CHAPTER 7: RATIO AND PROPORTION

EXERCISE 7.1

1.

(a) 12 kg and 3600 g = 12000 g and 3600 g = $\frac{12000}{3600} = \frac{10}{3} = 10:3$

(b) Rs 45 and 750 p = 4500 p and 75 p = $\frac{4500}{750} = \frac{6}{1} = 6:1$

(c) 34 feet and 16 feet = $\frac{34}{16} = \frac{17}{8} = 17:8$

(d) 14 min and 28 sec = 840 sec and 28 sec = $\frac{840}{28} = \frac{30}{1} = 30:1$

2.

(a) $64{:}88 = \frac{64}{88} \div \frac{8}{8} = \frac{8}{11} = 8{:}11$

(b) $42{:}36 = \frac{42}{36} \div \frac{6}{6} = \frac{7}{6} = 7{:}6$

(c) $45{:}115 = \frac{45}{115} \div \frac{5}{5} = \frac{9}{23} = 9{:}23$

(d) $24{:}336 = \frac{24}{336} \div \frac{12}{12} = \frac{2}{28} \div \frac{2}{2} = \frac{1}{14} = 1{:}14$

3. $x{:}y = 4{:}5$ and $y{:}z = 15{:}16$

$\frac{x}{y} \times \frac{y}{z} = \frac{4}{5} \times \frac{15}{16} = \frac{3}{4}$

$= x{:}z = 3{:}4$

4.

$x : y = 2 : 3$ and $y : z = 8 : 9$

In $x : y = 2 : 3$, y is 3 whereas in $y : z = 8 : 9$, y is 8.

The LCM of 3 and 8 is 24.

Now we will convert the given ratios into equivalent fractions with y as 24.

$\therefore \frac{x}{y} = \frac{2}{3} = \frac{2 \times 8}{3 \times 8} = \frac{16}{24} = 16 : 24$

$\frac{y}{z} = \frac{8}{9} = \frac{8 \times 3}{9 \times 3} = \frac{24}{27}$

Here the value of y is the same in both the ratios, so take y common from both the ratios and combine them.

Hence $x : y : z = 16 : 24 : 27$.

5. $\frac{4}{5} : \frac{2}{3} : \frac{1}{4}$

LCM of 5, 3, 4 = 60

$\frac{4}{5} \times \frac{12}{12} = \frac{48}{60} : \frac{2}{3} \times \frac{20}{20} = \frac{40}{60} : \frac{1}{4} \times \frac{15}{15} = \frac{15}{60}$

$\frac{48}{60} : \frac{40}{60} : \frac{15}{60} = 48 : 40 : 15$

6.

(a) 6:11 or 7:8

LCM of 11 and 8 = 88

$\frac{6}{11} \times \frac{8}{8} = \frac{48}{88}$ *or* $\frac{7}{8} \times \frac{11}{11} = \frac{77}{88}$

$\frac{48}{88} < \frac{77}{88}$

$\frac{6}{11} < \frac{7}{8}$

7:8 is greater

(b) 13:15 or 24:17

LCM of 15 and 17 = 255

$\frac{13}{15} \times \frac{17}{17} = \frac{221}{255}$ *or* $\frac{24}{17} \times \frac{15}{15} = \frac{360}{255}$

$\frac{221}{255} < \frac{360}{255}$

$\frac{13}{15} < \frac{24}{17}$

24:17 is greater.

7. Given ratio of two numbers = 5:6

Let the first number = $5x$ and second number = $6x$

Given $\frac{5x+2}{6x+3} = \frac{4}{5}$

$5(5x + 2) = 4(6x + 3)$

$25x + 10 = 24x + 12$

$25x - 24x = 12 - 10$

$= x = 2$

Putting the value of x in numbers

First number = $5x = 5 \times 2 = 10$

Second number = $6x = 6 \times 2 = 12$

The numbers are 10 and 12

8. Given ratio = 4:9

Let the first number = $4x$ and second number = $9x$

Given

$4x + 9x = 26$

$13x = 26$

$= x = 2$

Putting the value of x in numbers

First number = $4x = 4 \times 2 = 8$

Second number = $9x = 9 \times 2 = 18$

The numbers are 8 and 18

9. It is given that the ratio of the ages of Shreya and Kavita is 3 : 4.

Let the age of Shreya be $3x$ and the age of Kavita be $4x$.

