CHAPTER 11

VIII CLASS-CBSE (2024-25)

DIRECT AND INVERSE PROPORTIONS (Notes)

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Direct proportion:

If x and y are any two quantities such that both of them increase or decrease together and $\frac{x}{y}$ is constant (say k), then we say that x and y are in direct proportion.

This is written as $x \propto y$ and read as x is directly proportional to y.

x and y are in direct proportion, if $\frac{x}{y} = k \Rightarrow x = ky$ where k is constant of proportion

If y_1 and y_2 are the values of y corresponding to the values of x_1 and x_2 of x respectively,

then $\frac{x_1}{y_1} = \frac{x_2}{y_2}$ (or) $\frac{x_1}{x_2} = \frac{y_1}{y_2}$

TRY THESE

1. **Observe the following tables and find if x and y are directly proportional.**

(i)

x	20	17	14	11	8	5	2
y	40	34	28	22	16	10	4

$\frac{x_1}{y_1} = \frac{20}{40} = \frac{1}{2}$; $\frac{x_2}{y_2} = \frac{17}{34} = \frac{1}{2}$; $\frac{x_3}{y_3} = \frac{14}{28} = \frac{1}{2}$; $\frac{x_4}{y_4} = \frac{11}{22} = \frac{1}{2}$; $\frac{x_5}{y_5} = \frac{8}{16} = \frac{1}{2}$;

$\frac{x_6}{y_6} = \frac{5}{10} = \frac{1}{2}$; $\frac{x_7}{y_7} = \frac{2}{4} = \frac{1}{2}$

$\therefore \frac{x}{y} = \frac{1}{2} = constant \Rightarrow x$ and y are directly proportional

(ii)

x	6	10	14	18	22	26	30
y	4	8	12	16	20	24	28

$\frac{x_1}{y_1} = \frac{6}{4} = \frac{3}{2}$; $\frac{x_2}{y_2} = \frac{10}{8} = \frac{5}{4}$; $\frac{x_3}{y_3} = \frac{14}{12} = \frac{7}{6}$; $\frac{x_4}{y_4} = \frac{18}{16} = \frac{9}{8}$;

$\frac{x_5}{y_5} = \frac{22}{20} = \frac{11}{10}$; $\frac{x_6}{y_6} = \frac{26}{24} = \frac{13}{12}$; $\frac{x_7}{y_7} = \frac{30}{28} = \frac{15}{14}$

$\therefore \frac{x}{y}$ *is not constant* $\Rightarrow$ *x and y are not in directly proportional*

(iii)

x	5	8	12	15	18	20

y	15	24	36	60	72	100

$\frac{x_1}{y_1} = \frac{5}{15} = \frac{1}{3}$; $\frac{x_2}{y_2} = \frac{8}{24} = \frac{1}{3}$; $\frac{x_3}{y_3} = \frac{12}{36} = \frac{1}{3}$;

$\frac{x_4}{y_4} = \frac{15}{60} = \frac{1}{4}$; $\frac{x_5}{y_5} = \frac{18}{72} = \frac{1}{4}$; $\frac{x_6}{y_6} = \frac{20}{10} = \frac{1}{5}$

$\therefore \frac{x}{y}$ *is not constant* $\Rightarrow$ *x and y are not in directly proportional*

2. **Principal = ₹ 1000, Rate = 8% per annum. Fill in the following table and find which type of interest (simple or compound) changes in direct proportion with time period.**

Sol: P=1000; R=8%

(i) T=1 y

$$S.I = \frac{P \times R \times T}{100} = \frac{1000 \times 8 \times 1}{100} = ₹80$$

$$C.I = P\left(1 + \frac{R}{100}\right)^T - P = 1000\left(1 + \frac{8}{100}\right)^1 - 1000$$

$$= 1000 \times \frac{108}{100} - 1000$$

$$= 1080 - 1000 = ₹80$$

(ii) T=2 y

$$S.I = \frac{P \times R \times T}{100} = \frac{1000 \times 8 \times 2}{100} = ₹160$$

$$C.I = P\left(1 + \frac{R}{100}\right)^T - P = 1000\left(1 + \frac{8}{100}\right)^2 - 1000$$

