$

$\Rightarrow 33000$ people.

(c) No. of illiterate people in Gujarat $= \frac{80^\circ}{360^\circ}\times 108000$

$= 24000$ peoples

(d) Punjab,

No. of illiterate people in Punjab $= \frac{50^\circ}{360^\circ}\times 108000$

$= 15000$ people

8. Read the pie graph and answer the following questions :

(a) No. of healthy people $= \frac{130^\circ}{360^\circ}\times 216000$

$= 78000$ people

(b) No. of physically handicapped people

$= \frac{90^\circ}{360^\circ}\times 216000$

$= 54000$ people

(c) No. of Mentally handicapped people

$= \frac{30^\circ}{360^\circ}\times 216000$

$= 18000$ people

(d) No. of drug addicts people $= \frac{110^\circ}{360^\circ}\times 216000$

$= 66000$ people

MCQS

1. (a) (i) (b) (ii) (c) (iv) (d) (iii) (e) (ii)

2. (a) (ii) (b) (i) (c) (i)

Mental Maths

1. 7 **2.** class size **3.** class mark

NEP Life Skills

(a) The amount spent on Cricket $= \frac{90^\circ}{360^\circ}\times ₹\ 72000$

$= \frac{₹\ 72000}{4}$

$= ₹\ 18{,}000$

(b) The amount spent on Hocket $= \frac{100^\circ}{360^\circ}\times ₹\ 20{,}000$

$= ₹\ (200\times 100)$

$= ₹\ 20{,}000$

(c) The amount spent on Football $= \frac{60^\circ}{360^\circ}\times ₹\ 72000$

$= \frac{₹\ 72000}{4}$

$= ₹\ 12{,}000$

(d) The amount spent on Tennis $= \frac{110^\circ}{360^\circ}\times ₹\ 72000$

$= ₹\ (200\times 110)$

$= ₹\ 22{,}000$

Chapter 12

Probability

Exercise 12.1

1. HHHH, HHHT, HHTT, HTTT, HHTH, HTHH, HTTH, HTHT, THHH, THHT, THTH, THTT, TTHH, TTHT, TTTH, TTTT

2. Probability of getting a vowel from the word

English $= \frac{2}{7}$

3. 1, 2, 3, 4, 5, 6, 7, 8, 9

Probability of choosing a prime number $= \frac{4}{9}$

4. Probability of getting white balls

$$= \frac{\text{No. of white balls}}{\text{total No. of balls}}$$

$$= \frac{4}{23}$$

5. A box contains some balls, which are marked with numbers from 1 to 10. If a ball is drawn randomly, find the probability of getting :

(a) Probability a prime no. ball

$\Rightarrow \quad \frac{4}{10} = \frac{2}{5}$

(b) Probability of an odd no. ball $= \frac{5}{10}$

$= \frac{1}{2}$

(c) Probability of ball no. multiple of 3 $= \frac{3}{10}$

6. A die is thrown once, find the probability of getting :

(a) probability of getting an odd no. $= \frac{3}{6}$

$= \frac{1}{2}$

(b) probability of a no. less than 4 $= \frac{3}{6}$

$= \frac{1}{2}$

(c) probability of getting a composite no. $= \frac{2}{6}$

$= \frac{1}{3}$

(d) probability of a no. divisible by 2 $= \frac{3}{6}$

$= \frac{1}{2}$

7. Two coins are tossed simultaneously, find the probability of getting :

(a) Probability of getting exactly one head $= \frac{2}{4} = \frac{1}{2}$

(b) Probability of two heads $= \frac{1}{4}$

(c) Probability of No. head $= \frac{1}{4}$

8. Two die are rolled simultaneoulsy. Find the probability of getting :

(a) Probability of getting a sum of 5

$$= \frac{\text{favourable out comes}}{\text{total out comes}}$$

$$= \frac{4}{36}$$

$$= \frac{1}{9}$$

(b) Probability of two 5's $= \frac{1}{36}$

(c) Probability of sum of 10 $= \frac{3}{36}$

$= \frac{1}{12}$

9. A bag contains 6 red balls, 3 black balls and 5 white balls. A ball is drawn out of the bag at random. What is the probability that the ball is :