After 5 years, Shreya will be $3x + 5$.

After 5 years, Kavita will be $4x + 5$.

As the ratio of their ages after 5 years will be 5:6, we get

$\frac{3x+5}{4x+5} = \frac{5}{6}$

$\Rightarrow 6(3x + 5) = 5(4x + 5)$

$\Rightarrow 18x + 30 = 20x + 25$

$\Rightarrow 18x - 20x = 25 - 30$

$\Rightarrow -2x = -5$

$\Rightarrow x = \frac{5}{2}$

Thus Shreya's age = $3 \times \frac{5}{2} = \frac{15}{2} = 7\frac{1}{2}$ years and Kavita's age = $4 \times \frac{5}{2} = 2 \times 5 = 10$ years.

10. The ratio of the length of the side of a cubical water tank and the length of the side of a cubical oil tank is 2:5.
Let length of the side of a cubical water tank = $2x$
and the length of the side of a cubical oil tank = $5x$
Given, volume of the oil tank is 1,25,000 L

Volume of a cube = $(\text{side})^3$
$125000 = (5x)^3$
$\sqrt[3]{125000} = 5x$
$50 = 5x$
$= x = 10$
Putting the value of x in numbers
Let length of the side of a cubical water tank = $2x = 2\times10 = 20$ m
and the length of the side of a cubical oil tank = $5x = 5\times10= 50$ m.

11. Nandini distributes a sum of money among her two sons, Vihaan and Vyom, in the ratio = 5:9
Let Vihaan share = $5x$
Vyom's share = $9x$
Given, larger part is Rs.5,400
$9x = 5400$
$= x = 600$
Putting the value of x in numbers
Vihaan's share = $5x = 5 \times 600 = ₹3000$
Total money distributed = Vihaan's share + Vyom's share
= 3,000 + 5,400 = ₹8,400

12. The ratio of the length, breadth, and height of an underground water tank is 5:3:7
Let the length = $5x$, breath = $3x$ and height = $7x$
Given, the difference between the length and height of the tank is 8 m
Therefore, $7x - 5x = 8$
$= 2x = 8$
$= x = 4$
Putting the value of x in numbers
Length = $5 \times 4 = 20$ m
Breath = $3 \times 4 = 12$ m
Height = $7 \times 4 = 28$ m
Then,
Volume of a cuboid = length × breadth × height
= 20m × 12m × 28m = 6,720 m^3

13. Total beads in all in the necklace = 40
The ratio of the number of green and orange beads is 3:5
Let green beads = $3x$
Orange beads = $5x$

Given,
$3x + 5x = 40$
$8x = 40$
$= x = 5$
Putting the value of x in numbers
Green beads = $3x = 3 \times 5 = 15$
Orange beads = $5x = 5 \times 5 = 25$

14. Total Profit = ₹930
Ayush's father divides the profit among his three workers in the ratio = $\frac{1}{3}: \frac{1}{2}: \frac{1}{5}$
Let the ratio be in $x = \frac{1}{3}x + \frac{1}{2}x + \frac{1}{5}x$

$$\frac{1}{3}x + \frac{1}{2}x + \frac{1}{5}x = 930$$

LCM of 3, 2 and 5 = 30

$$\frac{10x + 15x + 6x}{30} = 930$$

$$\frac{31x}{30} = 930$$

$31x = 30 \times 930$
$31x = 27{,}900$
$x =$ ₹900
Putting the value of x in numbers
First worker = $\frac{1}{3}x = \frac{1}{3} \times 900 =$ ₹300
Second Worker = $\frac{1}{2}x = \frac{1}{2} \times 900 =$ ₹450
Third Worker = $\frac{1}{5}x = \frac{1}{5} \times 900 =$ ₹180
Second worker will receive ₹450 instead of ₹400.
Third worker will receive ₹180 instead of ₹230.

EXERCISE 7.2

1.

(a) 7, 5, 2.8, 3.5
If two ratios are proportional, then product of the extremes = product of the means.
From the given ratios,
Product of means = $5 \times 2.8 = 14$
Product of extremes = $7 \times 3.5 = 24.5$
As the products are not equal, the ratios 7:5 and 2.8:3.5 are not in proportion.

