Linear equation Exercise 3,4 and 5

Question 1

Solve the following pair of linear equations by the substitution method.
(i) x + y = 14
x − y = 4
(ii) s − t = 3
s/3 + t/2 = 6
(iii) 3x − y = 3
9x − 3y = 9
(iv) 0.2x + 0.3y = 1.3
0.4x + 0.5y = 2.3
(v) √2x+ √3y = 0
√3x - √8y = 0
(vi) 3/2x - 5/3y = -2
x/3 + y/2 = 13/6

Answer

1	Method of elimination by substitution	1) Suppose the equation are $a_1x+b_1y+c_1=0$ $a_2x+b_2y+c_2=0$ 2) Find the value of variable of either x or y in other variable term in first equation 3) Substitute the value of that variable in second equation 4) Now this is a linear equation in one variable. Find the value of the variable 5) Substitute this value in first equation and get the second variable

(i) *x* + *y* = 14 ... (i)
x − *y* = 4 ... (ii)
From equation (i), we get

$x = 14 - y$

Putting this value in equation (ii), we get

$(14 - y) - y = 4$

$14 - 2y = 4$

$10 = 2y$

$y = 5$

Putting this in equation (i), we get

$x + 5 = 14$

$x = 9$

$x = 9$ and $y = 5$

(ii) $s - t = 3$ ... (i)
$s/3 + t/2 = 6$ ... (ii)
From equation (i), we get $s = t + 3$
Putting this value in equation (ii), we get
$t+3/3 + t/2 = 6$
$2t + 6 + 3t = 36$
$5t = 30$
$t = 30/5 = 6$
Putting in equation (i), we obtain
$s - 6 = 3$

$s = 9, t = 6$

(iii) $3x - y = 3$ ... (i)
$9x - 3y = 9$ ... (ii)
From equation (i), we get
$y = 3x - 3$.
Putting this value in equation (ii), we get
$9x - 3(3x - 3) = 9$
$9x - 9x + 9 = 9$
$9 = 9$
This is always true.
Hence, the given pair of equations has infinite possible solutions and the relation between these variables can be given by
$y = 3x - 3$
Therefore, one of its possible solutions is $x = 1$, $y = 0$.

(iv) $0.2x + 0.3y = 1.3$ ... (i)
$0.4x + 0.5y = 2.3$ ... (ii)

Solving equation (i), we get
$0.2x = 1.3 - 0.3y$
Dividing by 0.2, we get

$x = 1.3/0.2 - 0.3/0.2$
$x = 6.5 – 1.5y$
Putting the value in equation (ii), we get
$0.4x + 0.5y = 2.3$
$(6.5 – 1.5y) \times 0.4x + 0.5y = 2.3$
$2.6 – 0.6y + 0.5y = 2.3$
$-0.1y = 2.3 – 2.6$
$y = -0.3/-0.1$
$y = 3$
Putting this value in equation (i) we get
$x = 2$
$x = 2$ and $y = 3$

v)
Solving we get
x=0 and y=0

(vi) $3/2x - 5/3y = -2$ ... (i)
$x/3 + y/2 = 13/6$ ... (ii)
From equation (i), we get
$9x - 10y = -12$
$x = -12 + 10y/9$
Putting this value in equation (ii), we get
y=3
Putting this value of y we get
x=2
x=2, y=3

Question 2
Solve 2x + 3y = 11 and 2x - 4y = - 24 and hence find the value of 'm' for which y =mx + 3.

Answer

2x + 3y = 11 ... (i)
Subtracting 3y both side we get
2x = 11 – 3y … (ii)
Putting this value in equation second we get
2x – 4y = – 24
11- 3y – 4y = - 24
7y = - 24 – 11

-7y = - 35
y = - 35/-7
y = 5
Putting this value in equation (i) we get
2x + 3 × 5=11
2x = 11- 15
2x = - 4
Dividing by 2 we get
x = - 2
Putting the value of x and y
y = mx + 3.
5 = -2m +3
2m = 3 – 5
m = -2/2
m = -1

Question 3
Form the pair of linear equations for the following problems and find their solution by substitution method
(i) The difference between two numbers is 26 and one number is three times the other. Find them.

Answer

Let larger number = *x*
Smaller number = y
The difference between two numbers is 26
x – *y* = 26
x = 26 + *y*
Given that one number is three times the other
So *x* = 3*y*
Putting the value of *x* we get
26*y* = 3*y*
-2*y* = - 2 6
y = 13
So value of *x* = 3*y*
Putting value of *y*, we get
x = 3 × 13 = 39
Hence the numbers are 13 and 39.