(a) Probability of getting a red ball $= \frac{6}{14} = \frac{3}{7}$

(b) Probability of getting a white ball $\frac{5}{14} \Rightarrow \frac{5}{14}$

(c) Probability of getting a black ball $= \frac{3}{14}$

(d) Probability of getting a green ball $= \frac{0}{14} = 0$

MCQs

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

Mental Maths

1. 2^n **2.** 1

3. greater than and less than 1

4. sample space

5. HH, HT, TH, TT

HOTS

List of all the possible outcomes of tossing there coins together HHH, HHT, HTH, HTT, THH, THT, TTH, TTT

NEP The 4Cs : Core Learning Skills

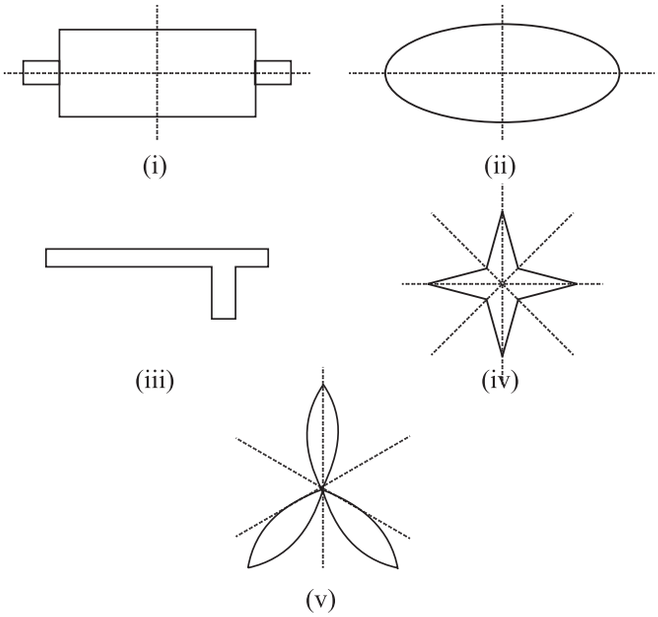
Probability of pointer stopping at a purple sector $= \frac{3}{5}$

Chapter 13

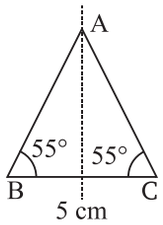
Symmetry, Reflection and Rotation

Exercise 13.1

1. For each of the given figure.
(i) (a) Two, (b) Two (ii) (a) Two, (b) Two (iii) (a) None, (b) None (iv) (a) Four, (b) Four (v) (a) Three, (b) Three



2.



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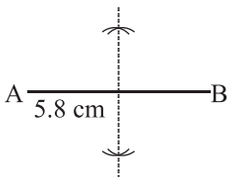

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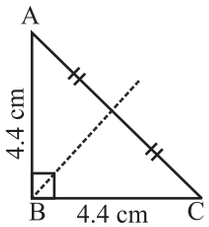
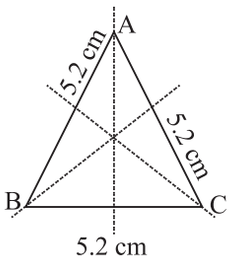


5.



6. Letters F, G, J, L, P and R have
No line of symmetry.

Exercise 13.2

1. Find the coordinates of the images of the following points under reflection in the x-axis :

(a) $(-3, 2)$
The reflection of the point $(-3, 2)$ in the x axis is : $(-3, -2)$

(b) $(5, -4)$
The reflection of the point $(5, -4)$ in the x axis is : $(5, 4)$

(c) $(3, 8)$
The reflection of the point $(3, 8)$ in the x-axis is : $(3, -8)$

(d) $(0, 2.5)$
The reflection of the point $(0, 2.5)$ in the x-axis is : $(0, -2.5)$

(e) $(3.5, 0)$
The reflection of the point $(3.5, 0)$ in the x-axis is : $(3.5, 0)$

2. Find the coordinates of the images of the following points under reflection in the y-axis.

(a) $(0, -5)$
The reflection of the point $(0, -5)$ in the y-axis is : $(0, -5)$

(b) $(4, -3)$
The reflection of the point $(4, -3)$ in the y-axis is : $(-4, -3)$

