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Class - 10

Mathematics

Chapter - 3

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Part - 3

Harsh Goyal

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

EXAMPLE 6 :

In a shop the cost of 2 pencils and 3 erasers is ₹ 9 and the cost of 4 pencils and 6 erasers is ₹ 18. Find the cost of each pencil and each erasers.

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let Pencil → x

value of eraser → y

$$2x + 3y = 9 \quad \text{——} (1)$$

$$2(2x+3y) = 9 \quad 4x + 6y = 18 \quad \text{——} (2)$$

from eqn (1)

$$2x = 9 - 3y$$

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

put value of x in eqn (2)

$$4\left(\frac{9-3y}{2}\right) + 6y = 18$$

$$\Rightarrow 2(9-3y) + 6y = 18$$

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$18 - 6y + 6y = 18$

$18 = 18$



Infinitely many sol^{n}

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EXAMPLE 7 :

Two rails are represented by the equations $x + 2y - 4 = 0$ and $2x + 4y - 12 = 0$. Will the rails cross each other ?

$x + 2y - 4 = 0$ — (1)

$2x + 4y - 12 = 0$ — (2)

$x = 4 - 2y$

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$2(4-24)+44-12=0$

$8-44+44=12$

$-4=0$ ✓

not possible

no sol^{n} ✓

$18=18$



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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

EXERCISE 3.2

1. Solve the following pair of linear equations by the substitution method.

(i) $x + y = 14$

$x - y = 4$

$x = 4 + y$

$4 + y + y = 14$

$2y = 14 - 4$

$2y = 10$

$y = 5$

$x = 4 + 5$

$x = 9$

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(ii) $s - t = 3$ — (1)

$\frac{s}{3} + \frac{t}{2} = 6$

$\frac{2s + 3t}{6} = 6$

$2s + 3t = 36$ — (2)

from eq (1)

$s = 3 + t$

put the value of s in eq (2)