$$= 1000 \times \frac{108}{100} \times \frac{108}{100} - 1000$$

$$= 1166.40 - 1000 = ₹166.40$$

(iii) T=3 y

$$S.I = \frac{P \times R \times T}{100} = \frac{1000 \times 8 \times 3}{100} = ₹240$$

$$C.I = P\left(1 + \frac{R}{100}\right)^T - P = 1000\left(1 + \frac{8}{100}\right)^3 - 1000$$

$$= 1000 \times \frac{108}{100} \times \frac{108}{100} \times \frac{108}{100} - 1000$$

$$= 1259.70 - 1000 = ₹259.70$$

For 1year $\frac{S.I}{T} = \frac{80}{1} = 80$

For 2years $\frac{S.I}{T} = \frac{160}{2} = 80$

For 3year $\frac{S.I}{T} = \frac{240}{3} = 80$

$$\frac{S.I}{T} \text{ is constant}$$

Simple interest (S.I) and time period (T) are in direct proportion.

$$For\ 1year\ \frac{C.I}{T} = \frac{80}{1} = 80$$

$$For\ 2years\ \frac{C.I}{T} = \frac{166.40}{2} = 83.20$$

$$For\ 3year\ \frac{C.I}{T} = \frac{259.70}{3} = 80$$

C.I and time period (T) are not in direct proportion.

Example 1: **The cost of 5 metres of a particular quality of cloth is ₹ 210. Tabulate the cost of 2, 4, 10 and 13 metres of cloth of the same type.**

Solution: .

Length of cloth: x (m)	$5(x_1)$	$2(x_2)$	$4(x_3)$	$10(x_4)$	$13(x_5)$
Cost: y(₹)	$210(y_1)$	y_2	y_3	y_4	y_5

Length of cloth is directly proportional to cost of cloth.

$$(i)\frac{x_1}{y_1} = \frac{x_2}{y_2} \Rightarrow \frac{5}{210} = \frac{2}{y_2} \Rightarrow y_2 = \frac{2 \times 210}{5} = 2 \times 42 = 84$$

$$(i)i\frac{x_1}{y_1} = \frac{x_3}{y_3} \Rightarrow \frac{5}{210} = \frac{4}{y_3} \Rightarrow y_3 = \frac{4 \times 210}{5} = 4 \times 42 = 168$$

$$(iii)\frac{x_1}{y_1} = \frac{x_4}{y_4} \Rightarrow \frac{5}{210} = \frac{10}{y_4} \Rightarrow y_4 = \frac{10 \times 210}{5} = 10 \times 42 = 420$$

$$(vi)\frac{x_1}{y_1} = \frac{x_5}{y_5} \Rightarrow \frac{5}{210} = \frac{13}{y_5} \Rightarrow y_5 = \frac{13 \times 210}{5} = 13 \times 42 = 546$$

Example 2: **An electric pole, 14 metres high, casts a shadow of 10 metres. Find the height of a tree that casts a shadow of 15 metres under similar conditions.**

Sol:

height of the object (in metres)	$14(x_1)$	$x(x_2)$
length of the shadow (in metres)	$10(y_1)$	$15(y_1)$

Length of the shadow is directly proportional to height of the object

$$\frac{x_1}{y_1} = \frac{x_2}{y_2} \Rightarrow \frac{14}{10} = \frac{x}{15}$$

$$\Rightarrow x \times 10 = 14 \times 15$$

$$\Rightarrow x = \frac{14 \times 15}{10} = 21$$

Height of the tree is 21 metres.

Example 3: **If the weight of 12 sheets of thick paper is 40 grams, how many sheets of the same paper would weigh $2\frac{1}{2}$ kilograms?**

Sol:

Number of sheets	$12(x_1)$	$x(x_2)$
Weight of sheets (in grams)	$40(y_1)$	$2500(y_2)$

Number of sheets is directly proportional to Weight of sheets.

$$\frac{x_1}{y_1}=\frac{x_2}{y_2}\Rightarrow\frac{12}{40}=\frac{x}{2500}$$

$$\Rightarrow x\times 40=12\times 2500$$

$$\Rightarrow x=\frac{12\times 2500}{40}=750$$

Thus, the required number of sheets of paper = 750

Example 4: A train is moving at a uniform speed of 75 km/hour. (i) How far will it travel in 20 minutes? (ii) Find the time required to cover a distance of 250 km.