(b) 14, 7, 10, 5
If two ratios are proportional, then product of the extremes = product of the means.
From the given ratios,
Product of means = $7 \times 10 = 70$
Product of extremes = $14 \times 5 = 70$
As the products are equal, the ratios 14, 7 and 10, 5 are in proportion.

(c) $\frac{1}{7}, \frac{1}{3}, \frac{1}{3}, \frac{1}{7}$

If two ratios are proportional, then product of the extremes = product of the means.

From the given ratios,

Product of means = $\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

Product of extremes = $\frac{1}{7} \times \frac{1}{7} = \frac{1}{49}$

As the products are not equal, the ratios $\frac{1}{7}, \frac{1}{3}$ and $\frac{1}{3}, \frac{1}{7}$ are not in proportion.

(d)

$\frac{3}{5} : \frac{3}{15}$ and $\frac{2}{9} : \frac{2}{27}$

Product of means = $\frac{3}{15} \times \frac{2}{9} = \frac{2}{45}$

Product of extremes = $\frac{3}{5} \times \frac{2}{27} = \frac{2}{45}$

As the products are equal, the ratios $\frac{3}{5} : \frac{3}{15}$ and $\frac{2}{9} : \frac{2}{27}$ are in proportion.

2.

(a) 26, 32, 43

If two ratios are proportional, then product of the extremes = product of the means.

From the given ratios,

Product of means = 26 × 43 = 1118

Product of extremes = 32 × 32 = 1024

As the products are not equal, the ratios 26, 32, 43 are not in continued proportion.

(b) 12, 15, 18

If two ratios are proportional, then product of the extremes = product of the means.

From the given ratios,

Product of means = 12 × 18 = 216

Product of extremes = 15 × 15 = 225

As the products are not equal, the ratios 12, 15, 18 are not in continued proportion.

(c) 36, 54, 81

If two ratios are proportional, then product of the extremes = product of the means.

From the given ratios,

Product of means = 36 × 81 = 2916

Product of extremes = 54 × 54 = 2916

As the products are equal, the ratios 36, 54, 81 are in continued proportion.

(d) 4, 36, 18

If two ratios are proportional, then product of the extremes = product of the means.

From the given ratios,

Product of means = $4 \times 18 = 72$

Product of extremes = $36 \times 36 = 1296$

As the products are not equal, the ratios 4, 36, 18 are not in continued proportion.

3.

(a)

$7 : 49 : : 49 : x$

From the formula of proportion,

Product of means = Product of extremes

$\Rightarrow 49 \times 49 = 7x$

$\Rightarrow x = \frac{49 \times 49}{7} = 343$

Thus the value of x is 343.

(b)

$24 : x : : 6 : 24$

From the formula of proportion,

Product of means = Product of extremes

$\Rightarrow 6 \times x = 24 \times 24$

$\Rightarrow x = \frac{24 \times 24}{6} = 24 \times 4 = 96$

Thus the value of x is 96.

(c)

$x : 25 : : 36 : 150$

From the formula of proportion,

Product of means = Product of extremes

$\Rightarrow 25 \times 36 = x \times 150$

$\Rightarrow x = \frac{25 \times 36}{150} = 6$

Thus the value of x is 6.

(d)

$\frac{2}{5} : x : : 20 : 70$

From the formula of proportion,

Product of means = Product of extremes

$\Rightarrow x \times 20 = 70 \times \frac{2}{5}$

$\Rightarrow 5x \times 20 = 70 \times 2$

$\Rightarrow x = \frac{70 \times 2}{5 \times 20} = \frac{7}{5}$

Thus the value of x is $\frac{7}{5}$.

4.

(a) 4, 36

Let the mean proportional be x.

$4: x :: x : 36$

$\frac{4}{x} = \frac{x}{36}$

$= x^2 = 4 \times 36$

$= x = \sqrt{144} = 12$

(b)

1, 1.69

Let the mean proportional be x.

$1 : x : : x : 1.69$

$\Rightarrow \frac{1}{x} = \frac{x}{1.69}$

$\Rightarrow x^2 = 1.69$

$\Rightarrow x = 1.3$

Thus the mean proportional of given numbers is 1.3.

(c)

3, 27

Let the mean proportional be x.

$\therefore 3 : x : : x : 27$

$\Rightarrow \frac{3}{x} = \frac{x}{27} \Rightarrow x^2 = 3 \times 27 = 81 \Rightarrow x = 9$

Thus the mean proportional of given numbers is 9.

