SHIKSHA CLASSES

Sub. : Maths. **Answer Paper** **Total Marks : 30**

Std. X **(CBSE)** **3 : Linear Equations in two Variables.**

Section : A (Each 1 Mark)

Multiple choice Questions (MCQs).

Q.1 : The pairs of equations x + 2y – 5 = 0 and – 4x – 8y + 20 = 0 have:

Ans : c) Infinitely many solutions

Q.2 : If a pair of linear equations is consistent, then the lines are:

Ans : d) Intersecting or coincident

Q.3 : If the lines 3x + 2ky – 2 = 0 and 2x + 5y + 1 = 0 are parallel, then what is the value of k?

Ans : b) $\frac{15}{4}$

Q.4 : The pair of equations x= 0 and y = 0 represents.....

Ans : c) Intersecting lines and are perpendicular

Q.5 : The age of a son is one third the age of his mother. If the present age of mother is x years, then the age of the son after 12 years is

Ans : a) $\frac{x}{3}+12$

Q.6 : The point of intersection of the lines x – 2 = 0 and y + 6 = 0 is

Ans : d) (2, –6)

Q.7 : The pair of equations x + y = 0 and x + y = –7 has

Ans : d) no solutions

Q.8 : If $ad \neq bc$, **then the pair of linear equations ax + by = p and cx + dy = q has .....**

Ans : c) unique solution

Q.9 : The pair of linear equations 3x + 5y = 3, 6x + ky = 8 does not have a solution if

Ans : b) k = 10

For question number 10 to 11 two statements are given one labeled Assertion and other labeled Reason select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below

Q.10 : Assertion: The graph of the linear equations 3x+2y=12 and 5x-2y=4 gives a pair of intersecting lines.

Reason: The graph of linear equations $a_1x + b_1y + c_1 = 0$ **and** $a_2x + b_2y + c_2 = 0$ **gives** a pair of intersecting lines if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Ans : a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Q.11 : Assertion: A pair of linear equations has no solution (s) if it is represented by intersecting lines graphically.

Reason: If the pair of lines are intersecting, then the pair has unique solution and is called consistent pair of equations.

Ans : d) Assertion (A) is false but reason (R) is true.

Section : B (Each 2 Marks)

Q.12 : The difference between two numbers is 12 and difference between their squares is 408. Find the numbers.

Ans. : Let two number be x and y where x > y.

$x - y = 12$ ---(Ist condition) ---(i)

$x^2 - y^2 = 408$ ---(IInd condition)

$\therefore \quad (x + y)(x - y) = 408$

$\therefore \quad (x + y)(12) = 408$

$$\therefore \quad x + y = \frac{408}{12}$$

$\therefore \quad x + y = 34$ ---(ii)

adding equation (i) & (ii)

$2x = 46$

$\therefore \quad \boxed{x = 23}$

put x = 23 in equation (ii)

$23 + y = 34$

$\therefore \quad \boxed{y = 11}$.

Q.13 : Solve : $\frac{x}{a} + \frac{y}{b} = 2$

$ax - by = a^2 - b^2$

Ans. : Given $\frac{x}{a} + \frac{y}{b} = 2$ ---(i)

$ax - by = a^2 - b^2$ ---(ii)

Multipliying equation (i) by b^2 we get

$$\frac{b^2 x}{a} + by = 2b^2 \text{ ---(iii)}$$

$ax - by = a^2 - b^2$ ---(ii)

Adding equation (ii) and (iii)

$$\frac{b^2}{a}x + ax = 2b^2 + a^2 - b^2$$

$$\therefore x\left(\frac{b^2}{a} + a\right) = a^2 + b^2$$

$$\Rightarrow x\frac{\left(a^2 + b^2\right)}{a} = a^2 + b^2$$

$\Rightarrow x = a$

putting x = a in equation (i)

$$\frac{a}{a} + \frac{y}{b} = 2$$

$$\Rightarrow 1 + \frac{y}{b} = 2$$

$$\Rightarrow \frac{y}{b} = 2 - 1 = 1$$

$\Rightarrow y = b$

Hence $x = a, \quad y = b$

OR

The sum of two numbers is 400 and the difference between their squares is 8000. find the numbers.

