

Class 8 Maths Ganita Prakash Chapter 7 Proportional Reasoning-1 NCERT Solutions

Textbook Page 165

Figure it Out

1. Circle the following statements of proportion that are true.

(i) $4 : 7 :: 12 : 21$

(ii) $8 : 3 :: 24 : 6$

(iii) $7 : 12 :: 12 : 7$

(iv) $21 : 6 :: 35 : 10$

(v) $12 : 18 :: 28 : 12$

(vi) $24 : 8 :: 9 : 3$

Solution:

(i) $4 : 7 :: 12 : 21$

$$4 : 7 = \frac{4}{7}$$

$12 : 21 \rightarrow$ H.C.F of 12 and 21 is 3

$$\therefore 12 : 21 = \frac{12}{21} = \frac{12 \div 3}{21 \div 3} = \frac{4}{7}$$

Since the ratios are equal, the proportion is true.

(ii) $8 : 3 :: 24 : 6$

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

H.C.F of 24 and 6 is 6

$$\therefore 24 : 6 = \frac{24}{6} = \frac{24 \div 6}{6 \div 6} = \frac{4}{1}$$

Since the ratios are not equal, the proportion is false.

(iii) $7 : 12 :: 12 : 7$

$$7 : 12 = \frac{7}{12}$$

$$12 : 7 = \frac{12}{7}$$

Since the ratios are not equal, the proportion is false.

(iv) $21 : 6 :: 35 : 10$

H.C.F of 21 and 6 is 3

$$\therefore 21 : 6 = \frac{21}{6} = \frac{21 \div 3}{6 \div 3} = \frac{7}{2}$$

H.C.F of 35 and 10 is 5

$$\therefore 35 : 10 = \frac{35}{10} = \frac{35 \div 5}{10 \div 5} = \frac{7}{2}$$

Since the ratios are equal, the proportion is true.

(v) $12 : 18 :: 28 : 12$

H.C.F of 12 and 18 is 6

$$\therefore 12 : 18 = \frac{12}{18} = \frac{12 \div 6}{18 \div 6} = \frac{2}{3}$$

H.C.F of 28 and 12 is 4

$$\therefore 28 : 12 = \frac{28}{12} = \frac{28 \div 4}{12 \div 4} = \frac{7}{3}$$

Since the ratios are not equal, the proportion is false.

(vi) $24 : 8 :: 9 : 3$

H.C.F of 24 : 8 is 8

$$\therefore 24 : 8 = \frac{24}{8} = \frac{24 \div 8}{8 \div 8} = \frac{3}{1}$$

H.C.F of 9 : 3 is 3

$$9 : 3 = \frac{9}{3} = \frac{9 \div 3}{3 \div 3} = \frac{3}{1}$$

Since the ratios are equal, the proportion is true.

2. Give 3 ratios that are proportional to 4 : 9.

Solution:

The given ratio is 4 : 9.

$$(i) \frac{4}{9} = \frac{4 \times 2}{9 \times 2} = \frac{8}{18}$$

$$(ii) \frac{4}{9} = \frac{4 \times 3}{9 \times 3} = \frac{12}{27}$$

$$(iii) \frac{4}{9} = \frac{4 \times 4}{9 \times 4} = \frac{16}{36}$$

Therefore, ratios proportional to 4 : 9 are 8 : 18, 12 : 27, and 16 : 36.

3. Fill in the missing numbers for these ratios that are proportional to 18 : 24.

3 : _____,

12 : _____,

20 : _____,

27 : _____

Solution:

(i) 3 : _____

Let $3 : a :: 18 : 24$

$$\therefore \frac{3}{a} = \frac{18}{24} \quad \text{or} \quad \frac{3}{a} = \frac{3}{4} \quad \text{or} \quad a \times 3 = 3 \times 4 \quad \text{or} \quad a = \frac{3 \times 4}{3} \quad \text{or} \quad a = 4.$$

Therefore, the missing number in the ratio $3 : \underline{\hspace{1cm}}$ is 4.