(c) $(-3, 6)$
The reflection of the point $(-3, 6)$ in the y-axis is : $(3, 6)$

(d) $(-5, 0)$
The reflection of the point $(-5, 0)$ in the y-axis is : $(5, 0)$

(e) $(-4, -7)$
The reflection of the point $(-4, -7)$ in the y-axis is : $(4, -7)$

3. Find the coordinates of the images of the following points under reflection about the origin :

(a) $(4, -3)$
The reflection of the point $(4, -3)$ about the origin is : $(-4, 3)$

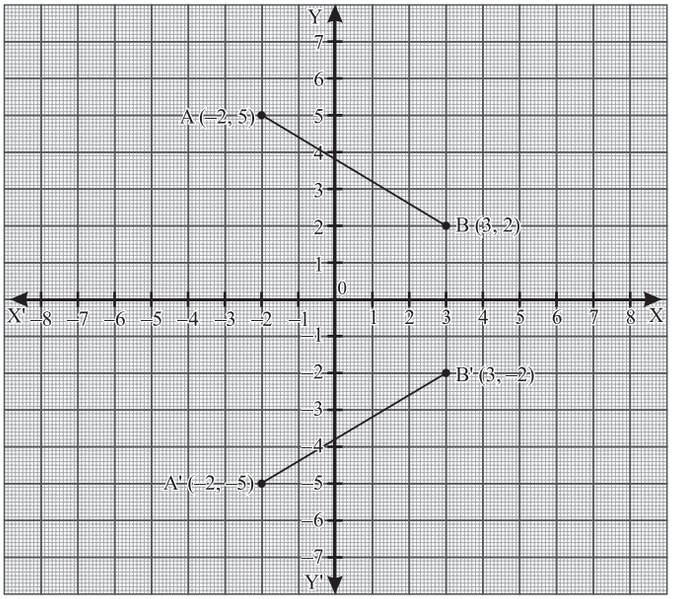
(b) $(-2, 4)$
The reflection of the point $(-2, 4)$ about the origin is : $(2, -4)$

(c) $(-5, -7)$
The reflection of the point $(-5, -7)$ about the origin is : $(5, 7)$

(d) $(8, 9)$
The reflection of the point $(8, 9)$ about the origin is : $(-8, -9)$

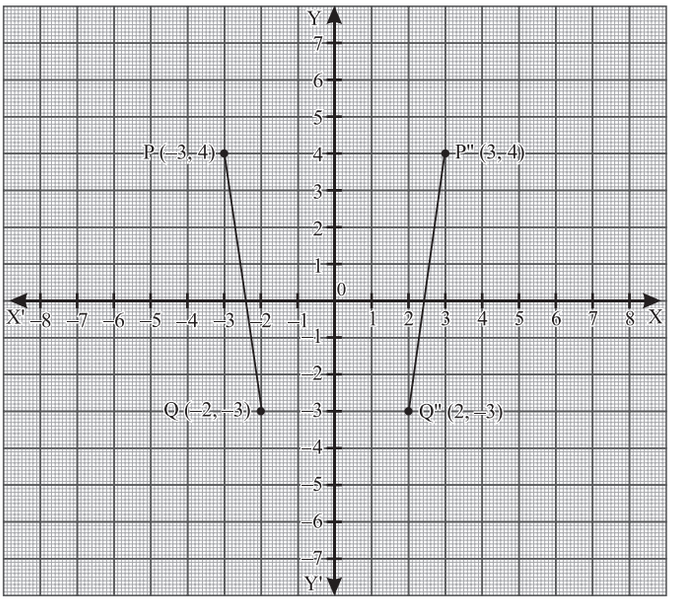
(e) $(7, 3)$
The reflection of the point $(7, 3)$ about the origin is : $(-7, -3)$