Ans. : Let x be greater number and y be the smaller number.

$x + y = 400$ ---Ist condition ---(i)

$x^2 - y^2 = 8000$ --- IInd condition

$\therefore \ (x + y)(x - y) = 8000$

$\therefore \ 400(x - y) = 8000$ ---from (i)

$$\therefore \ x - y = \frac{8000}{400}$$

$\therefore \ x - y = 20$ ---(ii)

Adding equation (i) and (ii)

$2x = 420$

$\therefore \ x = 210$

Put x = 210 in equation (i)

$\therefore \ 210 + y = 400$

$\therefore \ y = 190$

$\therefore$ Required numbers are 210 and 190.

Section : C (Each 3 Marks)

Q.14 : The sum of a two digit number and the number formed by interchanging its digits is 110. If 10 is subtracted from the first number, the new number is 4

more than 5 times the sum of the digits in the first number find the first number.

Ans. : Let the digit at units and tens place in the given number be x and y respectively then number = 10y + x

According to the question, we have

$10y + x + 10x + y = 110$

$\Rightarrow \quad 11x + 11y = 110$

$\Rightarrow \quad x + y = 10 \quad$ ---(i)

and $10y + x - 10 = 5(x + y) + 4$

$\Rightarrow \quad 10y + x - 10 = 5x + 5y + 4$

$\Rightarrow \quad 5y - 4x = 14$

$\Rightarrow \quad 4x - 5y = -14 \quad$ ---(ii)

Adding equations (i) & (ii) after multiplying equation (i) by 5, we have

$5x + 5y = 50$

$\underline{4x - 5y = -14}$

$9x \quad = 36$

$\Rightarrow \quad x = 4$

Putting x = 4 in equation (i), we get

$4 + y = 10$

$\Rightarrow \quad y = 10 - 4 = 6$

Hence, Number = $10 \times 6 + 4 = 64$.

Q.15 : The area of a rectangle gets reduced by 9 square units. If its length is reduced by 5 units and the breadth is increased by 3 units. If we increase the length by 3 units and breadth by 2 units, the area is increased by 67 square units. Find the length and breadth of the rectangle.

Ans. : Let the length of rectangle = x units

the breadth of reactangle = y units

then Area of rectangle = xy sq. units

According to the first condition

$xy - 9 = (x - 5)(y + 3)$

$\Rightarrow \quad xy - 9 = xy - 5y + 3x - 15$

$\Rightarrow \quad 3x - 5y = 6 \quad$ ---(i)

According to the second condition

$(x + 3)(y + 2) = xy + 67$

$\Rightarrow \quad xy + 3y + 2x + 6 = xy + 67$

$\Rightarrow \quad 2x + 3y = 61 \quad$ ---(ii)

Multiply equation (i) by 3

and equation (ii) by 5

$9x - 15y = 18 \quad$ ---(iii)

$10x + 15y = 305 \quad$ ---(iv)

adding equation (iii) & (iv)

$19x = 323$

$\therefore \quad x = 17$

put x = 17 in equation (ii)

$2x + 3y = 61$

$\therefore \quad 2(17) + 3y = 61$

$\therefore \quad 34 + 3y = 61$

$\therefore \quad 3y = 27$

$\therefore \quad y = 9$

Hence, Length = 17 units

& brcadth = 9 units.

OR

The sum of the numerator and denominator of a fraction is 3 less than twice the denominator. If the numerator and denominator are decreased by 1, the numerator becomes half the denominator Determine the fraction.