(ii) 12 : _____

Let $12 : a :: 18 : 24$

$$\therefore \frac{12}{a} = \frac{18}{24} \quad \text{or} \quad \frac{12}{a} = \frac{3}{4} \quad \text{or} \quad a \times 3 = 12 \times 4 \quad \text{or} \quad a = \frac{12 \times 4}{3} \quad \text{or} \quad a = 16.$$

Therefore, the missing number in the ratio $12 : \underline{\hspace{1cm}}$ is 16.

(iii) 20 : _____

Let $20 : a :: 18 : 24$

$$\therefore \frac{20}{a} = \frac{18}{24} \quad \text{or} \quad \frac{20}{a} = \frac{3}{4} \quad \text{or} \quad a \times 3 = 20 \times 4 \quad \text{or} \quad a = \frac{20 \times 4}{3} \quad \text{or} \quad a = \frac{80}{3}.$$

Therefore, the missing number in the ratio $20 : \underline{\hspace{1cm}}$ is $\frac{80}{3}$.

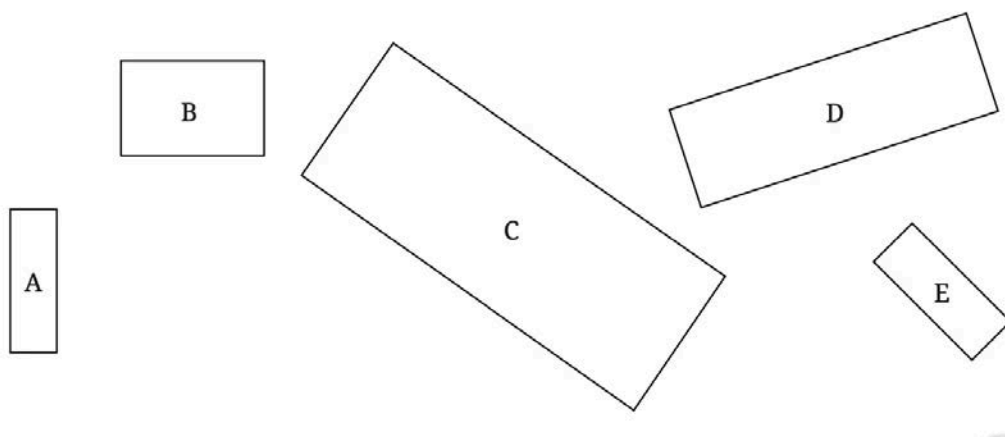
(iv) 27 : _____

Let $27 : a :: 18 : 24$

$$\therefore \frac{27}{a} = \frac{18}{24} \quad \text{or} \quad \frac{27}{a} = \frac{3}{4} \quad \text{or} \quad a \times 3 = 27 \times 4 \quad \text{or} \quad a = \frac{27 \times 4}{3} \quad \text{or} \quad a = 36.$$

Therefore, the missing number in the ratio $27 : \underline{\hspace{1cm}}$ is 36.

4. Look at the following rectangles. Which rectangles are similar to each other? You can verify this by measuring the width and height using a scale and comparing their ratios.

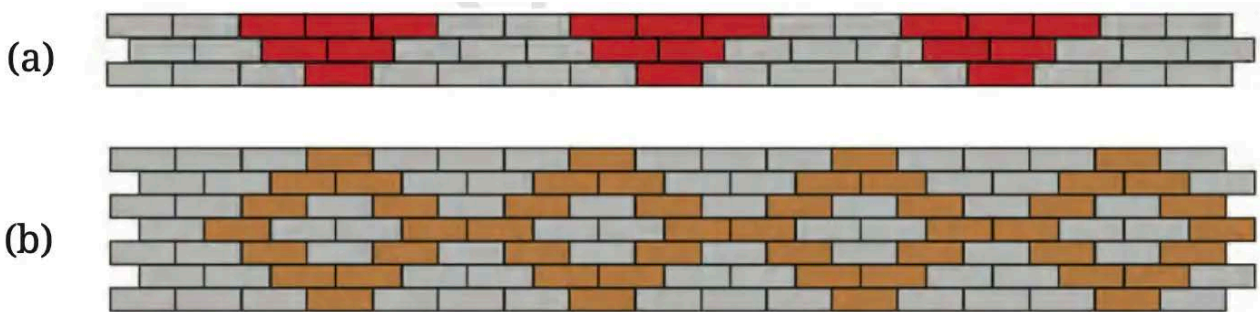


Solution:

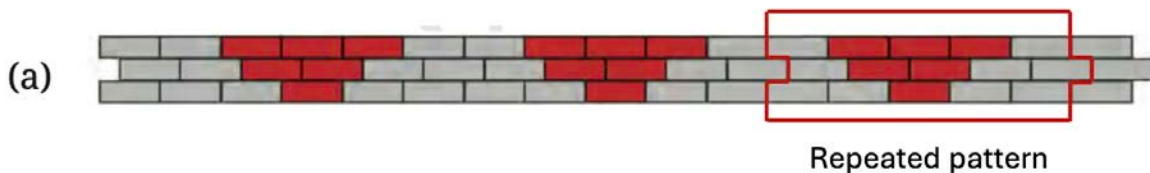
Rectangle	Width	Height	Ratio
A	5 mm	15 mm	$\frac{5}{15} = \frac{1}{3}$
B	15 mm	10 mm	$\frac{15}{10} = \frac{3}{2}$
C	45 mm	20 mm	$\frac{45}{20} = \frac{9}{4}$
D	35 mm	10 mm	$\frac{35}{10} = \frac{7}{2}$
E	5 mm	15 mm	$\frac{5}{15} = \frac{1}{3}$

Since rectangles A and E have the same simplified ratio 1 : 3. So, they are similar to each other.

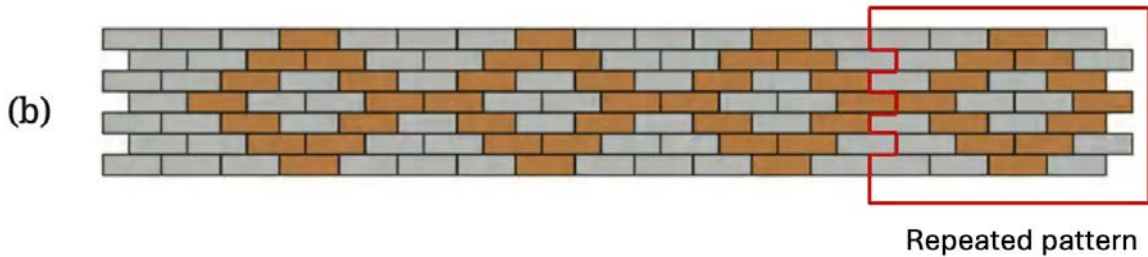
6. The following figure shows a small portion of a long brick wall with patterns made using coloured bricks. Each wall continues this pattern throughout the wall. What is the ratio of grey bricks to coloured bricks? Try to give the ratios in their simplest form.



Solution:

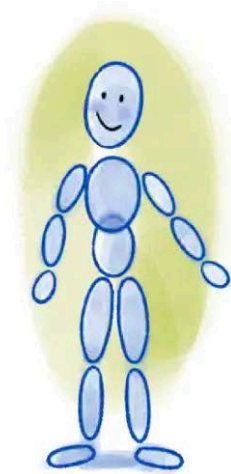


(a) Number of grey bricks in the pattern = 9
 Number of red bricks in the pattern = 6
 Ratio of grey to the red bricks = 9 : 6 = 3 : 2



(b) Number of grey bricks in the pattern = 16
 Number of red bricks in the pattern = 12
 Ratio of grey to the red bricks = $16 : 12 = 4 : 3$.

7. Let us draw some human figures. Measure your friend's body—the lengths of their head, torso, arms, and legs. Write the ratios as mentioned below—



head : torso

_____ : _____

torso : arms

_____ : _____

torso : legs

_____ : _____



Solution:

My friend's body measurements:

- (i) Head = 22 cm
 - (ii) Torso (neck to hip) = 50 cm
 - (iii) Arms (shoulder to fingertip) = 60 cm
 - (iv) Legs (hip to foot) = 80 cm
1. Head : Torso = $22 : 50 = 11 : 25$.

