Exercise 13.1

Question 1:

Following are the car parking charges near a railway station up to:

4 hours	₹60
8 hours	₹100
12 hours	₹140
24 hours	₹180

Check if the parking charges are in direct proportion to the parking time.

Answer 1:

Charges per hour:

$$C_1 = \frac{60}{4} = ₹15$$

$$C_2 = \frac{100}{8} = ₹12.50$$

$$C_3 = \frac{140}{12} = ₹11.67$$

$$C_4 = \frac{180}{24} = ₹7.50$$

Here, the charges per hour are not same, i.e., $C_1 \neq C_2 \neq C_3 \neq C_4$

Therefore, the parking charges are not in direct proportion to the parking time.

Question 2:

A mixture of paint is prepared by mixing 1 part of red pigments with 8 parts of base. In the following table, find the parts of base that need to be added.

Parts of red pigment	**1**	**4**	**7**	**12**	**20**
Parts of base	8	----	----	----	----

Answer 2:

Let the ratio of parts of red pigment and parts of base be $\frac{a}{b}$.

Here $a_1 = 1, b_1 = 8 \quad \Rightarrow \quad \frac{a_1}{b_1} = \frac{1}{8} = k$ (say)

When $a_2 = 4, b_2 = ?$

$$k = \frac{a_2}{b_2} \quad \Rightarrow \quad b_2 = \frac{a_2}{k} = \frac{4}{\frac{1}{8}} = 4 \times 8 = 32$$

When $a_3 = 7, b_3 = ?$

$$k = \frac{a_3}{b_3} \quad \Rightarrow \quad b_3 = \frac{a_3}{k} = \frac{7}{\frac{1}{8}} = 7 \times 8 = 56$$

When $a_4 = 12, b_4 = ?$

$$k = \frac{a_4}{b_4} \quad \Rightarrow \quad b_4 = \frac{a_4}{k} = \frac{12}{\frac{1}{8}} = 12 \times 8 = 96$$

When $a_5 = 20, b_5 = ?$

$$k = \frac{a_5}{b_5} \quad \Rightarrow \quad b_5 = \frac{a_5}{k} = \frac{20}{\frac{1}{8}} = 20 \times 8 = 160$$

Parts of red pigment	**1**	**4**	**7**	**12**	**20**
Parts of base	8	32	56	96	160

Question 3:

In Question 2 above, if 1 part of a red pigment requires 75 mL of base, how much red pigment should we mix with 1800 mL of base?

Answer 3:

Let the parts of red pigment mix with 1800 mL base be x.

Parts of red pigment	**1**	x
Parts of base	75	1800

Since it is in direct proportion.

$$\therefore \quad \frac{1}{75} = \frac{x}{1800} \quad \Rightarrow 75 \times x = 1 \times 1800 \quad \Rightarrow x = \frac{1 \times 1800}{75} = 24 \text{ parts}$$

Hence, with base 1800 mL, 24 parts red pigment should be mixed.

Question 4:

A machine in a soft drink factory fills 840 bottles in six hours. How many bottles will it fill in five hours?

Answer 4:

Let the number of bottles filled in five hours be x.

Hours	**1**	x
Bottles	75	1800

Here ratio of hours and bottles are in direct proportion.

$$\therefore \quad \frac{6}{840} = \frac{5}{x} \quad \Rightarrow 6 \times x = 5 \times 840 \quad \Rightarrow x = \frac{5 \times 840}{6} = 700 \text{ bottles}$$

Hence, machine will fill 700 bottles in five hours.

Question 5:

A photograph of a bacteria enlarged 50,000 times attains a length of 5 cm as shown in the diagram. What is the *actual* length of the bacteria? If the photograph is enlarged 20,000 times only, what would be its enlarged length?

Answer 5:

Let enlarged length of bacteria be x.

Actual length of bacteria = $\frac{5}{50000} = \frac{1}{10000}$ cm = 10^{-4} cm

Length	**5**	x
Enlarged length	50,000	20,000

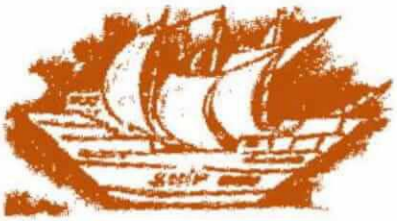
Here length and enlarged length of bacteria are in direct proportion.

$\therefore \quad \frac{5}{50000} = \frac{x}{20000} \quad \Rightarrow x \times 50000 = 5 \times 20000 \Rightarrow x = \frac{5 \times 20000}{50000} = 2 \text{ cm}$

Hence, the enlarged length of bacteria is 2 cm.

