

Grade 9

Mathematics

Reading Materials

Direct Proportion



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Direct Proportion.

Introduction to direct proportion

The way the price of soap varies depending on the quantity of soap is given in the following table.

Number of soaps	Price (Rs)
1	60
2	120
3	180
4	240
5	300
6	360

It is clear from the above that the price increases as the number of soap increase. Let us consider the number of soap and the price as two quantities.

Based on the above example, a few ratios of different amount of soap and the ratios of corresponding prices are shown in the following table. Observe that these ratio are equal.

Ratio of the number of soaps	Ratio of the corresponding prices
1 : 2	60 : 120
1 : 3	60 : 180
3 : 4	180 : 240
2 : 3	120 : 180
3 : 5	180 : 300

* Two distinct quantities are said to be in direct proportion if they increase or decrease in the same ratio.

- If two quantities are in direct proportion, then when one quantity increase the other quantity will also increase in the same ratio.
- Similarly, if two quantities are in direct proportion and one quantity decreases, then the other quantity will also decrease in the same ratio.

Exercise

01) For each of the cases given below, write whether the two quantities are directly proportional or not.

- The number of eggs and their price
- The radius of the circle and its circumference
- The quantity of fuel consumed and the distance travelled by a vehicle
- The number of units of water consumed by a household and the monthly bill
- The money which a man had and his age
- Area of a square and the length of one side

Solving problems related to direct proportion using the unitary method.

Grade

Example 1

If the price of 4 apples is Rs.200, Find the price of 15 such apples.

- Price of 4 apples = Rs.200
- Price of an apple = $\text{Rs.}200 \div 4$
= Rs.50
- Price of 15 apples = $\text{Rs.}50 \times 15$
= Rs.750

\therefore Price of 15 apples is Rs. 750

Example 2

If a motor vehicle moving at a constant speed travels 22km in 10 minutes. Calculate the distance it travels in 35 minutes.

$$\text{Distance traveled in 10 minutes} = \text{Rs.}22\text{km}$$

$$\begin{aligned}\text{Distance traveled in 1 minute} &= \text{Rs.}22\text{km} \div 10 \\ &= 2.2\text{km}\end{aligned}$$

$$\begin{aligned}\text{Distance traveled in 35 minutes} &= 2.2\text{km} \times 35 \\ &= 77\text{km}\end{aligned}$$

\therefore The distance traveled in 35minutes is 77km.

The method of solving a problem based on the value of a unit is called the **unitary method**.

Exercise

- 1) If the cost of 12 exercise books is Rs.900. Find the cost of 21 such exercise books?
- 2) If a vehicle consumes 4l of petrol to run a distance 96km. Find the distance it can travel with 7l of petrol?
- 3) If the time taken for a tank of capacity 1500 litres to be filled using a pump that release water at a constant rate is 15 minutes. Find the time taken in seconds to fill a tank of capacity 1200 litres?
- 4) If 13 oranges cost Rs.715, find the number of oranges which can be bought for Rs.1 375?
- 5) If it cost Rs.3 200 for lunch for 8 people for 4 days, how much will it cost for 5 people for 7 days?

Solving problems related to direct proportion using the definition.

Example 1

If the price of 7 pens is Rs.84. Find the price of 15 such pens?

■ Let's take the price of 15 pens as x . Then we can illustrate this information using an arrow diagram as show below.



■ Using this as the base, let us write an algebraic equation as shown below and by solving it, Find the value of x , that is the price of 15 pens.

$$7 : 15 = 84 : x$$

Therefore,

$$\frac{7}{15} = \frac{84}{x}$$

$$7x = 84 \times 15$$

$$x = \frac{84 \times 15}{7}$$

$$x = 180$$

Accordingly, the price of 15 pens is Rs.180

Example 2

Find the price at which an item bought for Rs.4 000 should to earn a profit of 18%

■ Let us write the information in this problem as follows, so that we can use direct proportions.

“ If the selling price of an item bought for Rs.100 is Rs.118. Find the selling price of an item bought for Rs.4000 ”.

Let's assume that the selling price of an item bought for Rs.4000 is Rs. x .

Buying price (Rs)

Selling price (Rs)

100  1184000  x

$$100 : 4000 = 118 : x$$

$$\frac{100}{4000} = \frac{118}{x}$$

$$100x = 118 \times 400$$

$$\frac{100x}{100} = \frac{118 \times 400}{100}$$

$$x = \text{Rs. } 4\ 720$$

Accordingly, the selling price should be Rs.4 720.