2. Torso : Arms = $50 : 60 = 5 : 6$.

3. Torso : Legs = $50 : 80 = 5 : 8$.

Textbook Page 170

1. The Earth travels approximately 940 million kilometres around the Sun in a year. How many kilometres will it travel in a week?

Solution:

Let the distance traveled by the Earth in a week be 'y' km.

The ratio of the distance traveled by the Earth should be proportional to the time taken.

So,

$$940 \text{ million} : 365 :: y : 7$$

or $940 \times 10,00,000 : 365 :: y : 7$

$$\frac{940 \times 10,00,000}{365} = \frac{y}{7}$$

By cross multiplication,

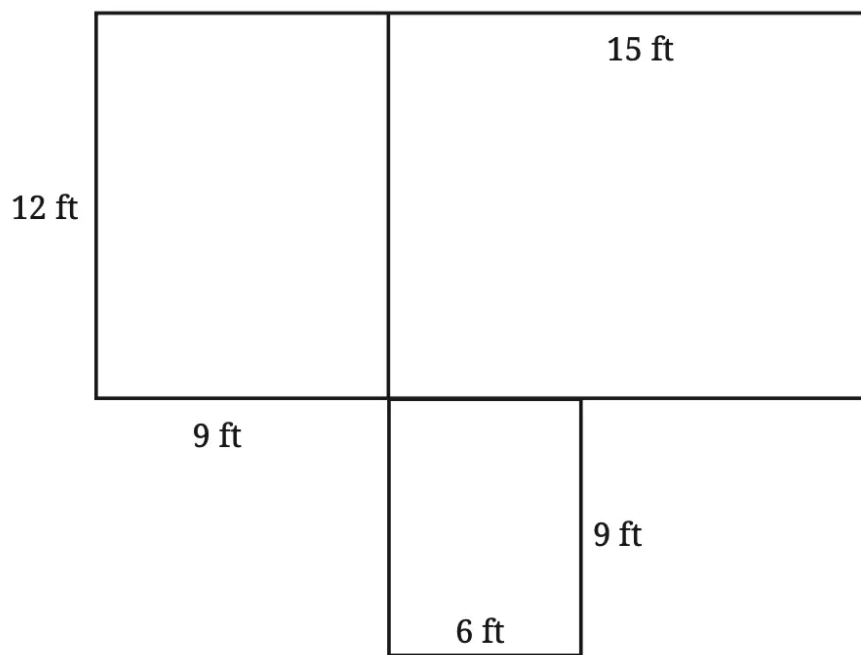
$$y \times 365 = 940 \times 10,00,000 \times 7$$

$$y = \frac{940 \times 10,00,000 \times 7}{365}$$

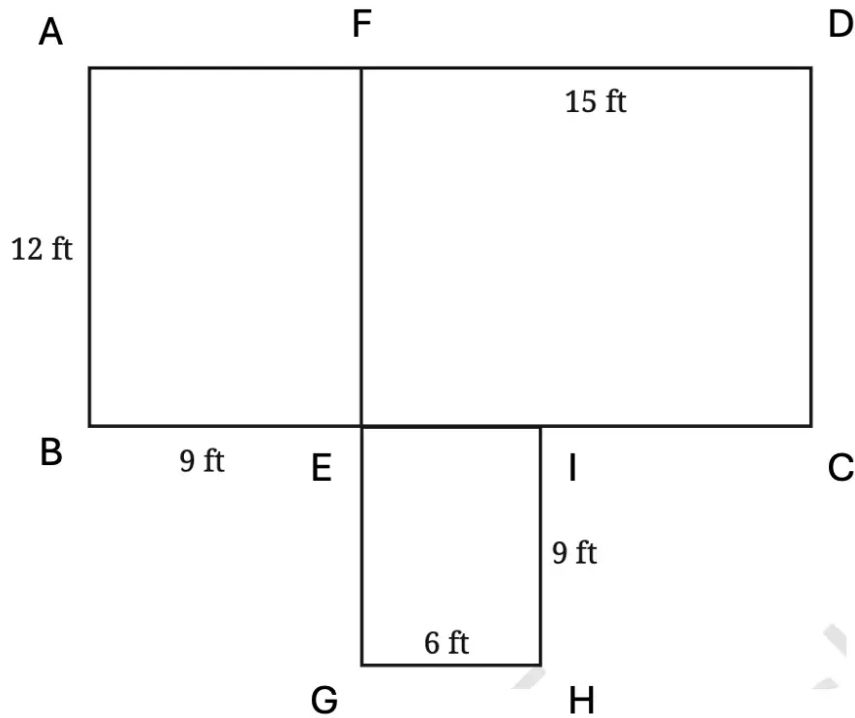
$$y = 18,04,00,000 \text{ km (approx.)}$$