(ii) The larger of two supplementary angles exceeds the smaller by 18 degrees. Find them.

Answer

Let first angle = *x*
And second number = *y*

As both angles are supplementary so that sum will 180
$x + y = 180$
$x = 180 - y$ ... (i)
Difference is 18 degrees so that
$x - y = 18$
Putting the value of x we get
$180 - y - y = 18$
$-2y = -162$
$y = -162/-2$
$y = 81$
Putting the value back in equation (i), we get
$x = 180 - 81 = 99$

the angles are 99^o and 81^o.

(iii) 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.

Answer

Let cost of each bat = Rs x
Cost of each ball = Rs y

Given that coach of a cricket team buys 7 bats and 6 balls for Rs 3800.
$7x + 6y = 3800$ ----(i)
$6y = 3800 - 7x$
Dividing by 6, we get
$y = (3800 - 7x)/6$

Given that she buys 3 bats and 5 balls for Rs 1750 later.
$3x + 5y = 1750$
Putting the value of y
$3x + 5((3800 - 7x)/6) = 1750$
Multiplying by 6, we get
$18x + 19000 - 35x = 10500$
$-17x = 10500 - 19000$
$-17x = -8500$
$x = -8500/-17$
$x = 500$
Putting this value in equation (i) we get
$6y = (3800 - 7 \times 500)$

$y = 300/6$
$y = 50$
So

cost of each bat = Rs 500 and cost of each balls = Rs 50.

(iv) The taxi charges in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is Rs 105 and for a journey of 15 km, the charge paid is Rs 155. What are the fixed charges and the charge per km? How much does a person have to pay for traveling a distance of 25 km?

Answer

Let the fixed charge for taxi = Rs x
And variable cost per km = Rs y
Total cost = fixed charge + variable charge
Given that for a distance of 10 km, the charge paid is Rs 105
$x + 10y = 105$ … (i)
$x = 105 - 10y$
Given that for a journey of 15 km, the charge paid is Rs 155
$x + 15y = 155$
Putting the value of x we get
$105 - 10y + 15y = 155$
$5y = 155 - 105$
$5y = 50$
$y = 50/5 = 10$
Putting this value in equation (i) we get
$x = 105 - 10 \times 10$
$x = 5$
People have to pay for traveling a distance of 25 km
$= x + 25y$
$= 5 + 25 \times 10$
$= 5 + 250$
$=255$

A person has to pay Rs 255 for 25 Km

(v) 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.

Answer

Let Numerator = x
Denominator = y
Fraction will = x/y
A fraction becomes 9/11, if 2 is added to both the numerator and the denominator
$(x + 2)/y+2 = 9/11$

By Cross multiplication, we get
$11x + 22 = 9y + 18$
Subtracting 22 both side, we get
$11x = 9y - 4$
Dividing by 11, we get
$x = 9y - 4/11$ … (i)
Given that 3 is added to both the numerator and the denominator it becomes 5/6.
If, 3 is added to both the numerator and the denominator it becomes 5/6
$(x+3)/y +3 = 5/6$ … (ii)
By Cross multiplication, we get
$6x + 18 = 5y + 15$
Subtracting the value of x, we get
$6(9y - 4)/11 + 18 = 5y + 15$
Subtract 18 both side we get
$6(9y - 4)/11 = 5y - 3$
$54 - 24 = 55y - 33$
$-y = -9$
$y = 9$
Putting this value of y in equation (i), we get
$x = 9y - 4$
11 … (i)
$x = (81 - 4)/77$
$x = 77/11$
$x = 7$

So our fraction is 7/9.

(vi) Five years hence, the age of Jacob will be three times that of his son. Five years ago, Jacob's age was seven times that of his son. What are their present ages?

Answer

Let present age of Jacob = x year
And present Age of his son is = y year
Five years hence,
Age of Jacob will = $x + 5$ year
Age of his son will = $y + 5$year
Given that the age of Jacob will be three times that of his son
$x + 5 = 3(y + 5)$
Adding 5 both side, we get

$x = 3y + 15 - 5$
$x = 3y + 10$ … (i)
Five years ago,
Age of Jacob will = x - 5 year
Age of his son will = y - 5 year
Jacob's age was seven times that of his son
$x - 5 = 7(y - 5)$
Putting the value of x from equation (i) we get
$3y + 10 - 5 = 7y - 35$
$3y + 5 = 7y - 35$
$3y - 7y = -35 - 5$
$-4y = -40$
$y = -40/-4$
$y = 10$ year
Putting the value of y in equation first we get
$x = 3 \times 10 + 10$
$x = 40$ years
Hence, Present age of Jacob = 40 years and present age of his son = 10 years.

