# Important Questions Class 10 Maths Chapter 3 Linear Equations In Two Variables

**Q.1: The cost of 2 kg of apples and 1kg of grapes on a day was found to be Rs.160. After a month, the cost of 4 kg of apples and 2 kg of grapes is Rs.300. Represent the situation algebraically.**

**Solution:**

Let the cost of 1 kg of apples be 'Rs. x'.
And, let the cost of 1 kg of grapes be 'Rs. y'.
According to the question, the algebraic representation is
$2x + y = 160$
And $4x + 2y = 300$

For, $2x + y = 160$ or $y = 160 - 2x$, the solution table is;

| | | | |
|---|---|---|---|
| x | 50 | 60 | 70 |
| y | 60 | 40 | 20 |

For $4x + 2y = 300$ or $y = (300 - 4x)/ 2$, the solution table is;

| | | | |
|---|---|---|---|
| x | 70 | 80 | 75 |
| y | 10 | -10 | 0 |

Note: Students can also represent these two equations graphically, by using the given points of x-coordinate and y-coordinate.

**Q.2: Half the perimeter of a rectangular garden, whose length is 4 m more than its width, is 36 m. Find the dimensions of the garden.**

**Solution:**

Given, half the perimeter of a rectangular garden = 36 m

so, $2(l + b)/2 = 36$

$(l + b) = 36$ ……….(1)
Given, the length is 4 m more than its width.

Let width = x

And length = x + 4

Substituting this in eq(1), we get;

x + x + 4 = 36
2x + 4 = 36
2x = 32
x = 16

Therefore, the width is 16 m and the length is 16 + 4 = 20 m.

**Q.3: On comparing the ratios $a_1/a_2$, $b_1/b_2$, and $c_1/c_2$, find out whether the following pair of linear equations are consistent, or inconsistent.**

**(i) 3x + 2y = 5 ; 2x – 3y = 7**

**(ii) 2x – 3y = 8 ; 4x – 6y = 9**

**Solution:**

(i) Given : 3x + 2y = 5 or 3x + 2y – 5 = 0
and 2x – 3y = 7 or 2x – 3y – 7 = 0

Comparing the above equations with $a_1x + b_1y + c_1=0$
And $a_2x + b_2y + c_2 = 0$
We get,
$a_1 = 3, b_1 = 2, c_1 = -5$
$a_2 = 2, b_2 = -3, c_2 = -7$

$a_1/a_2 = 3/2, b_1/b_2 = 2/-3, c_1/c_2 = -5/-7 = 5/7$
Since, $a_1/a_2 \neq b_1/b_2$ the lines intersect each other at a point and have only one possible solution.

Hence, the equations are consistent.

(ii) Given 2x – 3y = 8 and 4x – 6y = 9
Therefore,
$a_1 = 2, b_1 = -3, c_1 = -8$
$a_2 = 4, b_2 = -6, c_2 = -9$

$a_1/a_2 = 2/4 = 1/2, b_1/b_2 = -3/-6 = 1/2, c_1/c_2 = -8/-9 = 8/9$

Since, $a_1/a_2=b_1/b_2 \neq c_1/c_2$

Therefore, the lines are parallel to each other and they have no possible solution. Hence, the equations are inconsistent.

**Q.4: Solve the following pair of linear equations by the substitution method.**

**(i) $x + y = 14$**
**$x - y = 4$**

**(ii) $3x - y = 3$**
**$9x - 3y = 9$**

**Solution:**

(i) Given,
$x + y = 14$ and $x - y = 4$ are the two equations.
From 1st equation, we get,
$x = 14 - y$
Now, put the value of x in second equation to get,
$(14 - y) - y = 4$
$14 - 2y = 4$
$2y = 10$
Or $y = 5$
By the value of y, we can now find the value of x;
$\because x = 14 - y$
$\therefore x = 14 - 5$
Or $x = 9$
Hence, $x = 9$ and $y = 5$.