or $y = 18$ million km.

2. A mason is building a house in the shape shown in the diagram. He needs to construct both the outer walls and the inner wall that separates two rooms. To build a wall of 10-feet, he requires approximately 1450 bricks. How many bricks would he need to build the house? Assume all walls are of the same height and thickness.



Solution:



$$\begin{aligned} \text{Total wall length} &= AB + BE + EC + CD + DF + AF + EG + GH + HI + EF \\ &= 12 + 9 + 15 + 12 + 15 + 9 + 9 + 6 + 9 + 6 + 12 \\ &= 108 \text{ ft.} \end{aligned}$$

Let the bricks needed to built the house be y .

The ratio of length of the wall should be proportional to the number of the bricks.

So,

$$10 : 1450 :: 108 : y$$

$$\frac{10}{1450} = \frac{108}{y}$$

By cross multiplication,

$$10 \times y = 1450 \times 108$$

$$y = \frac{1450 \times 108}{10}$$

$$y = 145 \times 108$$

$$y = 15,660 \text{ bricks.}$$

Textbook Page 175

1. Divide ₹4,500 into two parts in the ratio 2 : 3.

Solution:

$$\text{Ration} = 2 : 3$$

$$\text{Money to be divided} = ₹4500$$

$$\text{First part} = \frac{2}{2+3} \times 4500$$

$$= \frac{2}{5} \times 4500$$

$$= 2 \times 900 = ₹1800. \text{ Second part} = \frac{3}{2+3} \times 4500$$

$$= \frac{3}{5} \times 4500$$

$$= 3 \times 900 = ₹2700.$$

Therefore, the two parts are ₹1800 and ₹2700.

2. In a science lab, acid and water are mixed in the ratio of 1 : 5 to make a solution. In a bottle that has 240 mL of the solution, how much acid and water does the solution contain?

Solution:

Ratio of acid and water = 1 : 5

Solution = 240 mL.

$$\text{Acid in solution} = \frac{1}{1+5} \times 240$$

$$= \frac{1}{6} \times 240$$

$$= 40 \text{ mL. Water in solution} = \frac{5}{1+5} \times 240$$

$$= \frac{5}{6} \times 240$$

$$= 5 \times 40 = 200 \text{ mL.}$$

Therefore, the solution contains 40 mL of acid and 200 mL of water.

3. Blue and yellow paints are mixed in the ratio of 3 : 5 to produce green paint. To produce 40 mL of green paint, how much of these two colours are needed? To make the paint a lighter shade of green, I added 20 mL of yellow to the mixture. What is the new ratio of blue and yellow in the paint?

Solution:

(i) Ratio of blue : yellow = 3 : 5

Quantity of green paint = 40 mL.

$$\text{Amount of blue} = \frac{3}{3+5} \times 40$$

$$= \frac{3}{8} \times 40$$

$$= 3 \times 5 = 15 \text{ mL.}$$

$$\text{Amount of yellow} = \frac{5}{3+5} \times 40$$

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

$$= 5 \times 5 = 25 \text{ mL.}$$

So, to make 40 mL of green paint, we need 15 mL blue and 25 mL yellow. **(ii) Quantity of yellow added to the mixture = 20 mL.**

Blue in the new mixture = 15 mL.