4. (a) $A = (-2, 5), B = (3, 2)$



$A' = (-2, -5)$,
$B' = (3, -2)$
Yes AB and $A'B'$ are equal

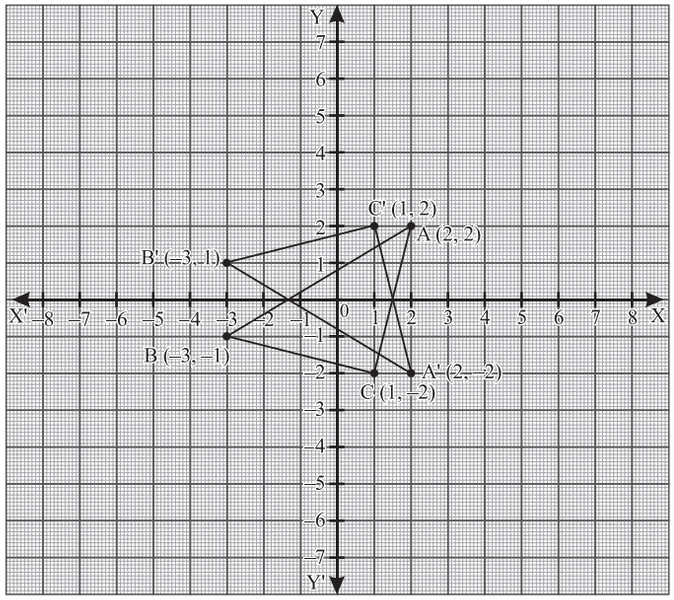
(b) $P = (-3, 4)$
and $Q = (-2, -3)$



$P'' = (3, 4)$,
$Q'' = (2, -3)$
Yes, PQ and $P''Q''$ are equal.

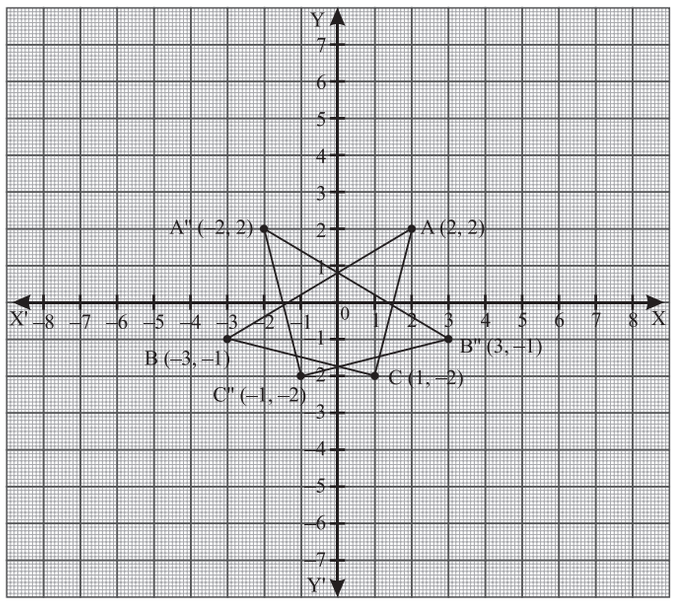
5. Plot the ΔABC whose vertices are $A(2, 2)$, $B(-3, -1)$ and $C(1, -2)$.

(a) $A\ (2, 2), B\ (-3, -1)$ and $C\ (1, -2)$



$A' = (2, -2), B' = (-3, 1), C' = (1, 2)$
Yes, the two triangles are congruent.

(b) $A = (2, 2), B = (-3, -1)$ and $C = (1, -2)$



$A'' = (-2, 2), B'' = (3, -1), C'' = (-1, -2)$
Yes, the two triangles are congruent.

Exercise 13.3

1. The following points are rotated through 90° anti-clockwise about the origin. Write the coordinates of their corresponding points.

(a) (5, 2)

We know if $P\ (x, y)$ is rotated through 90° anticlockwise about the origin to the point P', then $P'(-y, x)$

$\therefore$ corresponding to $P\ (5, 2)$ we get $P'(-2, 5)$

(b) $(-4, 6)$

We know if $P(x, y)$ is rotated through 90° anticlockwise about the origin to the point P', then $P'(-y, x)$

$\therefore$ corresponding to $P(-4, 6)$ we get $P'(-6, -4)$

(c) $(3, -6)$

We know if $P(x, y)$ is rotated through 90° anti-clockwise about the origin to the point P', then $P'(-y, x)$