Exercise

01) For each of the proportions given below, write the suitable value in the blanks.

a) $3 : 4 = 12 : \dots\dots$

b) $1 : 5 = \dots\dots : 40$

c) $7 : 9 = \dots\dots : 45$

d) $3 : 2 = 15 : \dots\dots$

e) $\dots\dots : 8 = 30 : 48$

f) $2 : \dots\dots = 14 : 21$

02) Solve each problems given below using proportions, by first drawing an arrow diagram and then writing an algebraic equation.

a) If the price of 5kg of potato is Rs.1100, find the price of 9kg of potato?

b) If a motor car can travel 72km on 3l of petrol, find the petrol liters it can travel 48km of the distance?

c) If a printing machine can print 7 newspapers in 5 seconds. How many newspapers can it print in an hour?

d) Find the price at which an item bought for Rs.2 500 should be sold to earn a profit of 20%?

e) Find the amount needed to buy an item worth Rs.2 000 from a shop which offers a discount of 5%

Solving problems related to direct proportion algebraically.

Example 1

If the price of 10 pencils is Rs.150. Find the price of 25 such pencils?

Let's take the number of pencils as x and the price as y . Then we can write

$$y = kx, \text{ where } k \text{ is a constant.}$$

The value of k can be found using the information given in the problem,

since, the price of 10 pencils is Rs.150

when $x = 10$ and $y = 150$

By substituting these values in the equation, we obtain

$$150 = k \times 10$$

By solving this we obtain

$$k = 15$$

By substituting this value of k in the first equation, we obtain the relationship between x and y

$$\therefore y = 15x$$

Now, using this equation, for any value of x the corresponding value of y or for any value of y the corresponding value of x can be found.

In this problem, since we need the price of 25 pencils, y need to be found when $x = 25$

By substituting $x = 25$, in the equation

$$y = 15x$$

$$y = 15 \times 25$$

$$y = 375$$

Accordingly, the price of 25 pencils is Rs.375.

Example 2

If the vendor sells an item he bought for Rs.1 000 such that he earns a profit of 10% determine the selling price of the item?

Taking the purchase price of the item as x and selling price as y we can write,

$$\frac{y}{x} = k$$

Since the selling price is Rs.110 when the purchase price is Rs.100 we obtain,

$$\frac{110}{100} = k$$

Let's assume that the selling price of an item bought for Rs.1000 is y . Then we obtain the equation

$$\frac{y}{1000} = k$$

Since k is a constant, we can write

$$\frac{y}{1000} = \frac{110}{100}$$

Therefore;

$$y = \frac{110 \times 1000}{100}$$

$$y = 1\ 100$$

\therefore The selling price of the item is Rs.1 100.

Exercise

Do the problems in this exercise, using the algebraic equation method.

- 01) If the daily wage of 5 workers who are paid equal wages is Rs.4 750, find the daily wage of 12 workers?
- 02) If a machine makes 560 tiles in 7 hours, determine the time it makes 240 tiles?
- 03) If the discount of 25% is given when an item is sold, what is the discount given for an item worth Rs.5 000?
- 04) If a distance of 15m is represented by 5cm on a map drawn to scale. Find the actual distance represented by 9cm on this map?

Foreign currency

The rate at which one country exchanges its currency with that of another country is called the **exchange rate**.

The currency units used by certain countries and their exchange rates with respect to the Sri Lankan rupees on a particular day, is given below.

Country / Union	Foreign currency unit	Exchange rate (Rs)
United State of America	American dollar	151.20
England	Sterling Pound	185.90
European Union	Euro	160.60
Japan	Yen	1.33
India	Indian Rupee	2.26
Saudi Arabia	Saudi Riyal	40.32
Singapore	Singapore dollar	107.30

(From the internet on 2021 – 03 – 05)

Example 1

If the monthly salary of a person working in a foreign country is 1 800 American dollars. What is this salary in Sri Lankan rupees?

$$\text{Value of 1 American dollar} = \text{Rs.}151.20$$

$$\begin{aligned} \text{Value of 1 800 American dollar} &= \text{Rs.}151.20 \times 1\ 800 \\ &= \text{Rs.}272\ 160 \end{aligned}$$

Example 2

A person visiting Singapore, converted Rs.96 300 into Singapore dollars on a day when the exchange rate was Rs.107 for a Singapore dollar. How many Singapore dollars did he receive?

The value of 107 Sri Lankan rupees = 1 Singapore dollars

The value of 1 Sri Lankan rupees = $\frac{1}{107}$ Singapore dollar

The value of 96 300 Sri Lankan rupees = $\frac{1}{107} \times 96\ 300$
= 900 Singapore dollars

Exercise

Do the following exercise by using the exchange rate table given earlier.

- 01) If the price of a laptop imported from Japan is 15 500 yen, what is its value in Sri Lankan rupees?
- 02) An electric equipment in a duty free shop is worth 900 euros. How many Sri Lankan rupees have to be paid to purchase it ?
- 03) If the monthly salary of a person working in a foreign country is 1800 American dollars, what is his salary in Sri Lankan rupees?
- 04) How many Singapore dollars are received when ready made garments worth Rs.160 950 are exported from Sri Lanka to Singapore?
- 05) A person visiting European Union, converted Rs.80 500 into Euro on a day when the exchange rate was Rs.161 for Euro. How many Euro did he receive ?