

# MATHEMATICS

## Chapter 13: Direct and Inverse Proportions



## Important Questions

### Multiple Choice Questions-

Question 1. 10 meters of cloth cost Rs 1000. What will 4 meters cost?

- (a) Rs 400
- (b) Rs 800
- (c) Rs 200
- (d) Rs 100.

Question 2. 15 books weigh 6 kg. What will 6 books weigh ?

- (a) 1.2 kg
- (b) 2.4 kg
- (c) 3.8 kg
- (d) 3 kg.

Question 3. A horse eats 18 kg of com in 12 days ? How much does he eat in 9 days ?

- (a) 11.5 kg
- (b) 12.5 kg
- (c) 13.5 kg
- (d) 14.5 kg.

Question 4. 8 g of sandal wood cost Rs 40. What will 10 g cost ?

- (a) Rs 30
- (b) Rs 36
- (c) Rs 48
- (d) Rs 50.

Question 5. 20 trucks can hold 150 metric tonnes. How much will 12 trucks hold ?

- (a) 80 metric tonnes
- (b) 90 metric tonnes
- (c) 60 metric tonnes
- (d) 40 metric tonnes.

Question 6. 120 copies of a book cost Rs 600. What will 400 copies cost ?

- (a) Rs 1000
- (b) Rs 2000
- (c) Rs 3000
- (d) Rs 2400.

Question 7. The rent of 7 hectares is Rs 875. What is the rent of 16 hectares ?

- (a) Rs 2000
- (b) Rs 1500
- (c) Rs 1600
- (d) Rs 1200.

Question 8. A boy runs 1 km in 10 minutes. How long will he take to ran 600 m ?

- (a) 2 minutes
- (b) 3 minutes
- (c) 4 minutes
- (d) 6 minutes.

Question 9. A shot travels 90 m in 1 second. How long will it take to go 225 m?

- (a) 2 seconds
- (b) 2.5 seconds
- (c) 4 seconds
- (d) 3.5 seconds.

Question 10. 3 knives cost Rs 63. What will 17 knives cost?

- (a) Rs 357
- (b) Rs 375
- (c) Rs 537
- (d) Rs 573.

### Very Short Questions:

1. A train is moving at a uniform speed of 100 km/h. How far will it travel in 20 minutes?
2. Complete the table if  $x$  and  $y$  vary directly.

$x$	3.5	4	7.5	-
$y$	-	8	-	15

3. If the cost of 20 books is ₹ 180, how much will 15 books cost?
4. If  $x_1 = 5$ ,  $y_1 = 7.5$ ,  $x_2 = 7.5$  then find  $y_2$  if  $x$  and  $y$  vary directly.
5. If 3 kg of sugar contains  $9 \times 10^8$  crystals. How many sugar crystals are there in 4 kg of sugar?
6. If 15 men can do a work in 12 days, how many men will do the same work in 6 days?

### Short Questions :

1. A train travels 112 km in 1 hour 30 minutes with a certain speed. How many kilometres it will travel in 4 hours 45 minutes with the same speed?
2. The scale of a map is given as 1 : 50,000. Two villages are 5 cm apart on the map. Find the actual distance between them.
3. 8 pipes are required to fill a tank in 1 hr 20 min. How long will it take if only 6 pipes of the same type are used?
4. 15 men can build a wall in 42 hours, how many workers will be required for the same work in 30 hours?
5. The volume of a gas  $V$  varies inversely as the pressure  $P$  for a given mass of the gas. Fill in the blank spaces in the following table:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Volume (in $\text{cm}^3$ )	–	48	60	–	100	–	200
Pressure (in atmosphere)	2	–	$\frac{3}{2}$	1	–	$\frac{1}{2}$	–

6. The cost of 5 metres of cloth is ₹ 210. Tabulate the cost of 2, 4, 10 and 13 metres of cloth of the same type.
7. Six pumps working together empty a tank in 28 minutes. How long will it take to empty the tank if 4 such pumps are working together?