Exercise 3.4

Question 1
Solve the following pair of linear equations by the elimination method and the substitution method:
(i) $x + y = 5$ and $2x - 3y = 4$
(ii) $3x + 4y = 10$ and $2x - 2y = 2$
(iii) $3x - 5y - 4 = 0$ and $9x = 2y + 7$
(iv) $x/2 + 2y/3 = -1$ and $x - y/3 = 3$

Answer

(i) $x + y = 5$ and $2x - 3y = 4$

By elimination method	**By substitution method**
$x + y = 5$ ... (i) $2x - 3y = 4$ ... (ii) Multiplying equation (i) by 2, we get $2x + 2y = 10$ ... (iii) $2x - 3y = 4$ ... (ii) Subtracting equation (ii) from equation (iii), we get $5y = 6$ $y = 6/5$ Putting the value in equation (i), we get $x = 5 - (6/5) = 19/5$	$x + y = 5$ ... (i) we get $x = 5 - y$ Putting the value of x in equation (ii) we get $2(5 - y) - 3y = 4$ $-5y = -6$ $y = -6/-5 = 6/5$ Putting the value of y in equation (i) we get $x = 5 - 6/5$

Hence, $x = 19/5$ and $y = 6/5$	$x = 19/5$ Hence, $x = 19/5$ and $y = 6/5$ again

(ii)
$3x + 4y = 10$
$2x - 2y = 2$

By elimination method	By substitution method
$3x + 4y = 10$ .... (i) $2x - 2y = 2$ ... (ii) Multiplying equation (ii) by 2, we get $4x - 4y = 4$ ... (iii) $3x + 4y = 10$ ... (i) Adding equation (i) and (iii), we get $7x + 0 = 14$ $x = 14/7 = 2$ Putting in equation (i), we get $3x + 4y = 10$ $3(2) + 4y = 10$ $6 + 4y = 10$ $y = 4/4 = 1$ Hence, answer is $x = 2$, $y = 1$	$3x + 4y = 10$ ... (i) Subtract $3x$ both side, we get $4y = 10 - 3x$ $y = (10 - 3x)/4$ Putting this value in equation (ii), we get $2x - 2y = 2$ ... (i) $2x - 2(10 - 3x)/4) = 2$ $8x - 2(10 - 3x) = 8$ $14x = 28$ $x = 28/14 = 2$ $y = (10 - 3x)/4$ $y = 4/4 = 1$ Hence, answer is $x = 2$, $y = 1$ again.

(iii) $3x - 5y - 4 = 0$
$9x = 2y + 7$

By elimination method	By substitution method
$3x - 5y - 4 = 0$ ---(i) $9x = 2y + 7$ ---(ii) Multiplying equation (i) by 3, we get	$3x - 5y = 4$ ... (i) $3x = 4 + 5y$ $x = (4 + 5y)/3$

$9x - 15y = 12$ ... (iii) $9x - 2y = 7$ ... (ii) Subtracting equation (ii) from equation (iii), we get $-13y = 5$ $y = -5/13$ Putting value in equation (i), we get $3x - 5y = 4$ $3x - 5(-5/13) = 4$ $x = 27/39 = 9/13$ Hence our answer is $x = 9/13$ and $y = -5/13$	Putting this value in equation (ii) we get $9x - 2y = 7$ $9((4 + 5y)/3) - 2y = 7$ Solve it we get $3(4 + 5y) - 2y = 7$ $12 + 15y - 2y = 7$ $13y = -5$ $y = -5/13$ Putting this value in equation (i) $x = 9/13$ Hence we get $x = 9/13$ and $y = -5/13$ again.

