Linear Equations in Two Variables

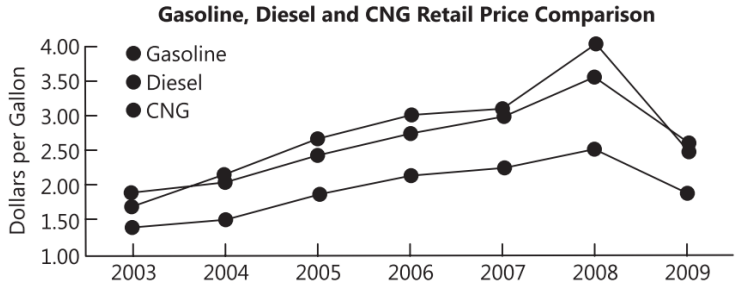
Case Study Based Questions

Case Study 1

As petrol, diesel and CNG are essential component of manufacturing sector and transportation. Due to increase in price fuel, the price of all consumers product directly increases. Suppose, there are two statements which are based on petrol and CNG that are given below:

Statement-I: Every one month price of petrol increases at the rate of ₹ 2 per litre. Consider the price of petrol in month of January 2020 as ₹ x and present price of petrol as ₹ y.

Statement-II: Because of continuous increase in the price of petrol, people found other option as CNG, whose price increases at the rate of ₹ 4 per litre in a year.



On the basis of the above information, solve the following questions:

Statement I

Q1. By using statement-I, form a linear equation that the amount spends on petrol in beginning of January 2021.

a. x = y + 24

b. y = x + 24

c. y = x + 2

d. y = x - 24

Q2. If x = 5, then the value of y is:

a. 28 b. 25

c. 29 d. 30

Statement II

Q 3. By using statement-II, form a linear equation taking price of CNG in January 2020 as l and its going upto January 2021 as:

a. $l = m + 4$ b. $2l = m + 4$

c. $m = l + 4$ d. $2m = l + 4$

Q 4. If $m = 2$, then the value of l is:

a. -4 b. -2

c. 2 d. 3

Q 5. Which of the following point (l, m) satisfy the equation $m = 2l + 4$?

a. (2, 0) b. (– 1, 3)

c. (1, 6) d. $\left(\frac{1}{2}, -4\right)$

Solutions

1. (b) It is given that price of petrol increase every month at the rate of ₹ 2 per litre. Therefore in 12 months, total price increase of

₹ 12×2 *i.e.* ₹ 24.

$\therefore$ The linear equation will be formed as

$$y = x + 24$$

So, option (b) is correct.

2. (c) We have $y = x + 24$

When $x = 5$, then

$y = 5 + 24 = 29$

So, option (c) is correct.

3. (c) The required linear equation formed by statement-II is $m = l + 4$

So, option (c) is correct.

4. (b) We have, $m = l + 4$

When $m = 2$, then

$$2 = l + 4 \quad \Rightarrow \quad l = -2$$

So, option (b) is correct.

5. (c) Given equation is

$$m = 2l + 4$$

(a) At point (2, 0),

$0 = 2 \times 2 + 4 \Rightarrow 0 = 8,$

Which is not true.

(b) At point (– 1, 3),

$3 = 2(-1) + 4 \Rightarrow 3 = 2,$

Which is not true

(c) At point (1, 6),

$6 = 2(1) + 4 \Rightarrow 6 = 6,$

Which is true.

Hence, point (1, 6) satisfy the given equation.

So, option (c) is correct.

Case Study 2

Vehicle parking is the major problem in any metropolitan city. In Delhi at Chandni Chowk, the parking charge of a two wheeler is as ₹ 20 for the first two hours and ₹ 5 for next subsequent hours. Suppose total charge of a two wheeler is ₹ x and total parking time is y hours.

On the basis of the above information, solve the following questions:

Q1. Write a linear equation in the given statement:

a. 5 + 5x = y b. 5x = y + 10

c. 10 + 5x = y d. 10 - 5x = y

Q2. If x = -1, then the value of y is:

a. 3 b. 5 c. - 5 d. – 3

Q3. If y = 20, then the value of x is:

a. 4 b. -2 c. 3 d. 2

Q4. Which of the following point satisfy the equation 10 + 5x = y?

a. (− 1, 3) b. (1, 15) c. (2, 15) d. (-2, 1)

Q5. A linear equation 10 + 5x = y satisfy:

a. only one point b. atmost two points

c. infinitely points d. zero point

Solutions

1. (c) It is given that charges of first two hours is ₹ 20 and the charges of next subsequent hour is ₹ 5 *i.e.* for $(x-2)$ hours, charges for per hour is ₹ 5.