Yellow in the new mixture = 25 + 20 = 45 mL.

New ratio of blue : yellow = 15 : 45 = 1 : 3.

4. To make soft idlis, you need to mix rice and urad dal in the ratio of 2 : 1. If you need 6 cups of this mixture to make idlis tomorrow morning, how many cups of rice and urad dal will you need?

Solution:

Ratio of rice : urad dal = 2 : 1

Quantity of mixture = 6 cups.

$$\text{Rice in the mixture} = \frac{2}{1+2} \times 6$$

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

$$= 2 \times 2 = 4 \text{ cups.}$$

$$\text{Urad dal in the mixture} = \frac{1}{1+2} \times 6$$

$$= \frac{1}{3} \times 6 = 2 \text{ cups.}$$

Therefore, 4 cups of rice and 2 cups of urad dal will be needed.

5. I have one bucket of orange paint that I made by mixing red and yellow paints in the ratio of 3 : 5. I added another bucket of yellow paint to this mixture. What is the ratio of red paint to yellow paint in the new mixture?

Solution:

Let the paint in one bucket be 'y' L.

Ratio of red : yellow = 3 : 5

$$\text{Quantity of red paint} = \frac{3}{3+5} \times y = \frac{3}{8}y$$

$$\text{Quantity of yellow paint} = \frac{5}{3+5} \times y = \frac{5}{8}y$$

On adding one bucket of yellow paint,

$$\text{Quantity of red paint in the new mixture} = \frac{3}{8}y$$

$$\text{Quantity of yellow paint in the new mixture} = \frac{5}{8}y + y = \frac{13}{8}y$$

$$\text{Ratio of red paint to yellow paint in the new mixture} = \frac{3}{8}y : \frac{13}{8}y = 3 : 13.$$

Textbook Page 176

1. Anagh mixes 600 mL of orange juice with 900 mL of apple juice to make a fruit drink. Write the ratio of orange juice to apple juice in its simplest form.

Solution:

Orange juice = 600 mL.

Apple juice = 900 mL.

Ratio of orange juice to apple juice = 600 : 900

$$= 2 : 3.$$

Therefore, ratio in its simplest form = 2 : 3.

2. Last year, we hired 3 buses for the school trip. We had a total of 162 students and teachers who went on that trip and all the buses were full. This year we have 204 students. How many buses will we need? Will all the buses be full?

Solution:

Last year,

3 buses could carry 162 students.

Capacity of one bus = $\frac{162}{3} = 54$ This year, there are 204 students.

$$\text{Number of buses needed} = \frac{204}{54} = 3.77$$

So, 4 buses are needed.

$$\text{Capacity of 4 buses} = 4 \times 54 = 216$$

$$\text{Number of empty seats} = 216 - 204 = 12$$

Therefore, we need 4 buses and there will be 12 empty seats.

3. The area of Delhi is 1,484 sq. km and the area of Mumbai is 550 sq. km. The population of Delhi is approximately 30 million and that of Mumbai is 20 million people. Which city is more crowded? Why do you say so?

Solution:

Population density for Delhi = $\frac{30\text{million}}{1484} = \frac{30 \times 10,00,000}{1484} = 20,000$ people per sq. km
Population density for Mumbai = $\frac{20\text{million}}{550} = \frac{20 \times 10,00,000}{550} = 36,000$ people per sq. km
Therefore, Mumbai is more crowded because its population density is higher than that of Delhi.

4. A crane of height 155 cm has its neck and the rest of its body in the ratio 4 : 6. For your height, if your neck and the rest of the body also had this ratio, how tall would your neck be?

**Solution:**

Height of the crane = 155 cm

Ratio of neck : rest of body = 4 : 6 My height = 165 cm

For my height, the length of neck = $\frac{4}{4+6} \times 165$
 $= \frac{4}{10} \times 165 = 66$ cm.

5. Let us try an ancient problem from Lilavati. At that time weights were measured in a unit named palas and niskas was a unit of money. “If $2\frac{1}{2}$ palas of saffron costs $\frac{3}{7}$ niskas, O expert

businessman! tell me quickly what quantity of saffron can be bought for 9 niskas?"