$\therefore$ corresponding to $P(3, -6)$, we get $P'(6, 3)$

(d) $(-4, -3)$

We know if $P(x, y)$ is rotated through 90° anti-clockwise about the origin to the point P', then $P'(-y, x)$

$\therefore$ corresponding to $p(-4, -3)$, we get $p'(3, -4)$

(e) $(0, 4)$

We know if $P(x, y)$ is rotated through 90° anti-clockwise about the origin to the point P', then $P'(-y, x)$

$\therefore$ corresponding to $P(0, 4)$, we get $P'(-4, 0)$

(f) $(-5, 0)$

We know if $P(x, y)$ is rotated through 90° anti-clockwise about the origin to the point P', then $P'(-y, x)$

$\therefore$ corresponding to $P(-5, 0)$, we get $P'(0, -5)$

2. The following points are rotated through 90° clockwise about the origin. Write the coordinates of their corresponding points.

(a) $(4, 5)$

We know if $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then $P'(y, -x)$

$\therefore$ corresponding to $p(4, 5)$, we get $P'(5, -4)$

(b) $(-3, 1)$

We know if $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then $P'(y, -x)$

$\therefore$ corresponding to $P(-3, 1)$ we get $P'(1, 3)$

(c) $(2, -5)$

We know if $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then $P'(y, -x)$

$\therefore$ corresponding to $P(2, -5)$, we get $P'(-5, -2)$

(d) $(-3, -4)$

We know if $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then $P'(y, -x)$

$\therefore$ corresponding to $P(-3, -4)$ we get $P'(-4, 3)$

(e) $(0, 3)$

We know if $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then $P'(y, -x)$

$\therefore$ corresponding to $P(0, 3)$, we get $P'(3, 0)$

(f) $(-4, 0)$

We know if $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then $P'(y, -x)$

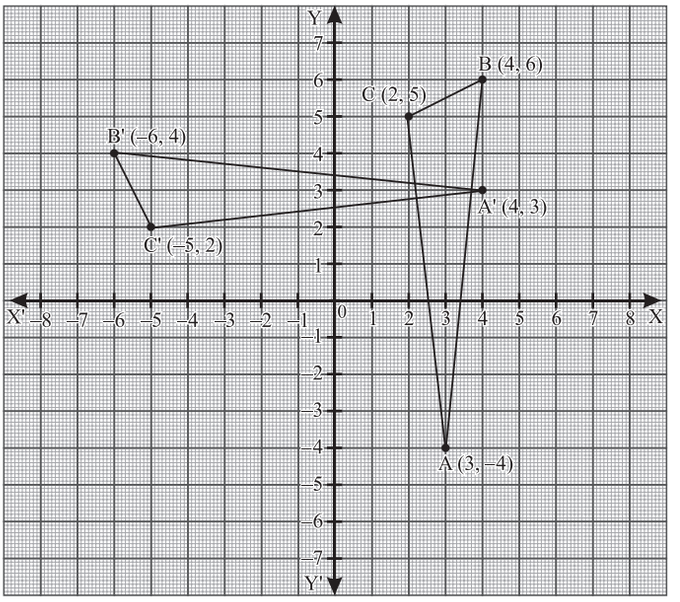
$\therefore$ corresponding to $P(-4, 0)$, we get $P'(0, 4)$

3. A triangle ABC with vertices $A(3, -4)$, $B(4, 6)$ and $C(2, 5)$ is rotated through 90° about the origin to the points A', B' and C' in the direction,

(a) When $P(x, y)$ is rotated through 90° anti-clockwise about the origin to the point P', then coordinates of P' are $(-y, x)$

$\therefore$ When A, B, C are rotated through 90° anti-clockwise about the origin to the points $A'B'C'$, then coordinates are $A'(4, 3)$, $B'(-6, 4)$, $C'(-5, 2)$

plottting these points on the graph paper, we get the $\Delta A'B'C'$ as shown on the graph.