(ii) Given,
$3x - y = 3$ and $9x - 3y = 9$ are the two equations.
From 1st equation, we get,
$x = (3 + y)/3$
Now, substitute the value of x in the given second equation to get,
$9[(3 + y)/3] - 3y = 9$

$\Rightarrow 3(3+y) - 3y = 9$
$\Rightarrow 9 + 3y - 3y = 9$
$\Rightarrow 9 = 9$
Therefore, y has infinite values and since, $x = (3 + y)/3$, so x also has infinite values.

**Q.5: Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$.**

**Solution:**

$2x + 3y = 11$................................(i)
$2x - 4y = -24$.............................. (ii)
From equation (i), we get;
$x = (11 - 3y)/2$ ..........................................(iii)

Putting the value of x in equation (ii), we get

$2[(11 – 3y)/2] – 4y = −24$
$11 – 3y – 4y = -24$
$-7y = -35$
$y = 5$……………………………………(iv)
Putting the value of y in equation (iii), we get;

$x = (11 – 15)/2 = -4/2 = −2$
Hence, $x = -2$, $y = 5$
Also,
$y = mx + 3$
$5 = -2m +3$
$-2m = 2$
$m = -1$
Therefore, the value of m is -1.

**Q.6: The coach of a cricket team buys 7 bats and 6 balls for Rs.3800. Later, she buys 3 bats and 5 balls for Rs.1750. Find the cost of each bat and each ball.**
**Solution:**
Let the cost of a bat be x and the cost of a ball be y.
According to the question,
$7x + 6y = 3800$ ………………. (i)
$3x + 5y = 1750$ ………………. (ii)
From (i), we get;
$y = (3800 – 7x)/6$ …………………… (iii)
Substituting (iii) in (ii). we get,
$3x + 5[(3800 – 7x)/6] = 1750$
$\Rightarrow 3x + (9500/3) – (35x/6) = 1750$
$3x – (35x/6) = 1750 – (9500/3)$

$(18x – 35x)/6 = (5250 – 9500)/3$
$\Rightarrow -17x/6 = -4250/3$
$\Rightarrow -17x = -8500$
$x = 500$
Putting the value of x in (iii), we get;

$y = (3800 – 7 \times 500)/6 = 300/6 = 50$
Hence, the cost of a bat is Rs 500 and the cost of a ball is Rs 50.

**Q.7: A fraction becomes 9/11 if 2 is added to both the numerator and the denominator. If, 3 is added to both the numerator and the denominator it becomes 5/6. Find the fraction.**

**Solution:**
Let the fraction be x/y.

According to the question,
$(x + 2)/(y + 2) = 9/11$

$11x + 22 = 9y + 18$

$11x - 9y = -4$ ................. (1)
$(x + 3)/(y + 3) = 5/6$

$6x + 18 = 5y + 15$
$6x - 5y = -3$ ................... (2)
From (1), we get

$x = (-4 + 9y)/11$ ................. (3)

Substituting the value of x in (2), we get
$6[(-4 + 9y)/11] - 5y = -3$

$-24 + 54y - 55y = -33$
$-y = -9$
$y = 9$ ..................... (4)
Substituting the value of y in (3), we get
$x = (-4 + 81)/11 = 77/11 = 7$

Hence, the fraction is 7/9.

**Q.8 Form the pair of linear equations in the following problems, and find their solutions (if they exist) by the elimination method:**

**(i) Five years ago, Nuri was thrice as old as Sonu. Ten years later, Nuri will be twice as old as Sonu. How old are Nuri and Sonu?**
**Solution:**
Let us assume, the present age of Nuri be x.
And the present age of Sonu is y.
According to the given condition, we can write as;
$x - 5 = 3(y - 5)$
$x - 3y = -10$.........................................(1)
Now,
$x + 10 = 2(y + 10)$
$x - 2y = 10$...........................................(2)
Subtract eq. 1 from 2, to get,
$y = 20$ .................................................(3)

Substituting the value of y in eq.1, we get,
$x - 3(20) = -10$
$x - 60 = -10$
$x = 50$

Therefore,
The age of Nuri is 50 years
The age of Sonu is 20 years.