(iv) $x/2 + 2y/3 = -1$

$x - y/3 = 3$

By elimination method	**By substitution method**
$x/2 + 2y/3 = -1$ ... (i) $x - y/3 = 3$ ... (ii) Multiplying equation (i) by 2, we get $x + 4y/3 = -2$ ... (iii) $x - y/3 = 3$ ... (ii) Subtracting equation (ii) from equation (iii), we get $5y/3 = -5$ $y = -15/5$ $y = -3$ Putting this value in equation (ii), we get $x - (-3)/3 = 3$ $x = 2$ Hence our answer is $x = 2$ and $y = -3$.	$x - y/3 = 3$ ... (ii) Add $y/3$ both side, we get $x = 3 + y/3$ ... (iv) Putting this value in equation (i) we get $x/2 + 2y/3 = -1$ ... (i) $(3 + y/3)/2 + 2y/3 = -1$ $3/2 + y/6 + 2y/3 = -1$ Multiplying by 6, we get $9 + y + 4y = -6$ $5y = -15$ $y = -3$ Hence our answer is $x = 2$ and $y = -3$.

Question 2
Form the pair of linear equations in the following problems, and find their solutions (if they exist) by the elimination method:

(i) If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It becomes 1/2 if we only add 1 to the denominator. What is the fraction?

(ii) 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?

(iii) The sum of the digits of a two-digit number is 9. Also, nine times this number is twice the number obtained by reversing the order of the digits. Find the number.

(iv) Meena went to bank to withdraw Rs 2000. She asked the cashier to give her Rs 50 and Rs 100 notes only. Meena got 25 notes in all. Find how many notes of Rs 50 and Rs 100 she received.

(v) 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.

Answer

(i) Let the fraction be x/y
According to the question
$(x + 1)/ (y - 1) = 1$
$x - y = -2$ ... (i)
$x/y+1 = 1/2$
$2x - y = 1$ ... (ii)
Subtracting equation (i) from equation (ii), we get
$x = 3$
Putting this value in equation (i), we get
$3 - y = -2$
$-y = -5$
$y = 5$
So the fraction is 3/5

(ii) Let present age of Nuri = x
and present age of Sonu = y
According to the given information

$(x - 5) = 3(y - 5)$
$x - 3y = -10$ ... (i)
$(x + 10y) = 2(y + 10)$
$x - 2y = 10$ ... (ii)
Subtracting equation (i) from equation (ii), we get
$y = 20$
Putting this value in equation (i), we get
$x - 60 = -10$
$x = 50$
age of Nuri = 50 years and age of Sonu = 20 years.

(iii) Let the unit digit and tens digits of the number be x and y respectively.
Then, number = $10y + x$
Number after reversing the digits = $10x + y$
According to the question,
$x + y = 9$ ... (i)
$9(10y + x) = 2(10x + y)$
$88y - 11x = 0$
$- x + 8y = 0$ ... (ii)
Adding equation (i) and (ii), we get
$9y = 9$
$y = 1$
Putting the value in equation (i), we get
$x = 8$
Hence, the number is $10y + x = 10 \times 1 + 8 = 18$.
The number is 18

(iv) Let the number of Rs 50 notes and Rs 100 notes be x and y respectively.
According to the question,
$x + y = 25$ ... (i)
$50x + 100y = 2000$ ... (ii)
Multiplying equation (i) by 50, we get
$50x + 50y = 1250$ ... (iii)
Subtracting equation (iii) from equation (ii), we get
$50y = 750$
$y = 15$
Putting this value in equation (i), we have $x = 10$
Hence, Meena has 10 notes of Rs 50 and 15 notes of Rs 100.

(v) Let the fixed charge for first three days and each day charge thereafter be Rs x and Rs y respectively.
According to the question,
$x + 4y = 27$ ... (i)
$x + 2y = 21$ ... (ii)

Subtracting equation (ii) from equation (i), we get
$2y = 6$
$y = 3$
Putting in equation (i), we get
$x + 12 = 27$
$x = 15$

fixed charge = Rs 15 and Charge per day = Rs 3

Exercise 3.5

Question 1
Which of the following pairs of linear equations has unique solution, no solution or infinitely many solutions? In case there is a unique solution, find it by using cross multiplication method.

(i) $x - 3y - 3 = 0$
$3x - 9y - 2 = 0$
(ii) $2x + y = 5$
$3x + 2y = 8$
(iii) $3x - 5y = 20$
$6x - 10y = 40$
(iv) $x - 3y - 7 = 0$
$3x - 3y - 15 = 0$

Answer

Simultaneous pair of Linear equation	**Condition**	**Algebraic interpretation**
$a_1x+b_1y+c_1=0$ $a_2x+b_2y+c_2=0$	$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	One unique solution only.
$a_1x+b_1y+c_1=0$ $a_2x+b_2y+c_2=0$	$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Infinite solution.
$a_1x+b_1y+c_1=0$ $a_2x+b_2y+c_2=0$	$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	No solution

(i) $x - 3y - 3 = 0$

$3x - 9y - 2 = 0$

$a_1/a_2 = 1/3$

$b_1/b_2 = -3/-9 = 1/3$ and

$c_1/c_2 = -3/-2 = 3/2$

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

So Third case

Therefore, the given sets of lines are parallel to each other. Therefore, they will not intersect each other and thus, there will not be any solution for these equations.