According to the given condition,

$$20 + 5(x-2) = y$$

$$\Rightarrow \quad 20 + 5x - 10 = y$$

$$\Rightarrow \quad 10 + 5x = y$$

So, option (c) is correct.

2. (b) We have, $10 + 5x = y$

When $x = -1$, then

$$10 + 5(-1) = y$$

$$\Rightarrow \quad y = 10 - 5 = 5$$

So, option (b) is correct.

3. (d) We have $10 + 5x = y$, then

Put $y = 20$, we get

$$10 + 5x = 20$$

$$\Rightarrow \quad 5x = 10$$

$$\Rightarrow \quad x = 2$$

So, option (d) is correct.

4. (b) We have, $10 + 5x = y$

(a) At point $(-1, 3)$,

$$10 + 5(-1) = 3$$

$$\Rightarrow \quad 5 = 3,$$

which is not true.

(b) At point (1, 15),

$10 + 5(1) = 15 \Rightarrow 15 = 15$, which is true.

Hence, point (1, 15) satisfy the equation

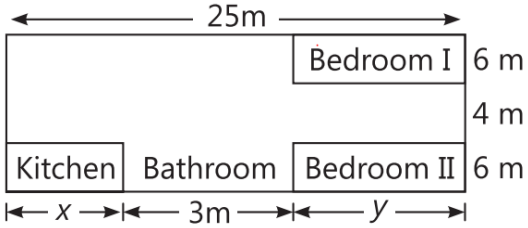
$$10 + 5x = y.$$

So, option (b) is correct.

5. (c) A linear equation $10 + 5x = y$ satisfy infinitely many points.
So, option (c) is correct.

Case Study 3

Gupta's family wanted to purchase a house near national highway 54. One day, they went to the property dealer and saw the different maps of houses there. One of the maps was shown below.



On the basis of the above information, solve the following questions:

Q1. Find the area of one kitchen and one bedroom.

Q2. Write the linear equation in two variables formed by the given layout.

Q3. Find the number of solutions exist in the equation x + y = 22.

Solutions

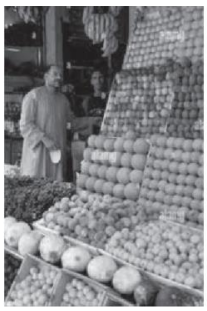
1. From figure, length of kitchen = x m
and width of kitchen = 6 m
$\therefore$ Area of kitchen = length $\times$ width
$= x \times 6 = 6x$ m^2
From figure, length of bedroom = y m
and width of bedroom = 6 m
$\therefore$ Area of one bedroom = length $\times$ width
$= y \times 6 = 6y$ m^2.
Hence, area of kitchen is $6x$ m^2 and area of one bedroom is $6y$ m^2.

2. From given layout,
$x + 3 + y = 25$
$\Rightarrow$ $x + y = 22$

3. There are infinitely many solutions exist in the equation $x + y = 22$.

Case Study 4

Sumit went to the market and ask the fruit seller about the rates of different fruits. He said that the cost of 3 kg apples and 2 kg of guava on a particular day was found to be ₹ 200. On the next day, the cost of 6 kg of apples and 3 kg of guava is ₹ 360.



Suppose x and y represent the quantity of apples and guava.

On the basis of the above information, solve the following questions:

Q1. Find the algebraic representation of both conditions.

Q2. By using II condition, find the value of x, when y = 10.

Q3. By using I condition, if Sumit purchase an apple of ₹ 40, then find the amount required to purchase guava.

Solutions

1. The algebraic representation of both conditions are

$3(x) + 2(y) = 200$

$\Rightarrow \quad 3x + 2y = 200$

and $\quad 6(x) + 3(y) = 360$

$\Rightarrow \quad 6x + 3y = 360 \quad$ or $\quad 2x + y = 120$

2. From II condition, $2x + y = 120$

When $y = 10$, then

$2x + 10 = 120$

$\Rightarrow \quad 2y = 110$

$\Rightarrow \quad x = 55$

3. From I condition,

$3x + 2y = 200$

When $x = 40$, then

$3(40) + 2y = 200$

$\Rightarrow \quad 2y = 200 - 120$

$\Rightarrow \quad 2y = 80$

$\Rightarrow \quad y = 40$

Hence, Sumit required ₹ 40 to purchase guava.