Exercise 3.4

1. Solve the following pair of linear equations by the elimination method and the substitution method :-

i, $x+y=5$

$2x-3y=4$

elimination method:-

put $x+y=5$ — ① and $2x-3y=4$ — ②

To eliminate x, multiply eqn ① by 2 and eqn ② by 1 and subtract eqn ② from ①

$x+y=5$ — ① $\times 2$ $\Rightarrow$ $2x+2y=10$

$2x-3y=4$ — ② $\times 1$ $\Rightarrow$ $-(2x-3y=4)$

$0+5y=6$

$y=6/5$

Substitute this value of y in eqn ①,

$x+y=5$

$x+\frac{6}{5}=5$

$x=5-6/5$

$x=\frac{25-6}{5}=\frac{19}{5}$.

therefore,

$x=\frac{19}{5}$ and $y=\frac{6}{5}$

Substitution method :-

$x+y=5$ — ①

$2x-3y=4$ — ②

from ①, $x+y=5$

$x=5-y$ — ③

Substitute this value of x in eqn ②.

$2(5-y)-3y=4$

$10-2y-3y=4$

$10-4=5y$

$6=5y$

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

Substitute y-value in eqn ③

$x=5-y$

$x=5-6/5$

$x=\frac{25-6}{5}$

$$\boxed{x=\frac{19}{5}}$$

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

The values obtained in elimination method and substitution method are same. So, these are correct.

ii, $3x+4y=10$

$2x-2y=2$

Elimination method

To put $3x+4y=10$ — ① and $2x-2y=2$ — ②

To eliminate y, multiply 1st eqn by 1 and 2nd eqn by 2 and add both the equations.

$3x+4y=10 \rightarrow ① \times 1 \Rightarrow 3x+4y=10$

$2x-2y=2 \rightarrow ② \times 2 \Rightarrow +(4x-4y=4)$

$7x = 14$

$\therefore \boxed{x=2}$

Substitute this value of x in eqn ②

$2(x)-2y=2$

$2(2)-2y=2$

$4-2y=2$

$2=2y$

$1=y \quad \therefore \boxed{y=1}$

Therefore, $x=2$ and $y=1$

Substitution method

$3x+4y=10$ — ①

$2x-2y=2$ — ② Divide this equation by 2 on both the sides.

$\frac{2(x-y)}{2} = \frac{2}{2}$ $\quad x-y=1$ — ②

from ② $x-y=1$

$\boxed{x=1+y}$ — ③

Substitute this x value in 1st eqn.

$3x+4y=10 \Rightarrow 3(1+y)+4y=10 \Rightarrow 3+3y+4y=10$

$3+7y=10$

$7y=10-3$

$7y=7$

$\boxed{y=1}$

put this value of y in ③

$x=1+y.$

$x=1+1=2$

$\boxed{x=2}$

Therefore,

$x=2$ and $y=1$

These answers are same as those which we got in elimination method.

So, these are correct.

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

$3x-5y-4=0$ — ① $\Rightarrow$ $3x-5y=4$ — ①

$9x=2y+7$ — ② $\Rightarrow$ $9x-2y=7$ — ②

Elimination method.

To eliminate x, multiply 1st eqn by 3, and 2nd eqn by 1. and subtract eqn ② from ①

$3x-5y=4$ — ① $\times 3$ $\Rightarrow$ $9x-15y=12$

$9x-2y=7$ — ② $\times 1$ $\Rightarrow$ $-(9x-2y=7)$

$0-13y=5$

$$y=-5/13$$

put $y=-5/13$ in eqn ①

$$3x-5(-5/13)=4$$

$$3x+25/13=4$$

$$3x=4-25/13$$

$$3x=\frac{27-9}{13}$$

$$x=9/13$$

therefore $x=9/13$, $y=-5/13$.

Substitution method

$3x - 5y = 4$ — ①

$9x - 2y = 7$ — ②

from ①,

$3x = 4 + 5y$.

$$\boxed{x = \frac{4+5y}{3}} \quad -③$$

Substitute this value of x, in eqn 2.

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

$$3(4+5y) - 2y = 7$$

$$12 + 15y - 2y = 7$$

$$13y = -5$$

$$\boxed{y = -5/13}$$

Therefore,
$x = 9/13$, $y = -5/13$
(Same values as in elimination method)

put y value in eqn ③

$$x = \frac{4 + 5(-5/13)}{3} = \frac{\frac{52 - 25}{13}}{3}$$

$$= \frac{27}{13 \times 3} = 9/13$$

$$\boxed{x = 9/13}$$

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

$\downarrow$ $\downarrow$

$\frac{3x + 4y}{6} = -61$, $\frac{3x - y}{3} = 3$

$3x + 4y = -6 \rightarrow (1)$ $3x - y = 9 \rightarrow (2)$

Elimination method:-

Subtract equation (2) from (1).

$$3x + 4y = -6$$
$$-(3x - y = 9)$$
$$0 + 5y = -15$$

$$\boxed{y = -3}$$

put y value in eqn (2)

$$3x - (-3) = 9$$
$$3x + 3 = 9$$
$$3x = 6$$
$$\boxed{x = 2}$$

Therefore,

$x = 2$ and $y = -3$

Substitution method

from (2), $3x - y = 9$

$\Rightarrow 3x = 9 + y \rightarrow (3)$

$\Rightarrow x = \frac{9+y}{3} \rightarrow (3)$

put (3) in (1)

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

$9 + 5y = -6$

$5y = -15$

$\boxed{y = -3}$

Sub $y = -3$ in eqn (3)

$x = \frac{9 + (-3)}{3} = \frac{9-3}{3}$

$x = 6/3 = 2$

So, $\boxed{x = 2}$ and

$\boxed{y = -3}$

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 $1/2$, if we only add 1 to the denominator. What is the fraction?