Sol:

Distance travelled (in km)	$75(x_1)$	$x(x_2)$	$250(x_3)$
Time taken (in minutes)	$60(y_1)$	$20(y_2)$	$y(y_5)$

The distance covered would be directly proportional to time. (Speed is uniform)

$$(i)\ \frac{75}{60}=\frac{x}{20}\Rightarrow x\times 60=75\times 20$$

$$\Rightarrow x=\frac{75\times 20}{60}=25$$

So, the train will cover a distance of 25 km in 20 minutes.

$$(ii)\ \frac{75}{60}=\frac{250}{y}\Rightarrow y\times 75=250\times 60$$

$$\Rightarrow y=\frac{250\times 60}{75}=200$$

The time required to cover a distance of 250 km is 200 minutes=3 hours 20 minutes.

Example 5: The scale of a map is given as 1:30000000. Two cities are 4 cm apart on the map. Find the actual distance between them.

Sol:

Distance on map (in cm)	1	4
Actual distance(in cm)	30000000	y

Distance on map is directly proportional to Actual distance.

$$\frac{1}{30000000}=\frac{4}{y}$$

$1\ km=100\ m$
$1\ km=100\times 100cm$

$$\Rightarrow y=12000000cm=\frac{12000000}{100\times 100}km=1200\ km$$

The actual distance between two cities=1200km

EXERCISE 11.1

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

parking time(x)(hours)	$4(x_1)$	$8(x_2)$	$12(x_3)$	$24(x_4)$
parking charges(y)	$60(y_1)$	$100(y_1)$	$140(y_1)$	$180(y_1)$

$$\frac{x_1}{y_1}=\frac{4}{60}=\frac{1}{15};\ \frac{x_2}{y_2}=\frac{8}{100}=\frac{2}{25};\ \frac{x_3}{y_3}=\frac{12}{140}=\frac{3}{35};\ \frac{x_4}{y_4}=\frac{24}{180}=\frac{2}{15}$$

$$\therefore \frac{x}{y} \text{ is not constant } \Rightarrow x \text{ and } y \text{ are not in directly proportional}$$

The parking charges are not in direct proportion to the parking time.

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(x)	$1(x_1)$	$4(x_2)$	$7(x_3)$	$12(x_4)$	$20(x_5)$
Parts of base(y)	$8\ (y_1)$	y_2	y_3	y_4	y_5

x, y are in direct proportion

$$\frac{y_2}{x_2}=\frac{y_1}{x_1}\Rightarrow\frac{y_2}{4}=\frac{8}{1}\Rightarrow y_2=4\times 8=32$$

$$\frac{y_3}{x_3}=\frac{y_1}{x_1}\Rightarrow\frac{y_3}{7}=\frac{8}{1}\Rightarrow y_3=7\times 8=56$$

$$\frac{y_4}{x_4}=\frac{y_1}{x_1}\Rightarrow\frac{y_4}{12}=\frac{8}{1}\Rightarrow y_4=12\times 8=96$$

$$\frac{y_5}{x_5}=\frac{y_1}{x_1}\Rightarrow\frac{y_5}{20}=\frac{8}{1}\Rightarrow y_5=20\times 8=160$$

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?

Sol: $x_1=1\ , y_1=75\ ml$

$If\ x_2=?\ , y_2=1800\ ml$

x, y are in direct proportion

$$\frac{x_2}{y_2}=\frac{x_1}{y_1}\Rightarrow\frac{x_2}{1800}=\frac{1}{75}\Rightarrow x_2=\frac{1800}{75}=24\ parts$$

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

Sol:

Number of bottles(x)	$840(x_1)$	$x(x_2)$
Time(hours)(y)	$6(y_1)$	$5(y_2)$

x, y are in direct proportion

$$\frac{x_2}{y_2}=\frac{x_1}{y_1}\Rightarrow\frac{x}{5}=\frac{840}{6}\Rightarrow x=\frac{840\times 5}{6}=140\times 5=700$$

700 bottles will be filling in five hours.