Ans. : Let the numerator and denominator of fraction be x and y respectively.

then fraction = $\frac{x}{y}$

According to the first condition

$x + y = 2y - 3$

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

According to the second condition

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

$\Rightarrow \quad 2x - 2 = y - 1$

$\Rightarrow \quad 2x - y = 1 \quad$ ---(ii)

Subtracting equation (i) from (ii)

$$\begin{array}{rrrr} 2x & -y & = 1 & ---(ii) \\ x & -y & = -3 & ---(i) \\ - & + & + & \\ \hline x & & = 4 & \end{array}$$

$\Rightarrow x = 4$

Putting $x = 4$ in equation (i), we get

$4 - y = -3$

$\Rightarrow -y = -3 - 4$

$\Rightarrow -y = -7$

$\Rightarrow y = 7$

Hence, fraction $= \frac{4}{7}$.

OR

Solve the system of equations for x :

$\frac{5}{x-1} + \frac{1}{y-2} = 2$ **and** $\frac{6}{x-1} - \frac{3}{y-2} = 1$

Ans. : $\frac{5}{x-1} + \frac{1}{y-2} = 2$

$\frac{6}{x-1} - \frac{3}{y-2} = 1$ ---(given)

Let $\frac{1}{x-1} = u$ and $\frac{1}{y-2} = v$

$\therefore 5u + v = 2$ ---(i)

$6u - 3v = 1$ ---(ii)

multiply equation (i) by 3

$\therefore 15u + 3v = 6$ ---(iii)

adding equation (ii) and (iii)

$\therefore 21u = 7$

$\therefore u = \frac{7}{21} = \frac{1}{3}$

Put $u = \frac{1}{3}$ in equation (i)

$5u + v = 2$

$\therefore 5\left(\frac{1}{3}\right) + v = 2$

$\therefore \frac{5}{3} + v = 2$

$\therefore v = 2 - \frac{5}{3}$

$\therefore v = \frac{1}{3}$

Resubstitute value of u and v

$\therefore \frac{1}{x-1} = u$ and $\frac{1}{y-2} = v$

$\therefore \frac{1}{x-1} = \frac{1}{3}$ and $\frac{1}{y-2} = \frac{1}{3}$

$\therefore x - 1 = 3$ and $y - 2 = 3$

$\therefore x = 4$ and $y = 5$

$\therefore$ $x = 4$ and $y = 5$ is the solution of equations.

Section - D(Each 5 Marks)

Q.16 : 8 men and 12 boys can finish a piece of work in 10 days while 6 men and 8 boys can finish it in 14 days. Find the time taken by one man alone and that by one boy alone to finish the work.

Ans. : Suppose that one man alone can finish the work in x days and one boy alone can finish it in y days. Then one man's one day's work $= \frac{1}{x}$

$\therefore$ 8 men's one day's work $= \frac{8}{x}$

and One boy's one day's work $= \frac{1}{y}$

$\therefore$ 12 boy's one day's work $= \frac{12}{y}$

since, 8 men and 12 boys can finish the work in 10 days.

$\therefore \frac{8}{x} + \frac{12}{y} = \frac{1}{10}$ ---(i)

Again, 6 men and 8 boys can finish the

work in 14 days.

$\therefore \quad \frac{6}{x}+\frac{8}{y}=\frac{1}{14}$ ---(ii)

putting $\frac{1}{x}=u$ and $\frac{1}{y}=v$ in equation (i)

and (ii) we get.

$8u+12v=\frac{1}{10}$ ---(iii)

$6u+8v=\frac{1}{14}$ ---(iv)

multiplying equation (iii) by
2 and equation 4 by 3

$16u+24v=\frac{2}{10}$ ---(v)

$18u+24v=\frac{3}{14}$ ---(vi)

Subtracting equation (iv) from (v)

$-2u=\frac{-3}{14}+\frac{2}{10}$

$-2u=\frac{-30+28}{140}$

$-2u=\frac{-2}{140}$

$u=\frac{1}{140}$

Put $u=\frac{1}{140}$ in equation (v)

$16u+24v=\frac{2}{10}$

$16\left(\frac{1}{140}\right)+24v=\frac{1}{5}$

$\therefore \quad \frac{4}{35}+24v=\frac{1}{5}$

$24v=\frac{1}{5}-\frac{4}{35}$

$24v=\frac{7-4}{35}$

$24v=\frac{3}{35}$

$v=\frac{1}{280}$

Now, $u=\frac{1}{140}$ & $v=\frac{1}{280}$

$\frac{1}{140}=\frac{1}{x}$ & $\frac{1}{280}=\frac{1}{y}$

$x = 140$ & $y = 280$.