$2(3 + t) + 3t = 36$

$6 + 2t + 3t = 36$

$5t = 30$

$t = 6$

$s = 9$

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

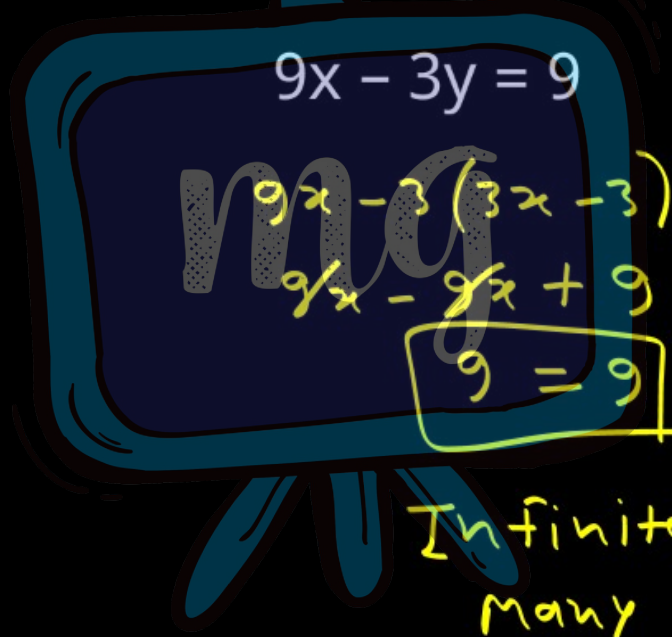
$9x - 3y = 9$

$9x - 3(3x - 3) = 9$

$9x - 9x + 9 = 9$

$9 = 9$

Infinitely many soln



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(iv) $0.2x + 0.3y = 1.3$

$0.4x + 0.5y = 2.3$

$\Rightarrow 0.4x = 2.3 - 0.5y$

$\Rightarrow x = \dfrac{2.3 - 0.5y}{0.4}$

$x = \dfrac{2.3 - 1.5}{0.4}$

$0.2\left(\dfrac{2.3 - 0.5y}{0.4}\right) + 0.3y = 1.3$

$x = \dfrac{0.8}{0.4}$

$2.3 - 0.5y + 0.6y = 2.6$

$x = 2$

$0.1y = 0.3$

$y = 3$

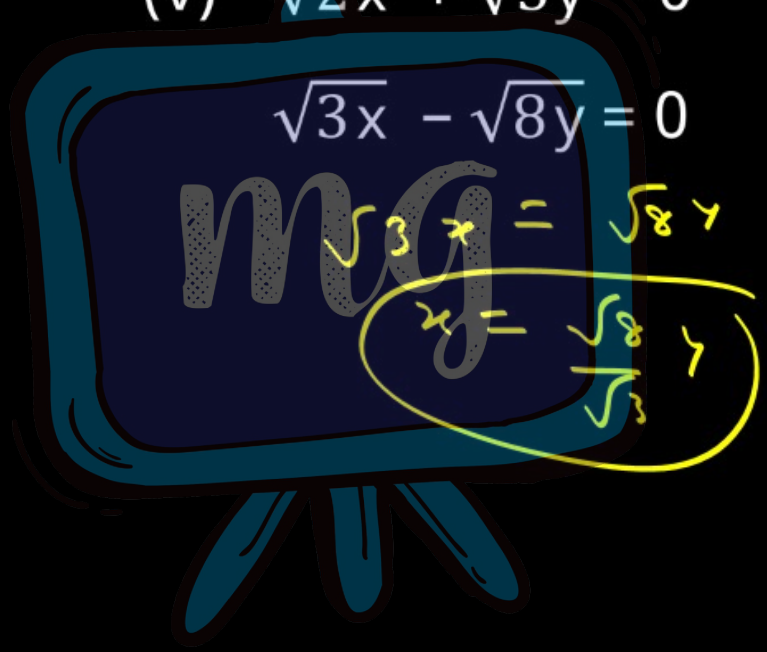
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(v) $\sqrt{2}x + \sqrt{3}y = 0$

$\sqrt{3}x - \sqrt{8}y = 0$



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(vi) $\frac{3x}{2} - \frac{5y}{3} = -2$

$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$

$\Rightarrow \frac{2x+3y}{6} = \frac{13}{6}$

$\Rightarrow 2x+3y-13=0$

$\Rightarrow x = \frac{13-3y}{2}$

$\Rightarrow \frac{9x-10y}{6} = -2$

$\Rightarrow 9x-10y = -12$

$\Rightarrow 9x-10y+12=0$

$9\left(\frac{13-3y}{2}\right)-10y+12 = 0$

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

$y = mx + 3$

$5 = m(-2) + 3$

$2 = -2m$

$m = -1$

$2x + 3y = 11$

$x = \frac{11 - 3y}{2}$

$2x - 4y = -24$

$x\left(\frac{11 - 3y}{2}\right) - 4y = -24$

$11 - 7y = -24$

$-7y = -35$

$y = 5$

$x = \frac{11 - 15}{2}$

$x = \frac{-4}{2} = -2$

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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.

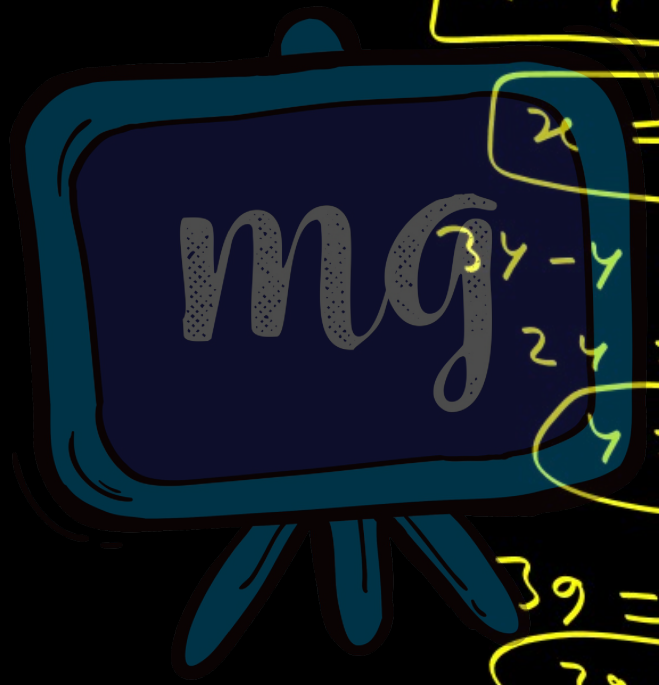
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let x and y are the number.