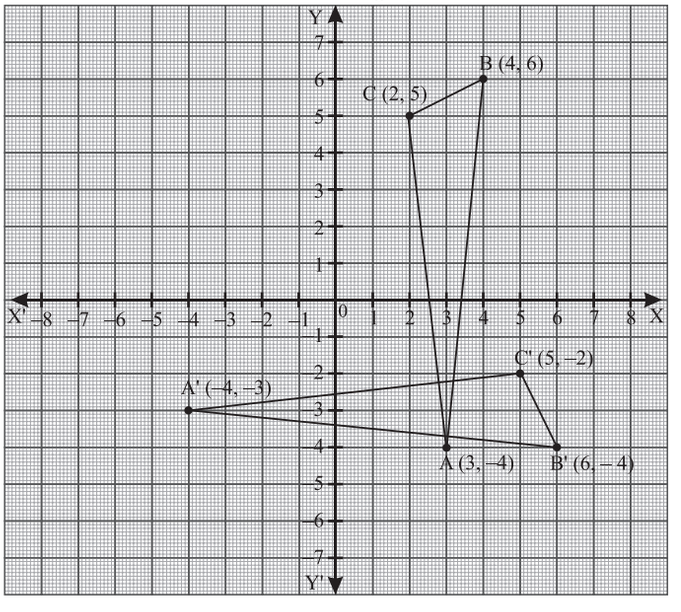


(b) $A(3, -4)$, $B(4, 6)$, $C(2, 5)$

When $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then co-ordinates of P' are $(y, -x)$

$\therefore$ When A, B, C are rotated through 90° clockwise about the origin to the points A', B', C', then coordinates are $A'(-4, -3)$, $B'(6, -4)$, $C'(5, -2)$

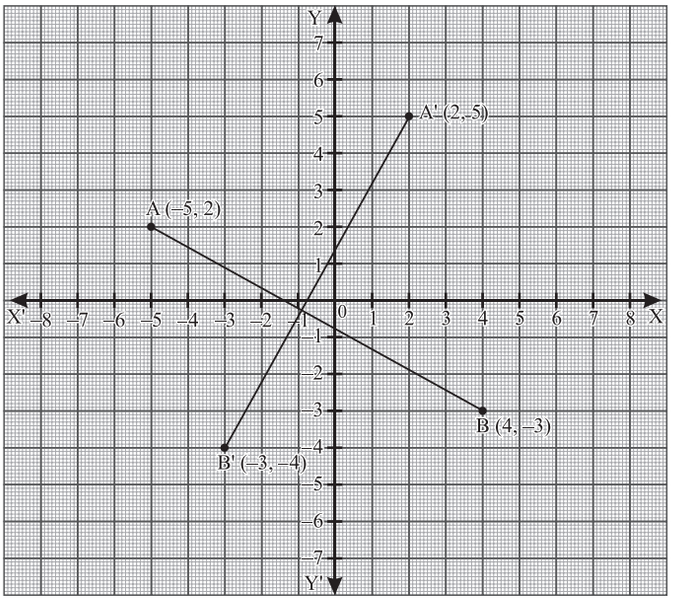
plotting these points on the graph paper, we get the $\Delta A'B'C'$ as shown on the graph.



4. Plot the points $A(-5, 2)$ and $B(4, -3)$ on the graph. Rotate these points through 90° about the origin.

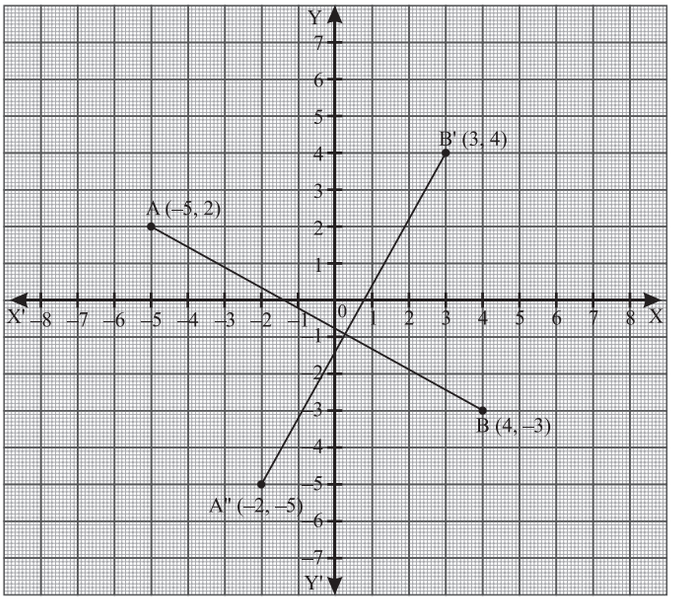
(a) When A, B are rotated through 90° clockwise about the origin to the point A', B', then coordinates are $A'(2, 5)$, $B'(-3, -4)$

plotting these points on the graph paper, we get the point A', B' as shown on the graph.