### Long Questions :

1. Mohit deposited a sum of ₹ 12000 in a Bank at a certain rate of interest for 2 years and earns an interest of ₹ 900. How much interest would be earned for a deposit of ₹ 15000 for the same period and at the same rate of interest?
2. A garrison of 120 men has provisions for 30 days. At the end of 5 days, 5 more men joined them. How many days can they sustain on the remaining provision?
3. In a scout camp, there is food provision for 300 cadets for 42 days. If 50 more persons join the camp, for how many days will the provision last?
4. If two cardboard boxes occupy 500 cubic centimetres space, then how much space is required to keep 200 such boxes?
5. Under the condition that the temperature remains constant, the volume of gas is inversely proportional to its pressure. If the volume of gas is 630 cubic centimetres at a pressure of 360 mm of mercury, then what will be the pressure of the gas if its volume is 720 cubic centimetres at the same temperature?

Answer Key-**Multiple Choice questions-**

1. (a)  $a^{m+n}$
2. (a) Rs 400
3. (b) 2.4 kg
4. (c) 13.5 kg
5. (d) Rs 50.
6. (b) 90 metric tonnes
7. (b) Rs 2000
8. (a) Rs 2000
9. (d) 6 minutes.
10. (b) 2.5 seconds
11. (a) Rs 357

**Very Short Answer :**

1. Let the distance travelled by train in 20 minutes be  $x$  km.

<b>Distance travelled (in km)</b>	100	$x$
<b>Time taken (in minutes)</b>	60	20

Since the speed is uniform, the distance travelled will be directly proportional to time.

$$\therefore \frac{100}{60} = \frac{x}{20}$$

$$\Rightarrow 60 \times x = 20 \times 100$$

$$\therefore x = \frac{20 \times 100}{60} = \frac{100}{3} \text{ km}$$

$$= 33\frac{1}{3} \text{ km.}$$

Hence, the required distance is  $33\frac{1}{3}$  km.

2. Let the blank spaces be filled with  $a$ ,  $b$  and  $c$ .

<b>x</b>	3.5	4	7.5	<i>c</i>
<b>y</b>	<i>a</i>	8	<i>b</i>	15

Since *x* and *y* vary directly,

$$\begin{aligned} \therefore \frac{x_1}{y_1} &= \frac{x_2}{y_2} \\ \Rightarrow \frac{3.5}{a} &= \frac{4}{8} \\ \Rightarrow 4 \times a &= 3.5 \times 8 \\ \therefore a &= \frac{3.5 \times 8}{4} = 7 \\ \frac{4}{8} &= \frac{7.5}{b} \\ \Rightarrow 4 \times b &= 8 \times 7.5 \end{aligned}$$

Hence, the required values are  $a = 7$ ,  $b = 15$  and  $c = 7.5$ .

3. Let the required cost be ₹ *x*.

Here, the two quantities vary directly.

<b>Number of books</b>	20	15
<b>Cost (in ₹)</b>	180	<i>x</i>

$$\begin{aligned} \frac{20}{180} &= \frac{15}{x} \\ \Rightarrow 20 \times x &= 15 \times 180 \\ \therefore x &= \frac{15 \times 180}{20} = ₹ 135 \end{aligned}$$

Hence, the required cost = ₹ 135.

4. Since *x* and *y* vary directly.

$$\begin{aligned} \therefore \frac{x_1}{y_1} &= \frac{x_2}{y_2} \\ \Rightarrow \frac{5}{7.5} &= \frac{7.5}{y_2} \\ \Rightarrow 5 \times y_2 &= 7.5 \times 7.5 \\ \therefore y_2 &= \frac{7.5 \times 7.5}{5} = 11.25 \end{aligned}$$

Hence, the required value is 11.25.

5. Let the required number of crystals be *x*.

<b>Sugar (in kg)</b>	3	4
<b>Number of crystals</b>	$9 \times 10^8$	$x$

Since the two quantities are directly proportional to each other.

$$\begin{aligned} \therefore \frac{x_1}{y_1} &= \frac{x_2}{y_2} \\ \Rightarrow \frac{3}{9 \times 10^8} &= \frac{4}{x} \\ \Rightarrow 3 \times x &= 4 \times 9 \times 10^8 \\ \therefore x &= \frac{4 \times 9 \times 10^8}{3} \\ &= 12 \times 10^8 = 1.2 \times 10^9 \end{aligned}$$

Hence, the required number of crystals =  $1.2 \times 10^9$ .

6. Let the required number of men be  $x$ .

Less days  $\rightarrow$  more men.

Thus the two quantities are inversely proportional to each other.