**(ii) A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid Rs.27 for a book kept for seven days, while Susy paid Rs.21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.**
**Solution:**

Let the fixed charge for the first three days be Rs. A and the charge for each day extra be Rs. B.
According to the information given,
A + 4B = 27 ………………………………………………………………… (i)
A + 2B = 21 …………………………………………………………………. (ii)
When equation (ii) is subtracted from equation (i) we get,
2B = 6
B = 3 …………………………………………………………………………(iii)
Substituting B = 3 in equation (i) we get,
A + 12 = 27
A = 15
Hence, the fixed charge is Rs. 15.
And the Additional charge per day is Rs. 3.

**Q.9: Solve the following pair of linear equations by the substitution and cross-multiplication methods:**
**8x + 5y = 9**
**3x + 2y = 4**

**Solution:**

8x + 5y = 9 …………………..(1)
3x + 2y = 4 …………………..(2)
From equation (2) we get;

x = (4 – 2y) / 3 ……………………. (3)
Substituting this value in equation 1, we get
8[(4 – 2y)/3] + 5y = 9
32 – 16y + 15y = 27
-y = -5
y = 5 ……………………………….(4)
Substituting this value in equation (2), we get
3x + 10 = 4

3x = -6
x = -2
Thus, x = -2 and y = 5.

Now, Using Cross Multiplication method:
$8x + 5y - 9 = 0$
$3x + 2y - 4 = 0$

$x/(-20 + 18) = y/(-27 + 32) = 1/(16 - 15)$
$-x/2 = y/5 = 1/1$
$\therefore x = -2$ and $y = 5$.

**Q.10: Formulate the following problems as a pair of equations, and hence find their solutions:**

**(i) Ritu can row downstream 20 km in 2 hours, and upstream 4 km in 2 hours. Find her speed of rowing in still water and the speed of the current.**

**Solution:**

(i) Let us consider,
Speed of boat is still water = x km/hr
Speed of current = y km/hr
Now, speed of Ritu, during,
Downstream = x + y km/hr
Upstream = x – y km/hr
As per the question given,
$2(x + y) = 20$
Or $x + y = 10$............................(1)
And, $2(x - y) = 4$
Or $x - y = 2$...........................(2)
Adding both the eq.1 and 2, we get,
$2x = 12$
$x = 6$
Putting the value of x in eq.1, we get,
$y = 4$
Therefore,

Speed of Ritu is still water = 6 km/hr
Speed of current = 4 km/hr

**Q.11: Solve the equations $x + 2y - 4 = 0$ and $2x + 4y - 12 = 0$ graphically.**

**Solution:**

Given,

$x + 2y - 4 = 0$....(i)

$2x + 4y - 12 = 0$....(ii)

