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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) $\frac{x}{2}+\frac{2y}{3}= -1$ ***and*** $x-\frac{y}{3}=3$

Solutions:

(i) x + y = 5 and 2x – 3y = 4

By the method of elimination.

x + y = 5 …….. (i)

2x – 3y = 4 ……..(ii)

When the equation (i) and is multiplied by 2, we get

2x + 2y = 10 ……(iii)

When the equation (ii) is subtracted from (iii) we get,

5y = 6

y = $\frac{6}{5}$ ……(iv)

Substituting the value of y in eq. (i) we get,

x=5–$\frac{6}{5}=\frac{19}{5}$

∴x = $\frac{19}{5}$**, y =** $\frac{6}{5}$

By the method of substitution.

From the equation (i), we get:

x = 5 – y…….. (v)

When the value is put in equation (ii) we get,

2(5 – y) – 3y = 4

-5y = -6

y = $\frac{6}{5}$

When the values are substituted in equation (v), we get:

x = 5–$\frac{6}{5}=\frac{19}{5}$

$\therefore x = \frac{19}{5}, y = \frac{6}{5}$

(ii) 3x + 4y = 10 and 2x – 2y = 2

By the method of elimination.

3x + 4y = 10……(i)

2x – 2y = 2 …… (ii)

When the equation (i) and (ii) is multiplied by 2, we get:

4x – 4y = 4 ……..(iii)

When the Equation (i) and (iii) are added, we get:

7x = 14

x = 2 ……(iv)

Substituting equation (iv) in (i) we get,

6 + 4y = 10

4y = 4

y = 1

Hence, x = 2 and y = 1

By the method of Substitution

From equation (ii) we get,

x = 1 + y…… (v)

Substituting equation (v) in equation (i) we get,

3(1 + y) + 4y = 10

7y = 7

y = 1

When y = 1 is substituted in equation (v) we get,

A = 1 + 1 = 2

Therefore, A = 2 and B = 1

(iii) 3x – 5y – 4 = 0 and 9x = 2y + 7

By the method of elimination:

3x – 5y – 4 = 0 …… (i)

9x = 2y + 7

9x – 2y – 7 = 0 ……(ii)

When the equation (i) and (iii) is multiplied we get,

9x – 15y – 12 = 0 ……(iii)

When the equation (iii) is subtracted from equation (ii) we get,

13y = -5

$y = -\frac{5}{13}$ ……(iv)

When equation (iv) is substituted in equation (i) we get,

$3x + \frac{25}{13} - 4 = 0$

$x = \frac{27}{13}$

$x = \frac{9}{13}$

$\therefore x = \frac{9}{13}$ **and** $y = -\frac{5}{13}$

By the method of Substitution:

From the equation (i) we get,

$x = \frac{5y+4}{3}$ …… (v)

Putting the value (v) in equation (ii) we get,

$9(\frac{5y+4}{3}) - 2y - 7 = 0$

13y = -5

$y = -\frac{5}{13}$

Substituting this value in equation (v) we get,

$x = \frac{5\left(-\frac{5}{13}\right)+4}{3}$

$x = \frac{9}{13}$

$\therefore x = \frac{9}{13}, y = -\frac{5}{13}$

(iv) $\frac{x}{2} + \frac{2y}{3} = -1$ ***and*** $x - \frac{y}{3} = 3$

By the method of Elimination.

3x + 4y = -6 …… (i)

$x - \frac{B}{3} = 3$

3x – B = 9 ……(ii)

When the equation (ii) is subtracted from equation (i) we get,

-5y = -15

y = 3 ……(iii)

When the equation (iii) is substituted in (i) we get,

3x – 12 = -6

3x = 6

x = 2

Hence, x = 2 , y = -3

By the method of Substitution:

From the equation (ii) we get,

$x = \frac{B+9}{3}$ ……(v)

Putting the value obtained from equation (v) in equation (i) we get,

$3(\frac{B+9}{3}) + 4y = -6$

5y = -15

y = -3

When y = -3 is substituted in equation (v) we get,

$x = \frac{-3+9}{3} = 2$

Therefore, x = 2 and y = -3

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 $\frac{1}{2}$ if we only add 1 to the denominator. What is the fraction?

Solutions:

Let the fraction be a/b

According to the given information,

$\frac{a+1}{b-1} = 1$ => a – b = -2 ……..(i)

$\frac{a}{b+1} = \frac{1}{2} \Rightarrow 2a - b = 1$ ……(ii)

When equation (i) is subtracted from equation (ii) we get,

a = 3 ……..(iii)

When a = 3 is substituted in equation (i) we get,

3 – b = -2

-b = -5

b = 5

Hence, the fraction is 3/5.

(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?

Solutions:

Let us assume, present age of Nuri is x

And 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,

Age of Nuri is 50 years

Age of Sonu is 20 years.

(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.

Solutions: Let the unit digit and tens digit of a number be x and y respectively.

Then, Number (n) = 10B + A

N after reversing order of the digits = 10A + B

According to the given information, A + B = 9…….(i)

9(10B + A) = 2(10A + B)

88 B – 11 A = 0

-A + 8B = 0 …….. (ii)

Adding the equations (i) and (ii) we get,

9B = 9

B = 1…….(3)

Substituting this value of B, in the equation (i) we get A= 8

Hence the number (N) is 10B + A = 10 x 1 +8 = 18

(iv) Meena went to a 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.

Solutions: Let the number of Rs.50 notes be A and the number of Rs.100 notes be B

According to the given information,

A + B = 25 …….. (i)

50A + 100B = 2000 ……(ii)

When equation (i) is multiplied with (ii) we get,

50A + 50B = 1250 ……..(iii)

Subtracting the equation (iii) from the equation (ii) we get,

50B = 750

B = 15

Substituting in the equation (i) we get,

A = 10

Hence, Manna has 10 notes of Rs.50 and 15 notes of Rs.100.

(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.

Solutions: 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 Charge per day is Rs.3/-.