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?**

Sol:

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

Enlarged length(cm) (x)	$5(x_1)$	$x(x_2)$
Enlarged times(y)	$50{,}000(y_1)$	$20{,}000(y_2)$

x, y *are in direct proportion*

$$\frac{x_2}{y_2} = \frac{x_1}{y_1}$$

$$\frac{x}{20000} = \frac{5}{50000}$$

$$x = \frac{20000 \times 5}{50000} = 2$$

Required length=2cm

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 of the ship is 28 m, how long is the model ship?**

Sol:

Length of modal ship(x) (cm)	$9(x_1)$	$x(x_2)$
Length of original ship(y)(m)	$12(y_1)$	$28(y_2)$

x, y *are in direct proportion*

$$\frac{x_2}{y_2} = \frac{x_1}{y_1}$$

$$\frac{x}{28} = \frac{9}{12}$$

$$x = \frac{9 \times 28}{12} = 21$$

Required length of model ship =21 cm

7. **Suppose 2 kg of sugar contains 9 × 106 crystals. How many sugar crystals are there in (i) 5 kg of sugar? (ii) 1.2 kg of sugar?**

Sol:

Number of Crystals(x)	$9 \times 10^6(x_1)$	x_2	x_3
Weight of sugar(kg) (y)	$2(y_1)$	$5(y_2)$	$1.2(y_3)$

x, y *are in direct proportion*

$$\frac{x_2}{y_2}=\frac{x_1}{y_1}$$

$$\Rightarrow \frac{x_2}{5}=\frac{9\times 10^6}{2}$$

$$\Rightarrow x_2=\frac{9\times 10^6\times 5}{2}=22.5\times 10^6$$

$$\frac{x_3}{y_3}=\frac{x_1}{y_1}$$

$$\Rightarrow \frac{x_3}{1.2}=\frac{9\times 10^6}{2}$$

$$\Rightarrow x_3=\frac{9\times 10^6\times 1.2}{2}=5.4\times 10^6$$

(i) 5 kg of sugar contains $22.5\times 10^6 = 225\times 10^5$ crystals

(ii) 1.2 kg of sugar contains $5.4\times 10^6 = 54\times 10^5$ crystals

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?

Sol:

Distance in the map(cm) (x)	1	x
Distance on road(km) (y)	18	72

x, y *are in direct proportion*

$$\frac{x_2}{y_2}=\frac{x_1}{y_1}\Rightarrow\frac{x}{72}=\frac{1}{18}\Rightarrow x=\frac{72}{18}=4$$

Required distance=4cm

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 5m long.

Sol:

Length of pole(m)	5.60	10.50	x
Length of shadow(m)	3.20	y	5

x, y *are in direct proportion*

$$\frac{x_2}{y_2}=\frac{x_1}{y_1}\Rightarrow\frac{10.50}{y}=\frac{5.60}{3.20}\Rightarrow y=\frac{10.50\times 3.20}{5.60}=6$$

If the height of the pole is 10.5 m, then length of the shadow is 6 m

$$\frac{x_3}{y_3}=\frac{x_1}{y_1}\Rightarrow\frac{x}{5}=\frac{5.60}{3.20}\Rightarrow y=\frac{5\times 5.60}{3.20}=8.75$$

If the height of the pole is 5 m, then length of the shadow is 8.75 m.

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

Sol:

Distance(km)	$14(x_1)$	$x(x_2)$
Time(Minutes)	$25(y_1)$	$300(y_2)$

x, y *are in direct proportion*

$5\ hours = 300\ minutes$

$$\frac{x_2}{y_2} = \frac{x_1}{y_1} \Rightarrow \frac{x}{300} = \frac{14}{25} \Rightarrow x = \frac{300 \times 14}{25} = 12 \times 14 = 166\ km$$

The truck travels 166 km in 5 hours.

INVERSE PROPORTION:

Two quantities x and y are said to be in inverse proportion if an increase in x causes a proportional decrease in y (and vice-versa) in such a manner that the product of their corresponding values remains constant.