<b>Men</b>	15	$x$
<b>days</b>	12	6

$$\begin{aligned} x_1 y_1 &= x_2 y_2 \\ \Rightarrow 15 \times 12 &= x \times 6 \\ \therefore x &= \frac{15 \times 12}{6} = 30 \end{aligned}$$

Hence, the required number of days = 30.

### Short Answer :

1. Let the required distance be  $x$  km.

More distance  $\rightarrow$  more time

Thus, the two quantities are directly proportional.

<b>Distance (in km)</b>	112	$x$
<b>Time (in hours)</b>	$\frac{3}{2}$ h	$\frac{19}{4}$ h

$$\left[ \begin{array}{l} \therefore 1 \text{ hr } 30 \text{ min} = \frac{3}{2} \text{ h} \\ 4 \text{ hrs } 45 \text{ min} = \frac{19}{4} \text{ h} \end{array} \right]$$

$$\begin{aligned} \frac{x_1}{y_1} &= \frac{x_2}{y_2} \\ \Rightarrow \frac{112}{x} &= \frac{3}{19} \\ \Rightarrow \frac{3}{2}x &= 112 \times \frac{19}{4} \\ \therefore x &= \cancel{112} \times \frac{19}{\cancel{4}_2} \times \frac{2}{3} = \frac{1064}{3} \\ &= 354.6 \text{ km.} \end{aligned}$$

Hence, the required distance = 354.6 km.

2. Let the map distance be  $x$  cm and actual distance be  $y$ .

$$1 : 50,000 = x : y$$

$$\Rightarrow \frac{1}{50,000} = \frac{x}{y}$$

Since  $x = 5$ , So  $\frac{1}{50,000} = \frac{5}{y}$

$$\begin{aligned} \therefore y &= 5 \times 50,000 \\ &= 2,50,000 \text{ cm} \\ &= 250 \text{ km} \end{aligned}$$

Hence, the required distance = 250 km.

3. Let the required time be 't' hours.

<b>Number of pipe</b>	8	6
<b>Time (in hours)</b>	$\frac{4}{3}$	t

$$[\because 1 \text{ hr } 20 \text{ min} = \frac{4}{3} \text{ h}]$$

Less number of pipes  $\rightarrow$  more time

$$\therefore x_1 y_1 = x_2 y_2$$

$$\Rightarrow 8 \times \frac{4}{3} = 6 \times t$$

$$\begin{aligned} \Rightarrow t &= \frac{8 \times 4}{6 \times 3} = \frac{16}{9} \text{ h} \\ &= 1\frac{7}{9} \text{ h.} \end{aligned}$$

Hence, the required time =  $1\frac{7}{9}$  h.



4. Let the required number of workers be  $x$ .

The number of workers, faster will they do the work.

So, the two quantities are inversely proportional.

<b>Number of hours</b>	42	30
<b>Number of men</b>	15	$x$

$$x_1y_1 = x_2y_2$$

$$\Rightarrow 42 \times 15 = 30 \times x$$

$$\Rightarrow x = 21$$

Hence, the required number of men = 21

5. Since volume and pressure are inversely proportional.

$$PV = K$$

From (C)  $60 \times \frac{3}{2} = K \therefore K = 90$

From (A)  $P = 2, K = 90$

$$\therefore V = \frac{K}{P} = \frac{90}{2} = 45 \text{ cm}^3$$

From (B)  $V = 48, K = 90$

$$\therefore P = \frac{K}{V} = \frac{90}{48}$$

$$= \frac{15}{8} \text{ atm}$$

From (D)  $P = 1, K = 90$

$$\therefore V = \frac{K}{P} = \frac{90}{1} = 90 \text{ cm}^3$$

From (E)  $V = 100, K = 90$

$$\begin{aligned} \therefore P &= \frac{K}{V} = \frac{90}{100} \\ &= \frac{9}{10} \text{ atm} \end{aligned}$$

From (F)  $P = \frac{1}{2}, K = 90$

$$\begin{aligned} \therefore V &= \frac{K}{P} = \frac{90}{\frac{1}{2}} \\ &= 180 \text{ cm}^3 \end{aligned}$$

From (G)  $V = 200, K = 90$

$$\begin{aligned} \therefore P &= \frac{K}{V} = \frac{90}{200} \\ &= \frac{9}{20} \text{ atm} \end{aligned}$$