$x - y = 26$

$x = 3y$



$3y - y = 26$

$2y = 26$

$y = 13$

$x = 3 \times 13$

$x = 39$

$39 = 3 \times 13$

$39 = 39$

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

let x and y are the angles

$x + y = 180$ —

$x = y + 18$

$y + 18 + y = 180$

$2y = 162$

$y = 81$

$x = 81 + 18$

$x = 99$

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(iii) The coach of a cricket team buys 7 bats and and 6 balls for ₹ 3800. Later, she buys 3 bats and 5 balls for ₹ 1750. Find the cost of each bat and each ball.

$3x + 5y = 1750$

let cost of bat = x ₹

" " ball = y ₹

$7x + 6y = 3800$

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$7x + 6y = 3800$

$3x + 5y = 1750$

$x = \frac{1750 - 5y}{3}$

$7\left(\frac{1750 - 5y}{3}\right) + 6y = 3800$



$x = 50$

$y = 50$

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(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 105 and for a journey of 15 km, the charge paid is 155.

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let fixed charge = x

charge by distance = y

$x + 10y = 105$

$x + 15y = 155$

$x = 155 - 15y$

$155 - 15y + 10y = 105$

$-5y = -50$

$y = 10$

$x = 155 - 150$

$x = 5$

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What are the fixed charges and the charge per km? How much does a person have to pay or travelling a distance of 25 km?

$x + 25y$

$5 + 25(10)$

$5 + 250 = 255$ Ans

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(v) A fraction becomes $\frac{9}{11}$, if 2 is added to both the numerator and the denominator. If, 3 is added to both the numerator and the denominator it becomes $\frac{5}{6}$. Find the fraction.

let num → x

den → y

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$\frac{x}{y}$

$\frac{x+2}{y+2} \neq \frac{9}{11}$

$11x + 22 = 9y + 18$

$11x - 9y = -4$

$\frac{x+3}{y+3} = \frac{5}{6}$

$6x + 18 = 5y + 15$

$6x - 5y = -3$

$x = \frac{-3+5y}{6}$

$11\left(\frac{-3+5y}{6}\right) - 9y = -4$

$x = 7, y = 9$

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(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?