That is, if xy = k, then x and y are said to vary inversely

(x varies inversely with y and y varies inversely with x. Thus two quantities x and y are said to vary in inverse proportion.)

$$If\ x\ and\ y\ are\ in\ inverse\ proportion\ then\ x \propto \frac{1}{y}$$

$\Rightarrow xy = k$ (k is constant of proportianality)

If y_1 , y_2 are the values of y corresponding to the values x_1 , x_2 of x respectively then

$$x_1 y_1 = x_2 y_2\ (= k), or\ \frac{x_1}{x_2} = \frac{y_2}{y_1}$$

DO THIS

Take a squared paper and arrange 48 counters on it in different number of rows.

Number of rows(R)	(R_1) 2	(R_2) 3	(R_3) 4	(R_4) 6	(R_5) 8
Number of Columns(C)	(C_1) 24	(C_2) 16	(C_3) 12	(C_4) 8	(C_5) 6

(i) Is $R_1 : R_2 = C_2 : C_1$?

Sol: $R_1 : R_2 = 2:3$; $C_2 : C_1 = 16:24 = 2:3$

Yes $R_1 : R_2 = C_2 : C_1$

(ii) Is $R_3 : R_4 = C_4 : C_3$?

Sol: $R_3 : R_4 = 4:6 = 2:3$ and $C_4 : C_3 = 8:12 = 2:3$

Yes $R_3 : R_4 = C_4 : C_3$

(iii) Are R and C inversely proportional to each other?

Sol: $R \times C = 48$ (constant). So, R and C inversely proportional to each other.

TRY THESE

Observe the following tables and find which pair of variables (here x and y) are in inverse proportion.

(i)

x	$50(x_1)$	$40(x_2)$	$30(x_3)$	$20(x_4)$
y	$5(y_1)$	$6(y_2)$	$7(y_3)$	$8(y_4)$

Sol:

$x_1y_1 = 50 \times 5 = 250$

$x_2y_2 = 40 \times 6 = 240$

$x_1y_1 \neq x_2y_2$

$x, y\ are\ not\ in\ inverse\ proportion.$

(ii)

x	$100(x_1)$	$200(x_2)$	$300(x_3)$	$400(x_4)$
y	$60(y_1)$	$30(y_2)$	$20(y_3)$	$15(y_4)$

Sol:

$x_1y_1 = 100 \times 60 = 6000$

$x_2y_2 = 200 \times 30 = 6000$

$x_3y_3 = 300 \times 20 = 6000$

$x_4y_4 = 400 \times 15 = 6000$

$xy = constant$

So, x, y are in inverse proportion.

(iii)

x	$90(x_1)$	$60(x_2)$	$45(x_3)$	$30(x_4)$	$20(x_5)$	$5(x_6)$
y	$10(y_1)$	$15(y_2)$	$20(y_3)$	$25(y_4)$	$30(y_5)$	$35(y_6)$

Sol:

$x_1y_1 = 90 \times 10 = 900$

$x_2y_2 = 60 \times 15 = 900$

$x_3y_3 = 45 \times 20 = 900$

$x_4y_4 = 20 \times 30 = 600$

$x_3y_3 \neq x_4y_4$

So, x, y are not in inverse proportion.

Example 7: 6 pipes are required to fill a tank in 1 hour 20 minutes. How long will it take if only 5 pipes of the same type are used?

Sol:

Number of pipes	$6(x_1)$	$5(x_1)$
Time (in minutes)	$80(y_1)$	$y(y_2)$

Numbers of pipes inversely proportional to time takes fill the tank.

$x_2\ y_2 = x_1\ y_1$

$5 \times y = 6 \times 80$

$$y = \frac{6 \times 80}{5} = 6 \times 16 = 96$$

Thus, time taken to fill the tank by 5 pipes is 96 minutes or 1 hour 36 minutes.

Example 8: There are 100 students in a hostel. Food provision for them is for 20 days. How long will these provisions last, if 25 more students join the group?

Sol:

Number of students	$100(x_1)$	$125(x_1)$
Number of days	$20(y_1)$	$y(y_2)$

Food provision for number of students is inversely proportional to number of days.

$$x_2\, y_2 = x_1\, y_1$$

$$125 \times y = 100 \times 20$$

$$y = \frac{100 \times 20}{125} = 16$$

Thus, the provisions will last for 16 days, if 25 more students join the hostel.