Solution:

Cost of $2\frac{1}{2}$ palas of saffron = $\frac{3}{7}$ niskas.

Let 'y' palas cost 9 niskas.

The ratio of quantity of saffron to its cost needs to be proportional.

So,

$$2\frac{1}{2} : \frac{3}{7} :: y : 9$$

$$\Rightarrow \frac{5}{2} : \frac{3}{7} :: y : 9$$

$$\Rightarrow \frac{3}{7} \times y = \frac{5}{2} \times 9$$

$$\Rightarrow y = \frac{5}{2} \times 9 \times \frac{7}{3}$$

$$\Rightarrow y = \frac{105}{2}$$

$$\text{or } y = 52\frac{1}{2}.$$

Therefore, $52\frac{1}{2}$ palas of saffron can be brought for 9 niskas.

6. Harmain is a 1-year-old girl. Her elder brother is 5 years old. What will be Harmain's age when the ratio of her age to her brother's age is 1 : 2?

Solution:

Harmain's present age = 1 year

Brother's present age = 5 years

Let after x years, the ratio of their ages becomes 1 : 2.

Then,

Harmain's age after x years = (1 + x) years

Brother's age after x years = (5 + x) years

Ratio of their ages after x years = (1 + x) : (5 + x)

Since the ratios are proportional:

$$\Rightarrow (1 + x) : (5 + x) :: 1 : 2$$

$$\Rightarrow \frac{1+x}{5+x} = \frac{1}{2}$$

$$\Rightarrow 2(1 + x) = 5 + x$$

$$\Rightarrow 2 + 2x = 5 + x$$

$$\Rightarrow 2x - x = 5 - 2$$

$$\Rightarrow x = 3.$$

Therefore, after 3 years Harmain's age = 1 + x = 1 + 3 = 4 years.

7. The mass of equal volumes of gold and water are in the ratio 37 : 2. If 1 litre of water is 1 kg in mass, what is the mass of 1 litre of gold?

Solution:

The ratio of the mass of gold and water of equal volumes = 37 : 2.

Mass of 1 litre of water = 1 Kg

Let the mass of 1 litre of gold be 'x' kg.

Ratio of masses of gold to water = x : 1

Since, the ratios are in proportion:

$$\Rightarrow 37 : 2 :: x : 1$$

$$\Rightarrow \frac{37}{2} = \frac{x}{1}$$

$$\Rightarrow 2x = 37$$

$$\Rightarrow x = \frac{37}{2} \text{ kg.}$$

Therefore, the mass of 1 litre of gold is $\frac{37}{2}$ kg.

8. It is good farming practice to apply 10 tonnes of cow manure for 1 acre of land. A farmer is planning to grow tomatoes in a plot of size 200 ft by 500 ft. How much manure should he buy? (Please refer to the section on Unit Conversions earlier in this chapter).

Solution:

$$10 \text{ tonne} = 10 \times 1000 = 10,000 \text{ kg}$$

$$1 \text{ acre} = 43,560 \text{ sq. ft.}$$

$$\text{Ratio of cow manure to the land} = 10,000 : 43,560$$

Let the manure needed for plot be 'y' tonnes.

$$\text{Area of plot} = 200 \times 500 = 1,00,000 \text{ sq. ft}$$

$$\text{Ratio of cow manure to the plot area} = y : 1,00,000.$$

Since, the ratios are proportional:

$$\Rightarrow 10,000 : 43,560 :: y : 1,00,000$$

$$\Rightarrow \frac{10,000}{43,560} = \frac{y}{1,00,000}$$

$$\Rightarrow y \times 43,560 = 10,000 \times 1,00,000$$

$$\Rightarrow y = \frac{10,000 \times 1,00,000}{43,560}$$

$$\Rightarrow y = 22956.84 \text{ kg.}$$

Therefore, cow manure needed = 22956.84 kg = $\frac{22956.84}{1000}$ = 22.9 tonnes = 23 tonnes.