(ii) $2x + y = 5$

$3x + 2y = 8$

$a_1/a_2 = 2/3$

$b_1/b_2 = 1/2$ and

$c_1/c_2 = -5/-8 = 5/8$

$a_1/a_2 \neq b_1/b_2$

So case 1

Therefore, they will intersect each other at a unique point and thus, there will be a unique solution for these equations.

By cross-multiplication method,

$x/(b_1c_2-b_2c_1) = y/(c_1a_2-c_2a_1) = 1/(a_1b_2-a_2b_1)$

$x/(-8+10) = y/(-15+16) = 1/(4-3)$

$x/2 = y/1 = 1$

$x/2 = 1,\ y/1 = 1$

$x = 2,\ y = 1$

(iii) $3x - 5y = 20$

$6x - 10y = 40$

$a_1/a_2 = 3/6 = 1/2$

$b_1/b_2 = -5/-10 = 1/2$ and

$c_1/c_2 = -20/-40 = 1/2$

$a_1/a_2 = b_1/b_2 = c_1/c_2$

So case 2

Therefore, the given sets of lines will be overlapping each other i.e., the lines will be coincident to each other and thus, there are infinite solutions possible for these equations.

(iv) $x - 3y - 7 = 0$

$3x - 3y - 15 = 0$

$a_1/a_2 = 1/3$

b_1/b_2 = -3/-3 = 1 and
c_1/c_2 = -7/-15 = 7/15
$a_1/a_2 \neq b_1/b_2$
So case 1
Therefore, they will intersect each other at a unique point and thus, there will be a unique solution for these equations.

By cross-multiplication,
$x/(b_1c_2-b_2c_1) = y/(c_1a_2-c_2a_1) = 1/(a_1b_2-a_2b_1)$
x/45-(21) = y/-21-(-15) = 1/-3-(-9)
x/24 = y/-6 = 1/6
x/24 = 1/6 and y/-6 = 1/6
x = 4 and y = -1

x = 4, y = -1

Question 2
(i) For which values of a and b does the following pair of linear equations have an infinite number of solutions?
$2x + 3y = 7$
$(a - b)x + (a + b)y = 3a + b - 2$

Answer
Converting them into format
$a_1x+b_1y+c_1=0$

$a_2x+b_2y+c_2=0$

2x + 3y -7 = 0
(a – b)x + (a + b)y - (3a +b –2) = 0
a_1/a_2 = 2/(a-b)
b_1/b_2 = -3/(a+b) and
c_1/c_2 = -7/-(3a+b-2) = 7/(3a+b-2)
For infinitely many solutions,
$a_1/a_2 = b_1/b_2 = c_1/c_2$

2/(a-b) = 7/(3a+b-2)
a - 9b = -4 ... (i)

2/(a-b) = 3/a+b
2a + 2b = 3a - 3b
a - 5b = 0 ... (ii)

Subtracting equation (i) from (ii), we get
4b = 4
b = 1

Putting this value in equation (ii), we get
a - 5 × 1 = 0
a = 5
Hence, a = 5 and b = 1 are the values for which the given equations give infinitely many solutions.

(ii) For which value of k will the following pair of linear equations have no solution?
$3x + y = 1$
$(2k - 1)x + (k - 1)y = 2k + 1$

Answer

$3x + y - 1 = 0$
$(2k - 1)x + (k - 1)y - (2k + 1) = 0$
$a_1/a_2 = 3/2k-1$
$b_1/b_2 = 1/k-1$ and
$c_1/c_2 = -1/-2k-1 = 1/2k+1$
For no solutions,
$a_1/a_2 = b_1/b_2 \neq c_1/c_2$
$3/2k-1 = 1/k-1 \neq 1/2k+1$
$3/2k-1 = 1/k-1$
$3k - 3 = 2k - 1$
$k = 2$
Hence, for $k = 2$, the given equation has no solution.