Example 9: If 15 workers can build a wall in 48 hours, how many workers will be required to do the same work in 30 hours?

Sol:

Number of hours	$48(x_1)$	$30(x_1)$
Number of workers	$15(y_1)$	$y(y_2)$

The number of hours and number of workers vary in inverse proportion.

$$x_2\, y_2 = x_1\, y_1$$

$$30 \times y = 48 \times 15$$

$$y = \frac{48 \times 15}{30} = 24$$

To finish the work in 30 hours, 24 workers are required.

EXERCISE 11.2

1. Which of the following are in inverse proportion?

(i) The number of workers on a job and the time to complete the job.

Sol: If the number of workers decreases, the time to complete the job increases in the same proportion.

So, number of workers varies inversely to the number of days.

(ii) The time taken for a journey and the distance travelled in a uniform speed.

Sol: If distance increases then the time taken for a journey is also increase.

So, time and distance are in direct proportion.

(iii) Area of cultivated land and the crop harvested.

Sol: If the area increases then the crop harvested also increase.

So, cultivated land and crop harvested are in direct proportion.

(iv) The time taken for a fixed journey and the speed of the vehicle.

Sol: As speed increases, time taken decreases in same proportion.

So the time taken varies inversely to the speed of the vehicle ,for the same distance

(v) The population of a country and the area of land per person.

Sol: If the population of a country increases then the area of land per person decrease.

So, the population of a country varies inversely the area of land per person.

2. In a Television game show, the prize money of ` 1,00,000 is to be divided equally amongst the winners. Complete the following table and find whether the prize money given to an individual winner is directly or inversely proportional to the number of winners?

Number of winners	1	2	3	4	5	8	10	20
Prize for each winner(in ₹)	1,00,000	50,000	...	....	...	....	....	....

Sol: Number of winners varies inversely to the prize for each winner.

$x_1y_1 = 1 \times 1,00,000 = 1,00,000 = k$

$x_2y_2 = 2 \times 50,000 = 1,00,000 = k$

$x_3y_3 = 1,00,000$

$\therefore y_3 = \frac{1,00,000}{x_3} = \frac{1,00,000}{4} = 25,000$

Similarly

$y_4 = \frac{1,00,000}{x_4} = \frac{1,00,000}{5} = 20,000$

$y_5 = \frac{1,00,000}{x_5} = \frac{1,00,000}{8} = 12,500$

$y_6 = \frac{1,00,000}{x_6} = \frac{1,00,000}{10} = 10,000$

$y_7 = \frac{1,00,000}{x_7} = \frac{1,00,000}{20} = 5,000$

3. Rehman is making a wheel using spokes. He wants to fix equal spokes in such a way that the angles between any pair of consecutive spokes are equal. Help him by completing the following table.

Number of spokes(x)	$4(x_1)$	$6(x_2)$	$8(x_3)$	$10(x_4)$	$12(x_5)$
Angle between a pair of consecutive spokes(y)	$90°(y_1)$	$60°(y_2)$	y_3	y_4	y_5

(i) Are the number of spokes and the angles formed between the pairs of consecutive spokes in inverse proportion?

Sol:

$x_1y_1 = 4 \times 90° = 360°$

$x_2y_2 = 6 \times 60° = 360°$

$x_1y_1 = x_2y_2 \rightarrow x, y\ are\ in\ inverse\ proportion$

(ii) Calculate the angle between a pair of consecutive spokes on a wheel with 15 spokes

$$Required\ angle = \frac{360°}{15} = 24°$$

(iii) How many spokes would be needed, if the angle between a pair of consecutive spokes is 40°?

Sol: Required number of spokes $= \frac{360°}{40^0} = 9$

4. If a box of sweets is divided among 24 children, they will get 5 sweets each. How many would each get, if the number of the children is reduced by 4?