Hence, the completed table is

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
<b>Volume (in cm<sup>3</sup>)</b>	45	48	60	90	100	180	200
<b>Pressure (in atmosphere)</b>	2	$\frac{15}{8}$	$\frac{3}{2}$	1	$\frac{9}{10}$	$\frac{1}{2}$	$\frac{9}{20}$

6. Let the length of the cloth be  $x$  m and its cost be ₹  $y$ . We have the following table.

<b><math>x</math></b>	2	4	5	10	13
<b><math>y</math></b>	$y_1$	$y_2$	210	$y_3$	$y_4$

Since  $x$  and  $y$  are directly proportional.

$$\therefore \frac{2}{y_1} = \frac{5}{210}$$

$$\Rightarrow 5 \times y_1 = 2 \times 210$$

$$\Rightarrow y_1 = \frac{2 \times 210}{5}$$

$$\Rightarrow y_1 = ₹ 84$$

$$\text{Similarly, } \frac{4}{y_2} = \frac{5}{210}$$

$$\Rightarrow 5 \times y_2 = 4 \times 210$$

$$\Rightarrow y_2 = \frac{4 \times 210}{5}$$

$$\Rightarrow y_2 = ₹ 168$$

$$\frac{10}{y_3} = \frac{5}{210}$$

$$\Rightarrow 5 \times y_3 = 10 \times 210$$

$$\Rightarrow y_3 = \frac{10 \times 210}{5} = ₹ 420$$

$$\frac{13}{y_4} = \frac{5}{210}$$

$$\Rightarrow 5 \times y_4 = 13 \times 210$$

$$\Rightarrow y_4 = \frac{13 \times 210}{5} = ₹ 546$$

7. Let the required time be  $t$  minutes.

<b>Number of pumps</b>	6	4
<b>Time (in minutes)</b>	28	$x$

Less pump  $\rightarrow$  More time

Since there is an inverse variation.

$$x_1 y_1 = x_2 y_2$$

$$6 \times 28 = 4 \times x$$

$$x = 42$$

Hence, the required time = 42 minutes.

### Long Answer :

1. Let the required amount of interest be ₹  $x$ .

<b>Deposit (in ₹)</b>	12000	15000
<b>Interest (in ₹)</b>	900	$x$

Since there is a direct variations.

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

$$\Rightarrow \frac{12000}{900} = \frac{15000}{x}$$

$$\Rightarrow 12000 \times x = 900 \times 15000$$

$$\Rightarrow x = \frac{900 \times 15000}{12000}$$

$$\Rightarrow x = 1125$$

Hence, the required amount of interest = ₹ 1125.

2. Let the number of days be  $x$ .

<b>Number of men</b>	120	125
<b>Number of days</b>	25	$x$

[ $\because$  Remaining days =  $30 - 5 = 25$ ]

[Total men =  $120 + 5 = 125$ ]

Since there is an inverse variation.

$$x_1y_1 = x_2y_2$$

$$120 \times 25 = 125 \times x$$

$$x = 24$$

Hence, the required number of days be 24.

3. More the persons, the sooner would be the provision exhausted. So, this is a case of inverse proportion.

Let the required number of days be  $x$ .

$$\text{Hence, } 300 \times 42 = (300 + 50) \times x$$

$$300 \times 42 = 350 \times x$$

$$x = 36$$

4. As the number of boxes increases, the space required to keep them also increases.

So, this is a case of direct proportion.

<b>Number of boxes</b>	2	200
<b>Space occupied (in cubic centimetres)</b>	500	$x$

$$\begin{aligned} \text{So } \therefore \quad & \frac{2}{500} = \frac{200}{x} \\ \Rightarrow \quad & 2x = 500 \times 200 \\ \Rightarrow \quad & x = \frac{500 \times 200}{2} \\ \therefore \quad & x = 50,000 \end{aligned}$$

Thus, the required space is 50,000 cubic centimetres.

5. Given that, at constant temperature pressure and volume of a gas are inversely proportional.

Let the required pressure be  $x$ .

<b>Volume of gas (in cubic centimetres)</b>	630	720
<b>Pressure of gas (in mm)</b>	360	$x$

$$\begin{aligned} \text{Then, } \quad & 630 \times 360 = 720 \times x \\ & \frac{630 \times 360}{720} = x \\ \therefore \quad & x = 315 \end{aligned}$$

Therefore, the required pressure is 315 mm of mercury.

*Swotters*