Thus, one man alone can finish the work in 140 days and one boy alone can finish the work in 280 days.

OR

A train covered a certain distance at a uniform speed. If the train could have been 10 Km/hr. faster, it would have taken 2 hours less than the scheduled time. And, if the train were slower by 10 Km/hr, it would have taken 3 hours more than the scheduled time. Find the distance covered by train.

Ans. : Let the speed of the train be x km/h and time taken by train to travel the given distance be t hours and the distance to travel was d km, we know that

$$\text{speed}=\frac{\text{Distance}}{\text{time}}$$

$\therefore \quad x=\frac{d}{t}$

or $d=xt$ ---(i)

using the information given in the question we get.

$$x+10=\frac{d}{t-2}$$

$\Rightarrow \quad (x+10)(t-2)=d$

$\Rightarrow \quad xt+10t-2x-20=xt$

$\Rightarrow -2x+10t=20$ ---(ii)

and $(x-10)=\frac{d}{t+3}$

$\Rightarrow (x-10)(t+3)=d$

$\Rightarrow xt-10t+3x-30=xt$

$\Rightarrow 3x-10t=30 \quad ---(iii)$

On solving equation (ii) and (iii)

$$\begin{array}{rrr} 3x & -10t & =30 \\ -2x & +10t & =20 \\ \hline x & & =50 \end{array}$$

$\Rightarrow x=50\text{km/h}$

Putting $x=50$ in equation (ii)

$-2\times50+10t=20$

$\Rightarrow 10t=20+100$

$\Rightarrow t=\frac{120}{10}=12$ hours

Now Distance $d=xt$

$=50\times12$

$\Rightarrow d=600$ km

Hence, the distance covered by train is 600 km.

Section : E

Q.17 : Case Study :

Speed of boat upstream and downstream

If a boat goes in the opposite direction to the stream, it is called upstream. The net speed of the boat is called the upstream speed.

Let the speed of the boat in still water be x km/h and speed of the stream by y km/h.

Speed of the boat upstream = Speed of the boat in still water – Speed of stream

i.e. (x – y) km/h

If a boat goes along direction of the stream, it is called downstream. The net speed of the boat is called the downstream speed.

Speed of the boat downstream = Speed of the boat in still water + Speed of the stream

i.e. (x + y) km/h

Now let us consider the following case

A boat goes 32 km upstream and 36 km downstream in 7 hours. In 9 hours, it can go 40 km upstream and 48 km downstream.

i) Find the expression for the time taken by the boat (in hours) to cover 32 km upstream.

Ans. : The expression for the time taken by the boat (in hours) to cover 32 km

$$\text{up stream}=\frac{32}{x-y}.$$

ii) Find the expression for the time taken by the boat (in hours) to cover 36 km downstream.

Ans. : The expression for the time taken by boat (in hours) to cover 36 km

$$\text{down strem}=\frac{36}{x+y}.$$

iii) Find the equation for the total time taken by the boat to cover 40 km upstream and 48 km downstream in 9 hours.

Ans. : The equation for the total time taken by the bot to 40 km upstream and 48 km down stream in 9 hours is

$$=\frac{40}{x-y}+\frac{48}{x+y}=9.$$

OR

A boat can travel with a speed of 14 km/h in still water. If the speed of the stream is 3 km/h. Find the time taken by the boat to go 68

km downstream.

Ans. : speed of a boat = 14 km/h

speed of stream = 3 km/h

$\therefore$ Speed of the boat down stream

= 14 + 3

= 17 km/h

Then, The time taken by the boat to go 68 km downstream

$= \frac{68}{17}$

= 4 hours.

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