(d)

$\frac{1}{8}, 1\frac{7}{18}$

Let the mean proportional be x.

$\frac{1}{8} : x :: x : 1\frac{7}{18}$

$\Rightarrow x^2 = \frac{1}{8} \times 1\frac{7}{18} \Rightarrow x^2 = \frac{1}{8} \times \frac{25}{18} \Rightarrow x = 12$

Thus the mean proportional of given numbers is $\frac{5}{12}$.

5.

Let the age of Kashvi be x years.

According to the question,

Income of Kashvi: Income of Avni = Age of Kashvi: Age of avni

150000: 120000 = x: 28

$\frac{150000}{120000} = \frac{x}{28}$

$x = \frac{150000 \times 28}{120000} = \frac{15 \times 28}{12} = 5 \times 7 = 35\ years$

6. 6, 8, 10,13
Let the number to be added to each number be = x
$(6 + x):(8 + x) = (10 + x):(13 + x)$
$$\frac{6+x}{8+x} = \frac{10+x}{13+x}$$
$(6 + x)(13 + x) = (8 + x)(10 + x)$
$78 + 6x + 13x + x^2 = 80 + 8x + 10x + x^2$
$78 + 19x = 80 + 18x$
$19x – 18x = 80 – 78$
$= x = 2$
The number to be added to each number to get a proportion is 2.

7.
Let the third number be x.
First number $\frac{120}{100} \times x = \frac{6x}{5}$
Second number $\frac{150}{100} \times x = \frac{3x}{2}$
Ratio = $\frac{6x}{5} : \frac{3x}{2}$
=4:5
Thus, the ratio of two numbers is 4:5.

8. The rate at which the water tank is filled by a pipe = 40 litres per minute
The water to be filled in 25 min will be
1 min = 40 L
25 min = 25 × 40 L = 1,000 L

9. Let the fourth term be x
4, 12, 10, x
From the given ratios,
Product of means = Product of extremes
Product of means = $4 \times x = 4x$
Product of extremes = $12 \times 10 = 120$
$4x = 120$
$= x = 30$
Fourth term = 30

EXERCISE 7.3

1.

(a) The given numbers are 2, 4, 8, and 4.

We see that $2 \times 8 = 4 \times 4 = 16$

Product of first term and third term = Product of second term and fourth term

Hence the given numbers are in inverse proportion.

(b) The given numbers are 4, 2, 16, and 8.

We see that $4 \times 8 = 2 \times 16 = 32$

Product of first term and fourth term = Product of second term and third term

Hence the given numbers are in direct proportion.

(c) The given numbers are $\frac{1}{6}, \frac{1}{5}, \frac{1}{42}$, and $\frac{1}{35}$.

We see that $\frac{1}{6} \times \frac{1}{35} = \frac{1}{5} \times \frac{1}{42} = \frac{1}{210}$

Product of first term and fourth term = Product of second term and third term

Hence the given numbers are in direct proportion.

(d) The given numbers are 64, 8, 1, and 8.

We see that $64 \times 1 = 8 \times 8 = 64$

Product of first term and third term = Product of second term and fourth term

Hence the given numbers are in inverse proportion.

2.

(a) The ratios 6 : 78 and x : 39 are in direct proportion.

$$\therefore \frac{6}{78} = \frac{x}{39}$$

$$\Rightarrow 78 \times x = 6 \times 39$$

$$\Rightarrow x = \frac{6 \times 39}{78} = \frac{6 \times 1}{2} = 3$$

Thus the value of x is 3.

(b) The ratios 12 : x and 3 : 9 are in direct proportion.

$$\therefore \frac{12}{x} = \frac{3}{9}$$

$$\Rightarrow 3 \times x = 9 \times 12$$

$$\Rightarrow x = \frac{9 \times 12}{3} = 3 \times 12 = 36$$

Thus the value of x is 36.

(c) The ratios $\frac{3}{4} : \frac{5}{6}$ and $x : \frac{9}{8}$ are in direct proportion.

$$\therefore \frac{3}{4} \times \frac{6}{5} = x \times \frac{8}{9}$$

$$\Rightarrow \frac{18}{20} = \frac{8x}{9}$$

$$\Rightarrow 20 \times 8x = 9 \times 18$$

$$\Rightarrow x = \frac{9 \times 18}{20 \times 8} = \frac{81}{80}$$

Thus the value of x is $\frac{81}{80}$.