(b) When A, B are rotated through 90° anti-clockwise about the origin to the point A', B', then coordinates are $A''(-2,-5), B''(3,4)$

plotting these points on the graph paper, we get the point A'', B'' as shown on the graph.

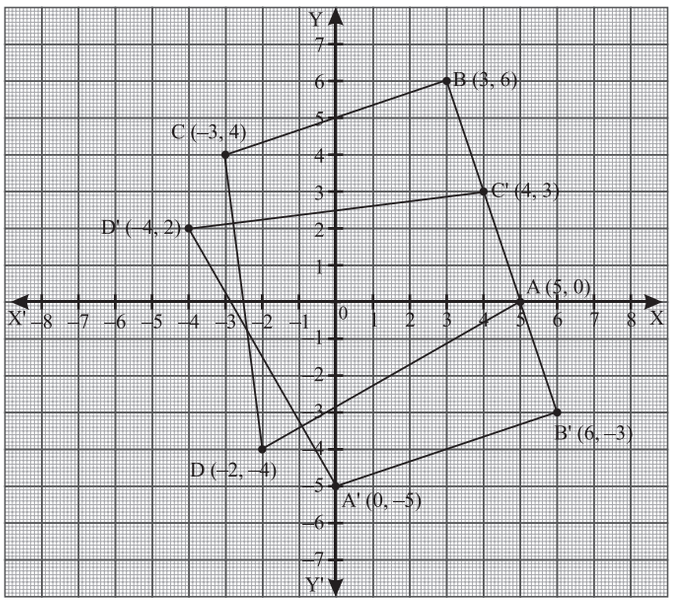


5. A quadrilateral $ABCD$ with its vertices $A(5, 0)$, $B(3, 6)$, $C(-3, 4)$ and $D(-2,-4)$ is rotated through 90°

(a) When $P(x, y)$ is rotated through 90° clockwise about the origin to the point P', then coordinates of P' are $(y, -x)$

∴ When A, B, C, D are rotated through 90° clockwise about the origin to the points A', B', C', D', then coordinates are $A'(0,-5), B'(6,-3), C'(4,3), D(-4,2)$

Plotting these points on the graph paper, we get the point A', B', C', D' as shown on the graph.

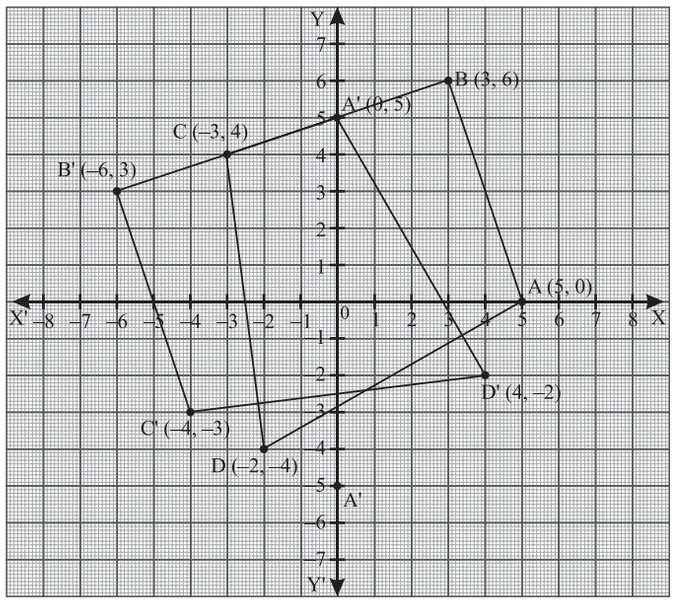


(b) $A(5, 0)$, $B(3, 6)$, $C(-3, 4)$, and $D(-2,-4)$

When $P(x, y)$ is rotated through 90° anti-clockwise about the origin to the point P', then coordinates of P' are $(-y, x)$

∴ When A, B, C, D are rotated through 90° anti-clockwise about the origin to the point A', B', C', D', then coordinates are $A'(0, 5), B'(-6, 3)$, $C'(-4,-3)$, and $D'(4,-2)$

Plotting these points on the graph paper, we get the point A', B', C', D' as shown on the graph.