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

Answer

Substitution	**Cross-multiplication**
$8x + 5y = 9$ ... (i) $3x + 2y = 4$ ... (ii) From equation (ii), we get $x = 4-2y/3$ Putting this value in equation (i), we get $8(4-2y/3) + 5y = 9$ $32 - 16y + 15y = 27$ $-y = -5$ $y = 5$ Putting this value in equation (ii), we get $3x + 10 = 4$	$8x + 5y - 9 = 0$ $3x + 2y - 4 = 0$ By cross-multiplication, $x/(b_1c_2-b_2c_1) = y/(c_1a_2-c_2a_1) = 1/(a_1b_2-a_2b_1)$ $x/-20-(-18) = y/-27-(-32) = 1/16-15$ $x/-2 = y/5 = 1/1$ $x/-2 = 1$ and $y/5 = 1$ $x = -2$ and $y = 5$

$x = -2$ Hence, $x = -2$, $y = 5$	

Question 4
Form the pair of linear equations in the following problems and find their solutions (if they exist) by any algebraic method:

(i) A part of monthly hostel charges is fixed and the remaining depends on the number of days one has taken food in the mess. When a student A takes food for 20 days she has to pay Rs 1000 as hostel charges whereas a student B, who takes food for 26 days, pays Rs 1180 as hostel charges. Find the fixed charges and the cost of food per day.

Answer

Let x be the fixed charge of the food and y be the charge for food per day.

According to the question,
$x + 20y = 1000$ ... (i)
$x + 26y = 1180$ ... (ii)
Subtracting equation (i) from equation (ii), we get
$6y = 180$
$y = 180/6 = 30$
Putting this value in equation (i), we get
$x + 20 \times 30 = 1000$
$x = 1000 - 600$
$x = 400$

So fixed charge = Rs 400 and charge per day = Rs 30

(ii) A fraction becomes 1/3 when 1 is subtracted from the numerator and it becomes 1/4 when 8 is added to its denominator. Find the fraction.

Answer

Let the fraction be x/y
According to the question,

$x-1/y = 1/3$

$\Rightarrow 3x - y = 3$... (i)

$x/y+8 = 1/4$

$\Rightarrow 4x - y = 8$ ... (ii)

Subtracting equation (i) from equation (ii), we get

$x = 5$

Putting this value in equation (i), we get

$15 - y = 3$

$y = 12$

Hence, the fraction is 5/12.

(iii) Yash scored 40 marks in a test, getting 3 marks for each right answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each incorrect answer, then Yash would have scored 50 marks. How many questions were there in the test?

Answer

Let the number of right answers and wrong answers be x and y respectively.

According to the question,

$3x - y = 40$ ... (i)

$4x - 2y = 50$

$\Rightarrow 2x - y = 25$ ... (ii)

Subtracting equation (ii) from equation (i), we get

$x = 15$

Putting this value in equation (ii), we get

$30 - y = 25$

$y = 5$

Therefore, number of right answers = 15

And number of wrong answers = 5

Total number of questions = 20

(iv) Places A and B are 100 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 5 hours. If they travel towards each other, they meet in 1 hour. What are the speeds of the two cars?

Answer

Let the speed of 1st car and 2nd car be u km/h and v km/h.
Respective speed of both cars while they are travelling in same direction = (u - v) km/h
Respective speed of both cars while they are travelling in opposite directions i.e., travelling towards each other = (u + v) km/h
According to the question,
$5(u - v) = 100$
$\Rightarrow u - v = 20$ ... (i)
$1(u + v) = 100$ ... (ii)
Adding both the equations, we get
$2u = 120$
$u = 60$ km/h
Putting this value in equation (ii), we obtain
$v = 40$ km/h

Hence, speed of one car = 60 km/h and speed of other car = 40 km/h

(v) The area of a rectangle gets reduced by 9 square units, if its length is reduced by 5 units and breadth is increased by 3 units. If we increase the length by 3 units and the breadth by 2 units, the area increases by 67 square units. Find the dimensions of the rectangle.

Answer

Let length and breadth of rectangle be x unit and y unit respectively.
Area = xy
According to the question,
$(x - 5)(y + 3) = xy - 9$
$\Rightarrow 3x - 5y - 6 = 0$ ... (i)
$(x + 3)(y + 2) = xy + 67$
$\Rightarrow 2x - 3y - 61 = 0$ ... (ii)
By cross multiplication, we get
$x/305-(-18) = y/-12-(-183) = 1/9-(-10)$
$x/323 = y/171 = 1/19$
$x = 17, y = 9$

Hence, the length of the rectangle = 17 units and breadth of the rectangle = 9 unit