(d) The ratios x : 0.05 and 21 : 2.1 are in direct proportion.

$$\therefore \frac{x}{0.05} = \frac{21}{2.1}$$

$$\Rightarrow x \times 2.1 = 21 \times 0.05$$

$$\Rightarrow x = \frac{21 \times 0.05}{2.1} = 0.5$$

Thus the value of x is 0.5.

3.

(a) The ratios 8 : 64 and x : 5 are in inverse proportion.

$\frac{8}{64}=\frac{5}{x}$

$\Rightarrow 8 \times x = 64 \times 5$

$\Rightarrow x=\frac{64 \times 5}{8}=8 \times 5 = 40$

Thus the value of x is 40.

(b) The ratios 42 : 7 and 9 : x are in inverse proportion.

$\Rightarrow \frac{42}{7}=\frac{x}{9}$

$\Rightarrow 42 \times 9 = 7 \times x$

$\Rightarrow x=\frac{42 \times 9}{7}=54$

Thus the value of x is 54.

(c) The ratios 1 : x and 0.025 : 2.5 are in inverse proportion.

$\Rightarrow \frac{1}{x}=\frac{2.5}{0.025}$

$\Rightarrow 1 \times 0.025 = x \times 2.5$

$\Rightarrow x=\frac{0.025}{2.5}=0.01$

Thus the value of x is 0.01.

(d) $x: 1\frac{2}{3}$ *and* $1\frac{2}{3}: 1\frac{1}{3} = x: \frac{5}{3} = \frac{5}{3}: \frac{4}{3}$

$x \times \frac{5}{3} = \frac{5}{3} \times \frac{4}{3}$

$\frac{5x}{3} = \frac{20}{9}$

$x = \frac{20 \times 3}{9 \times 5} = \frac{4}{3} = 1\frac{1}{3}$

4. Given, The variable x varies directly as y, and y is 28 when x is $\frac{4}{7}$

Let the value of $y = y$, when $x = 14$

$\frac{4}{7}: 28 = 14: y$

$\frac{4}{7 \times 28} = \frac{14}{y}$

$y = \frac{14 \times 7 \times 28}{4} = 14 \times 7 \times 7 = 686$

5. Hariti bought 16 handmade sheets for ₹336

Let the cost of 15 sheets be x

16 sheet: 15 sheet = ₹336:x

$\frac{16}{15} = \frac{336}{x}$

$16x = 15 \times 336$

$= x = \frac{5040}{16} = 315$

The cost of 15 sheets will be ₹315.

6. A bookbinder takes 12 days to bind = 504 books
Let the books he will bind in 24 days be x
12 days:24 days = 504 books:x books
$\frac{12}{24} = \frac{504}{x}$
$12x = 24 \times 504$
$= x = \frac{24 \times 504}{12} = 1008$
Books he will bind in 24 days is 1008 books

7. A map is given with a scale of 0.7 cm = 49.7 km
Let the distance for 14.7 cm be x
0.7 cm:14.7cm = 49.7 km:x km
$\frac{0.7}{14.7} = \frac{49.7}{x}$
$0.7x = 14.7 \times 49.7$
$= x = \frac{14.7 \times 49.7}{0.7} = 1043.7\ km$

8. Rahul take lap in 1 min = 3
Likewise, in 2 min = 6 laps
In 3 min = 9 laps
And in 4 min = 10 laps
Wrong solution:
The proportion of all laps are
$\frac{1}{3}:\frac{2}{6} = \frac{1}{3}:\frac{3}{9} = \frac{1}{3}:\frac{4}{10} = \frac{2}{5}$
The first three laps are proportional but not the fourth one.
The mistake done by Rahul is that he takes 10 laps in 4 min.

Correct solution:
Let the lap in 4 min be a
Then, 1:3 = 4:a
$\frac{1}{3} = \frac{4}{a}$
$= a = 4 \times 3 = 12$
So the lap in 4 min should be 12 so that all the fourth laps should be proportional.

MENTAL MATHS

1.