let age of Jacob = x years
age of son = y years

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$x+5 = 3(y+5)$

$x+5 = 3y+15$

$x-3y = 10$

$x-5 = 7(y-5)$

$x-5 = 7y-35$

$x-7y = -30$

$x = -30+7y$

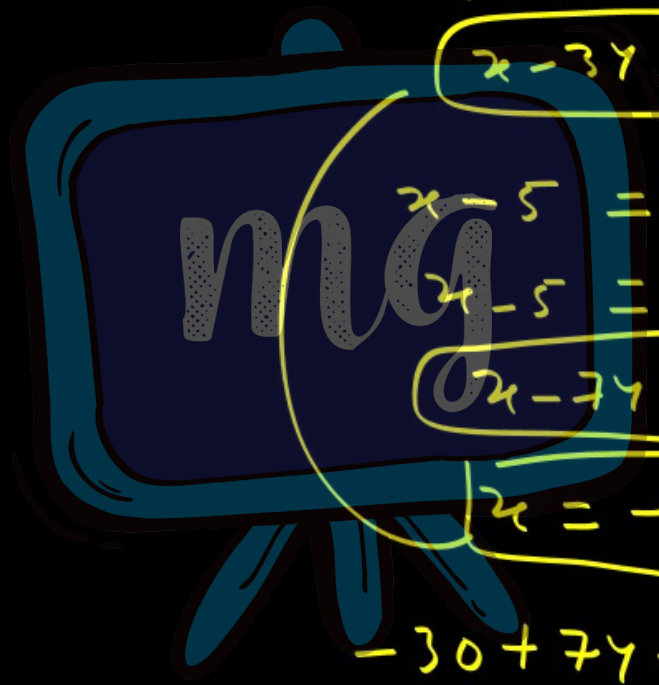
$-30+7y-3y = 10$

$4y = 40$

$y = 10$

$x = -30+70$

$x = 40$

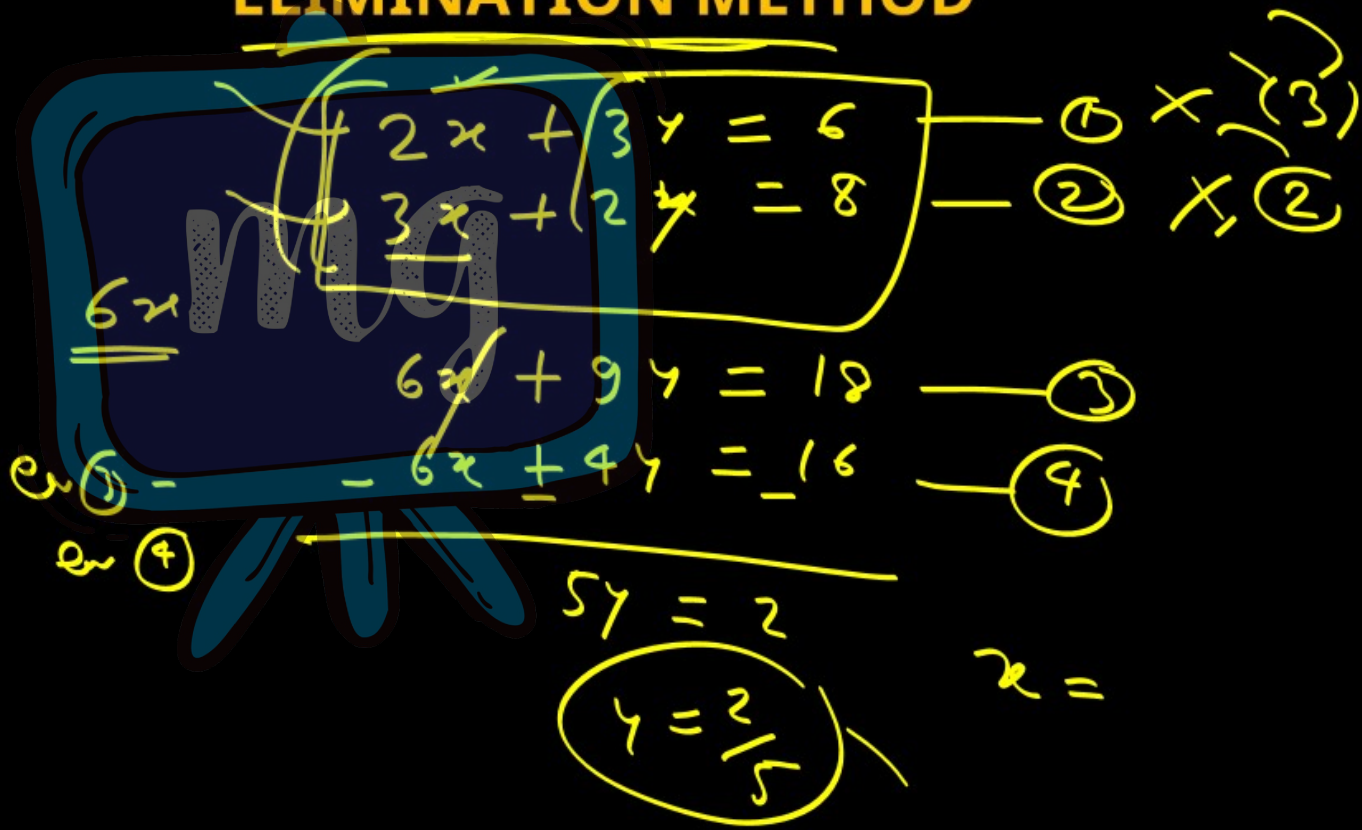


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ELIMINATION METHOD



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$2x + 3y = 6 \times (2)$

$3x + 2y = 8 \times (3)$

$4x + 6y = 12$

$-9x \pm 6y = 24$

$-5x = -12$

$x = \frac{12}{5}$

$2\left(\frac{12}{5}\right) + 3y = 6$

$y = ?$

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EXAMPLE 8 :

The ratio of incomes of two persons is 9 : 7 and the ratio of their expenditures is 4 : 3. If each of them manages to save 2000 per month, find their monthly incomes.

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Income 9 : 7
expence 4 : 3

let Income → x
expence = y

$9x - 4y = 0$
$7x - 3y = 0$