Question 6:

In a model of a ship, the mast is 9 cm high, while the mast of the actual ship is 12 m high. If the length if the ship is 28 m, how long is the model ship?



Answer 6:

Let the length of model ship be x.

Length of actual ship (in m)	**12**	**28**
Length of model ship (in cm)	9	x

Here length of mast and actual length of ship are in direct proportion.

$\therefore \quad \frac{12}{9} = \frac{28}{x} \quad \Rightarrow x \times 12 = 28 \times 9 \quad \Rightarrow x = \frac{28 \times 9}{12} = 21 \text{ cm}$

Hence, the length of the model ship is 21 cm.

Question 7:

Suppose 2 kg of sugar contains 9 x 10^6 crystals. How many sugar crystals are there in (i) 5 kg of sugar? (ii) 1.2 kg of sugar?

Answer 7:

(i) Let sugar crystals be x.

Weight of sugar (in kg)	**2**	**5**
No. of crystals	9×10^6	x

Here weight of sugar and number of crystals are in direct proportion.

$\therefore \quad \frac{2}{9 \times 10^6} = \frac{5}{x} \quad \Rightarrow x \times 2 = 5 \times 9 \times 10^6 \quad \Rightarrow x = \frac{5 \times 9 \times 10^6}{2} = 22.5 \times 10^6 = 2.25 \times 10^7$

Hence, the number of sugar crystals is 2.25×10^7.

(ii) Let sugar crystals be x.

Weight of sugar (in kg)	**2**	**1.2**
No. of crystals	9×10^6	x

Here weight of sugar and number of crystals are in direct proportion.

$\therefore \quad \frac{2}{9 \times 10^6} = \frac{1.2}{x} \quad \Rightarrow x \times 2 = 1.2 \times 9 \times 10^6 \Rightarrow x = \frac{1.2 \times 9 \times 10^6}{2} = 0.6 \times 9 \times 10^6 = 5.4 \times 10^6$

Hence, the number of sugar crystals is 5.4×10^6.

Question 8:

Rashmi has a road map with a scale of 1 cm representing 18 km. She drives on a road for 72 km. What would be her distance covered in the map?

Answer 8:

Let distance covered in the map be x.

Actual distance (in km)	**18**	**72**

Distance covered in map (in cm)	1	x

Here actual distance and distance covered in the map are in direct proportion.

$$\therefore \quad \frac{18}{1}=\frac{72}{x} \quad \Rightarrow x\times 18=72\times 1 \quad \Rightarrow x=\frac{72\times 1}{18}=4 \text{ cm}$$

Hence, the distance covered in the map is 4 cm.

Question 9:

A 5 m 60 cm high vertical pole casts a shadow 3 m 20 cm long. Find at the same time (i) the length of the shadow cast by another pole 10 m 50 cm high (ii) the height of a pole which casts a shadow 5 m long.

Answer 9:

Here height of the pole and length of the shadow are in direct proportion.

And 1 m = 100 cm

5 m 60 cm = 5 x 100 + 60 = 560 cm

3 m 20 cm = 3 x 100 + 20 = 320 cm

10 m 50 cm = 10 x 100 + 50 = 1050 cm

5 m = 5 x 100 = 500 cm

(i). Let the length of the shadow of another pole be x.

Height of pole (in cm)	**560**	**1050**
Length of shadow (in cm)	320	x

$$\therefore \quad \frac{560}{320}=\frac{1050}{x} \quad \Rightarrow x\times 560=1050\times 320 \Rightarrow x=\frac{1050\times 320}{560}=600 \text{ cm} = 6 \text{ m}$$

Hence, the length of the shadow of another pole is 6 m.

(ii). Let the height of the pole be x.

Height of pole (in cm)	**560**	x
Length of shadow (in cm)	320	500

$$\therefore \quad \frac{560}{320}=\frac{x}{500} \quad \Rightarrow x\times 320=560\times 500 \Rightarrow x=\frac{560\times 500}{320}=875 \text{ cm} = 8 \text{ m } 75 \text{ cm}$$

Hence, the height of the pole is 8 m 75 cm.

Question 10:

A loaded truck travels 14 km in 25 minutes. If the speed remains the same, how far can it travel in 5 hours?

Answer 10:

Let distance covered in 5 hours be x km.

$\because$ 1 hour = 60 minutes $\therefore$ 5 hours = 5 x 60 = 300 minutes

Distance (in km)	**14**	x
Time (in minutes)	25	300

Here distance covered and time in direct proportion.

$$\therefore \quad \frac{14}{25}=\frac{x}{300} \quad \Rightarrow x\times 25=14\times 300 \Rightarrow x=\frac{14\times 300}{25}=168 \text{ km}$$

Hence, the distance covered in 5 hours is 168 km.