(a) 180g and 9kg
180g : (9 × 1000)g
180g : 9000g
$\frac{180}{9000} = \frac{1}{5} = 1:50$

(b) $ak:bk:ck = a:b:c$

(c) product

(d)

3 : 9 : : 27 : 81

We see that $3 \times 81 = 9 \times 27 = 243$

Product of first term and fourth term = Product of second term and third term

The numbers 3, 9, 27, and 81 are in direct proportion.

(e)

4 : 8 : : 12 : 6

We see that $4 \times 12 = 8 \times 6 = 48$

Product of first term and third term = Product of second term and fourth term

The numbers 4, 8, 12, and 6 are in inverse proportion.

2.

(a) There can be three quantities in a ratio.

Hence the given statement is true.

(b) Fractions can be used as terms in a ratio.

Hence the given statement is false.

(c) The first term in a ratio is called the antecedent.

Hence the given statement is true.

(d)

In a proportion, the two ratios are equal.

Hence the given statement is true.

(e)

In a proportion there cannot be more than four proportional.

Hence the given statement is false.

3.

(a)

$x : 5 : : 25 : 125$

$\Rightarrow \frac{x}{5} = \frac{25}{125}$

$\Rightarrow 125 \times x = 25 \times 5$

$\Rightarrow x = \frac{25 \times 5}{125} = \frac{125}{125} = 1$

Thus the correct answer is (i).

(b)

$7 : x : : 8 : 28$

$\Rightarrow \frac{7}{x} = \frac{28}{8}$

$\Rightarrow 7 \times 8 = x \times 28$

$\Rightarrow x = \frac{7 \times 8}{28} = 2$

Thus the correct answer is (iv)

(c)

Ratio of 2 days and 18 hours = (2 × 24) h:18 h = 48 h:18 h = 8:3

Thus the correct answer is (i).

(d)

Total students = 40

Number of boys = 18

∴ Number of girls = 40 – 18 = 22

Therefore the ratio of number of girls to the number of boys is 22:18 –that is, 11:9.

Thus the correct answer is (iii).

(e)

Ratio of 75 cm and 6 m = Ratio of 75 cm and (6 × 100) cm = 75:600 = 1:8

Thus the correct answer is (iii).

(f) 4, x , 18, 36

$4:x = 18:36$

$\frac{4}{x} = \frac{18}{36}$

$18x = 4 \times 36$

$= x = \frac{4\times36}{18} = 4 \times 2 = 8$

The correct answer is (iv).

REVISION

1. The average annual humidity of Delhi is about 55 °C and the average annual humidity of Mumbai is about 75 °C.

55°C = 75°C

$\frac{55}{75} = \frac{11}{15} = 11:15$

2.

(a) $5:4 = \frac{5}{4}$ and $\frac{30}{24} = \frac{30\div6}{24\div6} = \frac{5}{4}$

Thus the given ratios are in proportion.

(b) 1.5 : 1.2 and 75 : 50

$\frac{1.5}{1.2} = \frac{15\div3}{12\div3} = \frac{5}{4}$

$\frac{75}{50} = \frac{75\div25}{50\div25} = \frac{3}{2}$

Thus the given ratios are not in proportion.

(c) 24:14 and 11:13

$\frac{24}{14} \div \frac{2}{2} = \frac{12}{7}$

$\frac{11}{13}$

Thus the given ratios are not in proportion.

3.

(a) 12 m to 75 m = $\frac{12}{75} \div \frac{3}{3} = \frac{4}{25} = 4:25$

(b) 3 days to 48 hours = (3 × 24) hours:48hours = 72:48 = $\frac{72}{48} = \frac{3}{2} = 3:2$

(c) ₹56 to 112 paise = (56 × 100) p:112 p = 5600:112 = $\frac{5600}{112} = \frac{50}{1} = 50:1$

(d) 10 L to 2200 mL = (10 × 1000) mL:2200 mL = 10000:2200 = $\frac{10000}{2200} = \frac{50}{11} = 50:11$

4.

(a) 1050:1500 = $\frac{1050}{1500} = \frac{105}{150} \div \frac{5}{5} = \frac{21}{30} \div \frac{3}{3} = \frac{7}{10}$ 7: 10

(b) 39:51 = $\frac{39}{51} \div \frac{3}{3} = \frac{13}{17} = 13:17.$

(c) 108:24 = $\frac{108}{24} \div \frac{4}{4} = \frac{27}{6} = 27:6 = 9:2$

(d) 153:39 = $\frac{153}{39} \div \frac{3}{3} = \frac{51}{13} = 51:13$

5. Answers may vary

(a) 12:7

We can find equivalent ratios by multiplying the terms of the given ratio by the same number.