A) Let the fraction be x/y.

• After adding 1 to the numerator and subtracting 1 from the denominator, fraction reduces to 1.

('reduces to' means it becomes)

$$\frac{x+1}{y-1} = 1$$

$$x+1 = (y-1)1$$

$$x+1 = y-1$$

$$\boxed{x-y = -2} \quad -(1)$$

Adding 1, only to the denominator, it becomes $1/2$;

$$\frac{x}{y+1} = 1/2$$

$$2x = y+1$$

$$\boxed{2x-y = 1} \quad -(2)$$

Now let us eliminate y.

So, subtract eqn ② from ①.

$$x - y = -2$$
$$-(2x - y = 1)$$
$$-x + 0 = -3$$
$$-x = -3$$
$$\boxed{x = 3} \checkmark$$ put this in eqn ①.

$$x - y = -2$$
$$3 - y = -2$$
$$-y = -5$$
$$\boxed{y = 5}$$

therefore, the fraction required is $\boxed{3/5}$

ii, five years ago, Nuri was three times as old as Sonu. Ten years later, Nuri will be twice as old as sonu. How old are Nuri and Sonu?

A) let present ages of Nuri and Sonu be x and y.

Their ages 5 years ago $\Rightarrow$ $x-5$, $y-5$ Respectively.

Their ages after 10 years $\Rightarrow$ $x+10$, $y+10$ Respectively.

5 years ago, Nuri was 3 times as old as sonu.

$$\Rightarrow x-5 = 3(y-5)$$

$$x-5 = 3y-15$$

$$\boxed{x-3y=-10} \quad -(1)$$

10 years later, Nuri will be twice as old as Sonu.

$$\Rightarrow x+10 = 2(y+10)$$

$$x+10 = 2y+20$$

$$\boxed{x-2y = 10} \quad -(2)$$

To eliminate x, subtract eqn (2) from (1)

$$x-3y = -10$$

$$-(x-2y = 10)$$

$$0-y = -20$$

$$-y = -20$$

$$\boxed{y = 20}$$

put $y = 20$ in eqn (2).

$x - 2(20) = 10$

$x - 40 = 10$

$\boxed{x = 50}$

So, their present ages that of Nuri and Sonu are 50 and 20 respectively.

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

A) Let the ~~Num~~ digits be x and y.

given, sum of the digits $\boxed{x + y = 9}$ — (1)

The number ~~formed~~ $\Rightarrow 10x + y$.

Number ~~formed~~ by reversing the order of digits is $10y + x$.

Given ~~Actual nu~~ $9(10x + y) = 2(10y + x)$

$90x + 9y = 20y + 2x$

$88x = 11y$

$8x = y$.

$\boxed{8x - y = 0}$ — (2)

Add equations ① and ②

$$\begin{array}{r} x + y = 9 \\ +(8x - y = 0) \\ \hline 9x = 9 \end{array}$$

$$\boxed{x = 1}$$

put $x = 1$ in eqn ①.

$$x + y = 9$$
$$1 + y = 9$$
$$y = 9 - 1$$
$$\boxed{y = 8}$$

So, the actual number is $10x + y$

$$\Rightarrow 10(1) + 8$$
$$\Rightarrow 10 + 8 = \boxed{18}$$

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.

Ag let number of Rs.50 notes received by Meena = x.

let number of Rs.100 notes received by Meena = y.

Given, total number of notes = $\boxed{x+y=25}$ — (1)

Money made by x Rs.50 Notes = 50x Rs.

Money made by y Rs.100 Notes = 100y Rs.

Total Money $50x + 100y = 2000$

$50(x+2y) = 2000$

$x+2y = \frac{2000}{50}$

$\boxed{x+2y = 40}$ — (2)

Subtract eqn (2) from (1). to eliminate x.

$x+y=25$

$-(x+2y=40)$

$0+y=+15$

$\boxed{y=15}$

$y=15$, substitute in eqn (1)

$x+15=25$

$\boxed{x=10}$.

So, Rs 50 notes received

Therefore,

Number of Rs.50 notes received are 10.

Number of Rs.100 notes received are 15.

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.

~~A) let the fixed charge per day be Rs x.~~

Ans) let the fixed charge for first three days be x.

let the ~~extra~~ charge for each extra day be y.

In case of Saritha, for three days = Rs. x

for other four days = Rs. 4y

total $\Rightarrow$ $\boxed{x + 4y = 27}$ — (1)

In case of susy, for first three days $\Rightarrow$ Rs. x

for other two days $\Rightarrow$ Rs. 2y

total $\Rightarrow$ $\boxed{x + 2y = 21}$ — (2)

Subtract eqn ② from ①

$$x + 4y = 27$$
$$-(x + 2y = 21)$$
$$0 + 2y = 6$$

$$y = 6/2$$

- $\boxed{y = 3}$ — charge for each extra day.

put y value in eqn ②.

$$x + 2y = 21$$
$$x + 2(3) = 21$$
$$x = 21 - 6$$

- $\boxed{x = 15}$ — fixed charge for first three days.

Therefore, fixed charge for first 3 days is Rs. 15.

charge for each extra day is Rs. 3