From (i),

x + 2y = 4

2y = 4 – x

y = (4 – x)/2

| | | | |
|---|---|---|---|
| x | 0 | 2 | 4 |
| y | 2 | 1 | 0 |

From (ii),

2x + 4y = 12

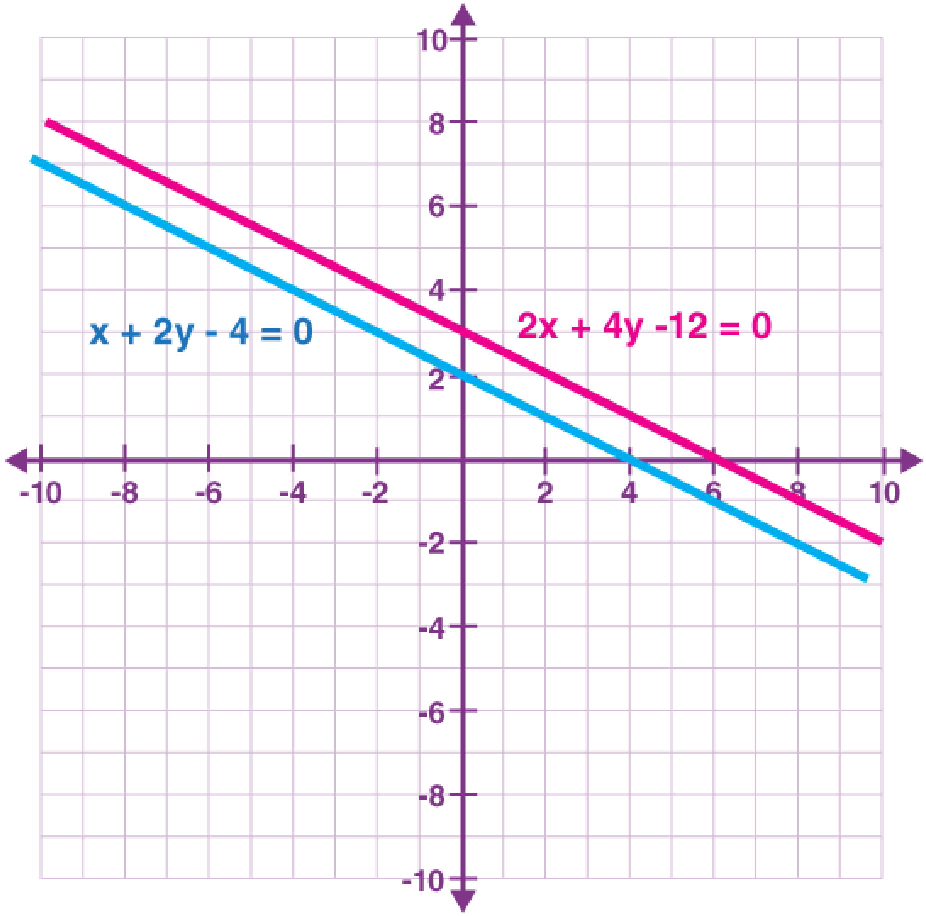
x + 2y = 6

2y = 6 – x

y = (6 – x)/2

| | | | |
|---|---|---|---|
| x | 0 | 2 | 4 |
| y | 3 | 2 | 1 |

Plotting the points on the graph, we get;




Here, the lines represent the given pair of linear equations are parallel.

Thus, there is no solution to the given pair of linear equations.

**Q.12: Find the value(s) of k so that the pair of equations x + 2y = 5 and 3x + ky + 15 = 0 has a unique solution.**

**Solution:**

Given,

$x + 2y = 5$

$3x + ky + 15 = 0$

Also, given that the pair of equations has a unique solution.

Comparing the given equations with standard form,

$a_1 = 1, b_1 = 2, c_1 = -5$

$a_2 = 3, b_2 = k, c_2 = 15$

Condition for unique solution is:

$a_1/a_2 \neq b_1/b_2$

$1/3 \neq 2/k$

$k \neq (2)(3)$

$k \neq 6$

Thus, for all real values of k except 6, the given pair of equations has a unique solution.

**Q.13: Determine graphically the coordinates of vertices of a triangle, the equation of whose sides are given by 2y – x = 8, 5y – x = 14 and y – 2x = 1.**

**Solution:**

Given,

$2y - x = 8$....(i)

$5y - x = 14$....(ii)

$y - 2x = 1$....(iii)