So, $\frac{12}{7} \times \frac{2}{2} = \frac{24}{14} = 24:14$

(b) 54:14

We can find equivalent ratios by dividing the terms of the given ratio by the same number.

So, $\frac{54}{14} \div \frac{2}{2} = \frac{27}{7} = 27:7$

(c) 13:11

We can find equivalent ratios by multiplying the terms of the given ratio by the same number.

So, $\frac{13}{11} \times \frac{2}{2} = \frac{26}{22} = 26:22$

(d) 9:21

We can find equivalent ratios by dividing the terms of the given ratio by the same number.

So, $\frac{9}{21} \div \frac{3}{3} = \frac{3}{7} = 3:7$

6.

(a) 4, 36

Let the mean proportional be x.

$\therefore 4 : x :: x : 36$

$\Rightarrow \frac{4}{x} = \frac{x}{36}$

$\Rightarrow x^2 = 4 \times 36 = 144$

$\Rightarrow x = 12$

Thus the mean proportional between the given numbers is 12.

(b) 4, 9

Let the mean proportional be x.

$\therefore 4 : x :: x : 9$

$\Rightarrow \frac{4}{x} = \frac{x}{9}$

$\Rightarrow x^2 = 4 \times 9$

$\Rightarrow x^2 = 36$

$\Rightarrow x = 6$

Thus the mean proportional between the given numbers is 6.

(c) 2, 32

Let the mean proportional be x.

$\therefore 2 : x :: x : 32$

$\Rightarrow \frac{2}{x} = \frac{x}{32}$

$\Rightarrow x^2 = 2 \times 32 = 64$

$\Rightarrow x = 8$

Thus the mean proportional between the given numbers is 8.

7.

(a) 4:28 :: x:77

As the given ratios are in proportion, $\frac{4}{28} = \frac{x}{77}$

$= 28x = 4 \times 77$

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

Thus the value of x is 11

(b) 7:x :: 1:3

As the given ratios are in proportion, $\frac{7}{x} = \frac{1}{3}$

$= x = 3 \times 7 = 21$

(c) $x : 14 :: 25 : 175$

As the given ratios are in proportion, $\frac{x}{14} = \frac{25}{175}$.

$\Rightarrow 175x = 14 \times 25$

$\Rightarrow x = \frac{14 \times 25}{175} = \frac{14}{7} = 2$

Thus the value of x is 2.

8. The amount of cash was distributed in the ratio = 3:7
Given, smaller share = ₹2100
Let the larger share be x
3:7 = 2100:x
$\frac{3}{7} = \frac{2100}{x}$
$= 3x = 7 \times 2100$
$= x = \frac{7 \times 2100}{3} = 7 \times 700 = 4900$
Total Amount of cash distributed = small share + large share
$= 2100 + 4900 = ₹7000$

9.

Let Sahil' age be $5x$ and Amit' age be $4x$.
After 4 years, Sahil's age = $5x + 4$
After 4 years, Amit' age = $4x + 4$
The ratio of their ages after 4 years will be 6:5.

$$\Rightarrow \frac{5x+4}{4x+4} = \frac{6}{5}$$

$\Rightarrow 6(4x + 4) = 5(5x + 4)$
$\Rightarrow 24x + 24 = 25x + 20$
$\Rightarrow 24x - 25x = 20 - 24$
$\Rightarrow x = 4$
$\therefore$ Sahil' age = $5 \times 4 = 20$ years
Amit' age = $4 \times 4 = 16$ years

10.

. Let the ages of Swati & Pawan be is $7x$ years and $9x$ years respectively.
As the age of Swati 21 years, $7x = 21$.

$$\Rightarrow x = \frac{21}{7} = 3$$

$\therefore$ Pawan's age = $9x = 9 \times 3 = 27$ years
Hence Pawan is 27 years old.