9. A tap takes 15 seconds to fill a mug of water. The volume of the mug is 500 mL. How much time does the same tap take to fill a bucket of water if the bucket has a 10-litre capacity?

Solution:

$$\text{Mug volume} = 500 \text{ mL}$$

$$\text{Bucket volume} = 10 \text{ L} = 10 \times 1000 = 10,000 \text{ mL.}$$

Let time taken to fill the bucket be 'y' seconds.

Since volume is proportional to time:

$$\Rightarrow 500 : 15 :: 10,000 : y$$

$$\Rightarrow \frac{500}{15} = \frac{10,000}{y}$$

$$\Rightarrow 500y = 10,000 \times 15$$

$$\Rightarrow y = \frac{10,000 \times 15}{500} = 300 \text{ seconds.}$$

$$300 \div 60 = 5 \text{ minutes.}$$

Therefore, time taken to the bucket = 300 sec = 5 minutes.

10: One acre of land costs ₹15,00,000. What is the cost of 2,400 square feet of the same land?

Solution:

$$1 \text{ acre} = 43,560 \text{ square feet.}$$

$$\text{Cost of 1 acre} = ₹15,00,000$$

Let the cost of 2400 sq. ft land be ₹x.

The ratio of the area of land to the cost needs to be proportional.

$$\Rightarrow 43,560 : 15,00,000 :: 2400 : x$$

$$\Rightarrow \frac{43,560}{15,00,000} = \frac{2400}{x}$$

$$\Rightarrow 43,560x = 2400 \times 15,00,000$$

$$\Rightarrow x = \frac{2400 \times 15,00,000}{43,560}$$

$$\Rightarrow x = 82,644.63.$$

Therefore, the cost of 2,400 sq. ft. of the land is ₹82,644.63.

11. A tractor can plough the same area of a field 4 times faster than a pair of oxen. A farmer wants to plough his 20-acre field. A pair of oxen takes 6 hours to plough an acre of land. How much time would it take if the farmer used a pair of oxen to plough the field? How much time would it take him if he decides to use a tractor instead?

Solution:

Time taken by a pair of oxen to plough 1 acre of land = 6 hours

Time taken by a pair of oxen to plough 20-acre field = $20 \times 6 = 120$ hours

A tractor is 4 times faster than a pair of oxen.

Let tractor time = y hours.

The ratio of land ploughed needs to be proportional to the time.

$$\Rightarrow 4 : 1 :: 120 : y$$

$$\Rightarrow \frac{4}{1} = \frac{120}{y}$$

$$\Rightarrow 4y = 120$$

$$\Rightarrow y = \frac{120}{4} = 30.$$

Therefore, the tractor will take 30 hours to plough the 20-acre field.

12. The ₹10 coin is an alloy of copper and nickel called 'cupro-nickel'. Copper and nickel are mixed in a 3 : 1 ratio to get this alloy. The mass of the coin is 7.74 grams. If the cost of copper is ₹906 per kg and the cost of nickel is ₹1,341 per kg, what is the cost of these metals in a ₹10 coin?

Solution:

Ratio of copper and nickel in coin = 3 : 1

Total mass of one coin = 7.74 g

$$\text{Mass of copper in coin} = \frac{3}{1+3} \times 7.74$$

$$= \frac{3}{4} \times 7.74 = 5.805 \text{ g}$$

$$\text{Mass of nickel in coin} = \frac{1}{1+3} \times 7.74$$

$$= \frac{1}{4} \times 7.74 = 1.935 \text{ g} \quad \text{Cost of 1 kg copper} = ₹906$$

$$\text{Cost of 1 g copper} = ₹\frac{906}{1000}$$

$$\text{Cost of copper in the coin} = \frac{906}{1000} \times 5.805 = ₹5.26 \quad \text{Cost of 1 kg nickel} = ₹1,341$$

$$\text{Cost of 1 g nickel} = ₹\frac{1341}{1000}$$

$$\text{Cost of nickel in the coin} = \frac{1341}{1000} \times 1.935 = ₹2.59$$

Therefore, the cost of copper and nickel in a ₹10 coin are ₹5.26 and ₹2.59.