MCQs

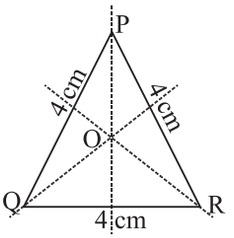
1. (d) **2.** (a) **3.** (b) **4.** (c)

Mental Maths

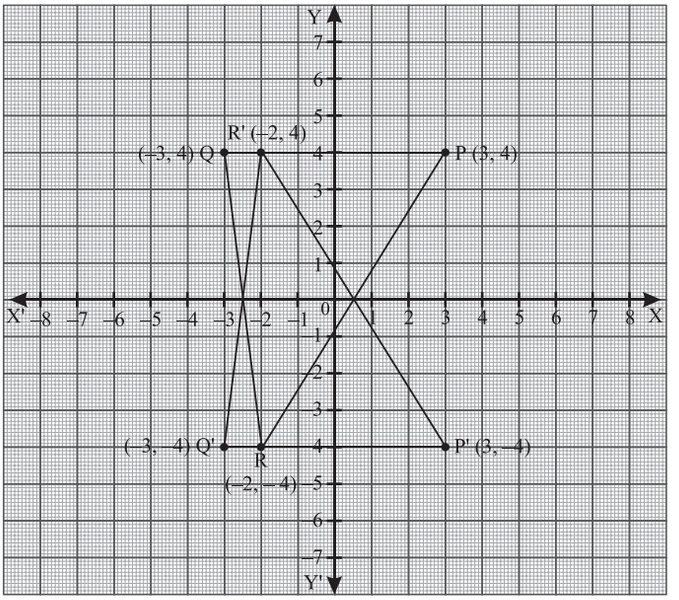
1. True **2.** False **3.** True **4.** True **5.** True

HOTS

- (a) Lines of symmetry = 3
  (b) Order of rotational symmetry = 3

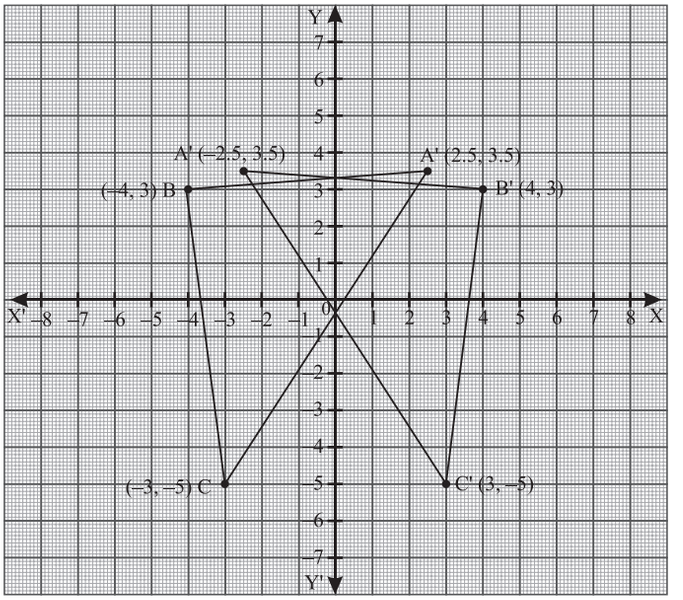


- Co-ordinates of $P'Q'$ and R' are $(3, -4)$; $(-3, -4)$ and $(-2, 4)$ respectively.



So, ΔPQR and $\Delta P'Q'R'$ are congruent.

- The co-ordinates of A', B' and C' are $(-2.5, 3.5)$; $(4, 3)$ and $(3, -5)$ respectively.



NEP Multiple Intelligence

Do it yourself.