Sol: $x_1 = 24\ and\ y_1 = 5$

$x_2 = 20\ and\ y_2 = ?$

$x\ and\ y\ are\ in\ inverse\ proportion$

$x_2y_2 = x_1y_1$

$20 \times y_2 = 24 \times 5$

$$y_2 = \frac{24 \times 5}{20} = 6$$

Hence, 20 children will get 6 sweets each

5. A farmer has enough food to feed 20 animals in his cattle for 6 days. How long the food last if would there were 10 more animals in his cattle?

Sol:

Number of animals(x)	$20(x_1)$	$30(x_2)$
Enough food for days(y)	$6(y_1)$	y_2

Number of animals is inversely proportional to enough food for days

$x_2y_2 = x_1y_1$

$30 \times y_2 = 20 \times 6$

$$y_2 = \frac{20 \times 6}{30} = 4$$

If there were 10 more animals in cattle the food last for 4 days.

6. A contractor estimates that 3 persons could rewire Jasminder's house in 4 days. If, he uses 4 persons instead of three, how long should they take to complete the job?

Sol:

Number of persons(x)	3	4
Number of days(y)	4	y_2

Number of persons is inversely proportional to number of days.

$x_2y_2 = x_1y_1$

$4 \times y_2 = 3 \times 4$

$y_2 = \frac{3 \times 4}{4} = 3$

4 persons will take 3 days to complete the job

7. A batch of bottles were packed in 25 boxes with 12 bottles in each box. If the same batch is packed using 20 bottles in each box, how many boxes would be filled?

Sol:

Number of bottles in each box (x)	$12(x_1)$	$20(x_2)$
Number of boxes(y)	$25(y_1)$	y_2

$x_2 y_2 = x_1 y_1$

$20 \times y_2 = 12 \times 25$

$y_2 = \frac{12 \times 25}{20} = 15$

Hence 15 boxes will be filled with 20 bottles in each box.

8. A factory requires 42 machines to produce a given number of articles in 63 days. How many machines would be required to produce the same number of articles in 54 days?

Sol:

Number of days	$63(x_1)$	$54(x_2)$
Number of machines required	$42(y_1)$	$y(y_2)$

Number of days is inversely proportional to number of machines required.

$x_2 y_2 = x_1 y_1$

$54 \times y = 63 \times 42$

$y = \frac{63 \times 42}{54} = 49$

49 machines will be required to produce the same number of articles in 54 days.

9. A car takes 2 hours to reach a destination by travelling at the speed of 60 km/h. How long will it take when the car travels at the speed of 80 km/h?

Sol:

Speed of the car(km/h)	$60\ (x_1)$	$80(x_2)$
Time taken(h)	$2(y_1)$	$y(y_2)$

Speed of the car is inversely proportional to time taken.

$x_2 y_2 = x_1 y_1$

$80 \times y = 60 \times 2$

$y = \frac{60 \times 2}{80} = 1\frac{1}{2}$

$1\frac{1}{2}$ hours will it take when the car travels at the speed of 80 km/h.

10. Two persons could fit new windows in a house in 3 days.

(i) One of the persons fell ill before the work started. How long would the job take now?

Number of persons	$2(x_1)$	$1(x_2)$
Number of days	$3(y_1)$	$y(y_2)$

Number of persons is inversely proportional to number of days

$$x_2y_2 = x_1y_1$$

$$1 \times y = 2 \times 3$$

$$y = 6$$

∴ The job will be completed in 6 days.

(ii) How many persons would be needed to fit the windows in one day?

Number of persons	$2(x_1)$	$x\ (x_2)$
Number of days	$3(y_1)$	$1(y_2)$

Number of persons is inversely proportional to number of days

$$x_2y_2 = x_1y_1$$

$$x \times 1 = 2 \times 3$$

$$x = 6$$

6 persons will need to fix the window in one day.

11. A school has 8 periods a day each of 45 minutes duration. How long would each period be, if the school has 9 periods a day, assuming the number of school hours to be the same?

Sol:

Number of periods	$8(x_1)$	$9(x_2)$
Duration for each period(minutes)	$45(y_1)$	$y(y_2)$

Number of periods is inversely proportional to duration for each period.

$$x_2y_2 = x_1y_1$$

$$9 \times y = 8 \times 45$$

$$y = \frac{8 \times \cancel{45}^{5}}{\cancel{9}} = 40$$

Hence, each period would be 40 minutes long.

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