From (i),

$2y = x + 8$

$y = (x + 8)/2$

| | | | |
|---|---|---|---|
| x | -4 | 0 | 2 |
| y | 2 | 4 | 5 |

From (ii),

$5y = x + 14$

$y = (x + 14)/5$

| | | | |
|---|---|---|---|
| x | -4 | 1 | 6 |
| y | 2 | 3 | 4 |

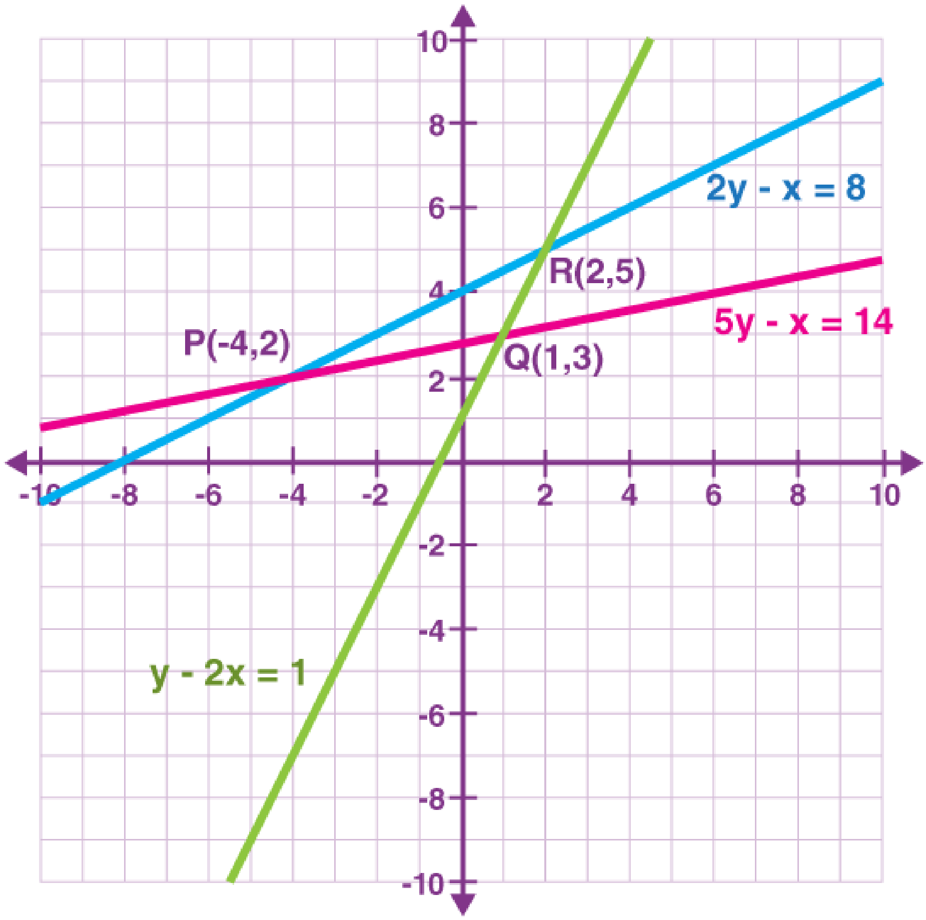
From (iii),

$y = 2x + 1$

| | | | |
|---|---|---|---|
| x | -1 | 1 | 2 |

| | | | |
|---|---|---|---|
| y | -1 | 3 | 5 |

Let us plot all these points on the graph.




From the graph, we can write the coordinates of vertices of triangle formed are:

P(-4, 2), Q(1, 3), and R(2, 5)

**Q.14: Use elimination method to find all possible solutions of the following pair of linear equation:**

**2x + 3y = 8**

**4x + 6y = 7**

**Solution:**

Given,

2x + 3y = 8....(i)

4x + 6y = 7....(ii)

Multiply Equation (1) by 2 and Equation (2) by 1 to make the coefficients of x equal.

$4x + 6y = 16$….(iii)

$4x + 6y = 7$….(iv)

Subtracting (iv) from (iii),

$4x + 6y – 4x – 6y = 16 – 7$

$0 = 9$, it is not possible

Therefore, the pair of equations has no solution.

**Q.15: Solve the following pairs of equations by reducing them to a pair of linear equations:**

**$1/2x + 1/3y = 2$**

**$1/3x + 1/2y = 13/6$**

**Solution:**

Given,

$1/2x + 1/3y = 2$

$1/3x + 1/2y = 13/6$

Let us assume $1/x = m$ and $1/y = n$ , then the equations will change as follows.

$m/2 + n/3 = 2$

$\Rightarrow 3m+2n-12 = 0$….(1)

$m/3 + n/2 = 13/6$

$\Rightarrow 2m+3n-13 = 0$….(2)

Now, using cross-multiplication method, we get,

$m/(-26-(-36) ) = n/(-24-(-39)) = 1/(9-4)$

$m/10 = n/15 = 1/5$

$m/10 = 1/5$ and $n/15 = 1/5$

So, $m = 2$ and $n = 3$

$1/x = 2$ and $1/y = 3$

$x = 1/2$ and $y = 1/3$