11. Two numbers are in the ratio 6:10
Let the number be x
First number = $6x$; Second number = $10x$
Given, sum of the numbers is 272
Then, $6x + 10x = 272$
$16x = 272$
$= x = \frac{272}{16} = 17$
First number = $6 \times 17 = 102$
Second number = $10 \times 17 = 170$

12. Perimeter of a quadrilateral = sum of all sides
Let the sides be $3x$, $6x$, $5x$ and $4x$
Given, perimeter of the quadrilateral is 324 m
$3x + 6x + 5x + 4x = 324$
$18x = 324$
$= x = \frac{324}{18} = 18$
Putting the value of x in sides
Then sides are = (3 × 18), (6 × 18), (5 × 18), (4 × 18) = 54 m, 108 m, 90 m, 72 m.

13. Let the smallest number which when subtracted from the numbers 14, 17, 34, and 42 brings them in proportion be x
$\frac{14 - x}{17 - x} = \frac{34 - x}{42 - x}$
$(14 - x)(42 - x) = (17 - x)(34 - x)$
$588 - 14x - 42x + x^2 = 578 - 34x - 17x + x^2$
$588 - 56x = 578 - 51x$
$5x = 10$
$x = 2$

14. The monthly expenses of company A having 80 employees is Rs.9,00,000
If employees increases by 15, then employees will be = 80 + 15 = 95
Let the increased monthly expense be x
$80:95 = 900000:x$
$80x = 900000 \times 95$
$x = \frac{900000 \times 95}{80} = ₹10,68,750$

15. A DNA model was built using the scale 4 cm:0.0000001 mm
If the model of the chain is = 16cm
Let the length be x
$4:16 = 0.0000001:x$
$4x = 16 \times 0.0000001$
$= x = \frac{16 \times 0.0000001}{4} = 0.0000004\ mm$

16. A model height = 2 inch: 3 feet
If model is 12 feet, let its height be x
$2:x = 3:12$
$3x = 2 \times 12$
$x = 2 \times 4 = 8$ inch.

17.

(a) Ratio of Ma to Pa = $352:396 = \frac{352}{396} = \frac{8}{9} = 8:9$

(b) Ratio of Pa to Ga = $396:330 = \frac{396}{330} = \frac{6}{5} = 6:5$

(c) Ratio of Sa (first note) to Ni = 264:495 = $\frac{264}{495} = \frac{8}{15} = 8:15$

Ratio of Sa (last note) to Ni = 528:495 = $\frac{528}{495} = \frac{16}{15} = 16:15$

(d) Ratio of Dha to Ni = 440:495 = $\frac{440}{495} = \frac{8}{9} = 8:9$

(e) Ratio of Re to Pa = 297:396 = $\frac{297}{396} = \frac{3}{4} = 3:4$

18. There are 18 boys and 12 girls in your gym class.
If 6 boys joined the class, then total boys = 18 + 6 = 24 boys
Let the increased girls be x
18:12 = 24:12 + x

$$\frac{18}{12} = \frac{24}{12+x}$$

$18(12 + x) = 12 \times 24$
$216 + 18x = 288$
$18x = 288 - 216$
$18x = 72$
$= x = \frac{72}{18} = 4$
4 girls needs to be join for the ratio to remain the same.

19. Recycling 2,000 kg of paper saves about 16 trees
If it recycle 5,000 kg of paper
Let the trees saved be x
2000:16 = 5000:x
$2000x = 16 \times 5000$
$= x = \frac{16 \times 5000}{2000} = 40\ trees$

20. the ratio of type A donors to type B donors was 44:36
Let the donors be $44x$ and $36x$
Given, $44x + 36x = 200$
$80x = 200$
$= x = \frac{200}{80} = 2.5$
Putting the value of x in A donor = $44 \times 2.5 = 110$ donors.

21.

(a) 13000:6500 = $\frac{13000}{6500} = \frac{130}{65} = 2:1$

(b) 3100:2970 = $\frac{3100}{2970} = \frac{310}{297} = 310:297$

(c) Enlarged species = 6500 + 3100 = 9600
Vulnerable species = 2970 + 13000 = 15970
9600:15970 = $\frac{9600}{15970} = \frac{960}{1597} = 960:1597$

22. ANGLE
(a) 3:2
(b) 2:3
PERCENTAGE
(a) 6:2 = 3:1
(b) 2:6 = 1:3

VARIABLE
(a) 4:3
(b) 3:4
PERIMETER
(a) 4:2 = 2:1
(b) 2:4 = 1:2
PROPORTION
(a) 4:2 = 2:1
(b) 2:4 = 1:2
(c) 2:5