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Class - 10

Mathematics

Chapter - 3

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Part - 4

Harsh Goyal

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

ELIMINATION METHOD

$2x + 3y = 6 \quad \times 3$

$3x + 2y = 8 \quad \times 2$

$6x + 9y = 18$

$-6x \pm 4y = \pm 16$

$5y = 2$

$y = \frac{2}{5}$

Put the value of y in eq^n (1)

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

$2x + \frac{6}{5} = 6$

$2x = 6 - \frac{6}{5}$

$2x = \frac{30 - 6}{5}$

$2x = \frac{24}{5}$

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

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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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9 : 7

4 :

let income = x ₹

expence = y ₹

$9x - 4y = 2000$ — (1) ×3

$7x - 3y = 2000$ — (2) ×4

$27x - 12y = 6000$

$-28x + 12y = -8000$

$-x = -2000$

$x = 2000$

$9(2000) - 4y = 2000$

$18000 - 4y = 2000$

$4y = 16000$

$y = 4000$

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EXAMPLE 9 :

Use elimination method to find all possible solutions of the following pair of linear equations :

$$2x + 3y = 8 \quad \times 2$$

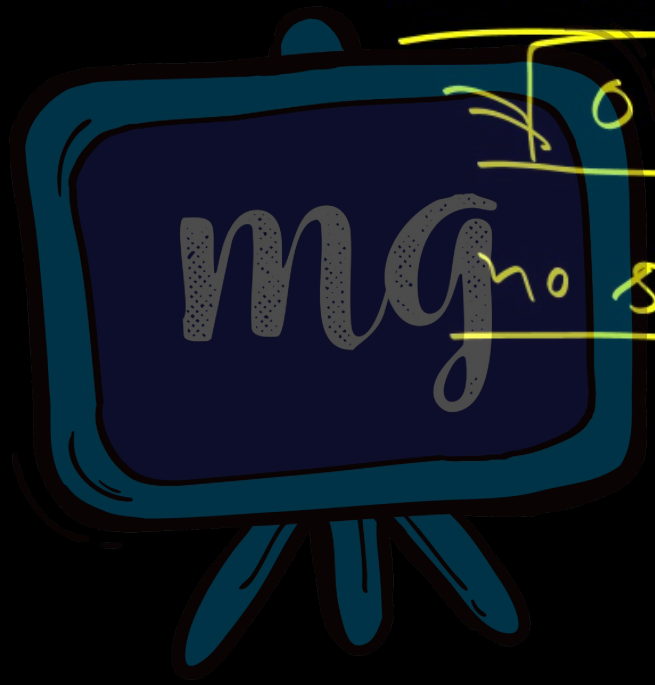
$$4x + 6y = 7$$

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$$4x + 6y = 16$$
$$-\ 4x \pm 6y = \mp 7$$

$$0 = 9$$ not possible



no soln

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EXAMPLE 10 :

The sum of a two-digit number and the number obtained by reversing the digits is 66. If the digits of the number differ by 2, find the number. How many such numbers are there?

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two digit number

let unit digit $= x$

ten's digit $= y$

$yx = 10y + x$

$24 = 20 + 4$
$= 2 \times 10 + 4$

reversing the digit

$= xy$

$= 10x + y$

A.T.Q

$10y + x + 10x + y = 66$

$11x + 11y = 66$

$x + y = 6$ ——— (1)

$x - y = 2$

or

$y - x = 2$

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$x + y = 6$
$x + y = 2$

$2x = 8$

$x = 4$

then

$4 + y = 6$

$y = 2$

$yx = 24$

$x + y = 6$
$x + y = 2$

$2y = 8$

$y = 4$

then

$2x + 4 = 6$

$x = 2$

$yx = 42$

24, 42

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

EXERCISE 3.3

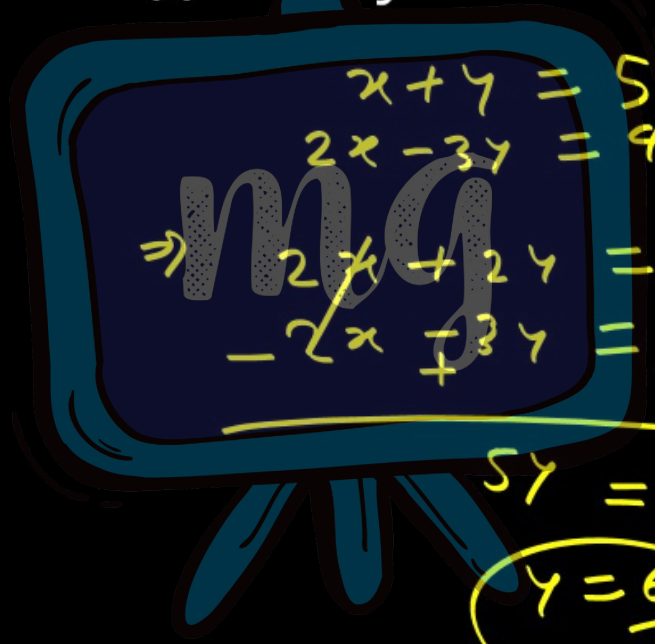
1. Solve the following pair of linear equations by the elimination method and the substitution method :

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

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



$x + y = 5$ ... (1)

$2x - 3y = 4$ ... (2)

$\Rightarrow$ $2x + 2y = 10$ (1) $\times 2$

$-2x + 3y = -4$

$5y = 6$

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

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

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

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

$3x + 4y = 10$ — (1)

$2x - 2y = 2$ — (2) × 2

$3x + 4y = 10$

$4x - 4y = 4$

$7x = 14$

$x = 2$

put $x = 2$ in eqn (2)

$2(2) - 2y = 2$

$4 - 2y = 2$

$-2y = -2$

$y = 1$

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Substitution method

$3x + 4y = 10$ — (1)

$2x - 2y = 2$ — (2)

$2x = 2 + 2y$

$x = 1 + y$

put the value of x in eq (1)

$3(1+y) + 4y = 10$

$3 + 3y + 4y = 10$

$7y = 7$

$y = 1$

$x = 1 + 1$

$x = 2$

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

$3x - 5y - 4 = 0$ —— (1) $\times 3$

$9x - 2y - 7 = 0$ —— (2)

$\rightarrow$

$9x - 15y - 12 = 0$

$-9x + 2y + 7 = 0$

$-13y - 5 = 0$

$-13y = 5$

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

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

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

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

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

$\Rightarrow \frac{3x+4y}{6} = -1$

$3x + 4y = -6$ — (1)

$3x - y = 9$ — (2)

$3x + 4y = -6$

$-3x + y = 9$

$5y = -15$

$y = -3$

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

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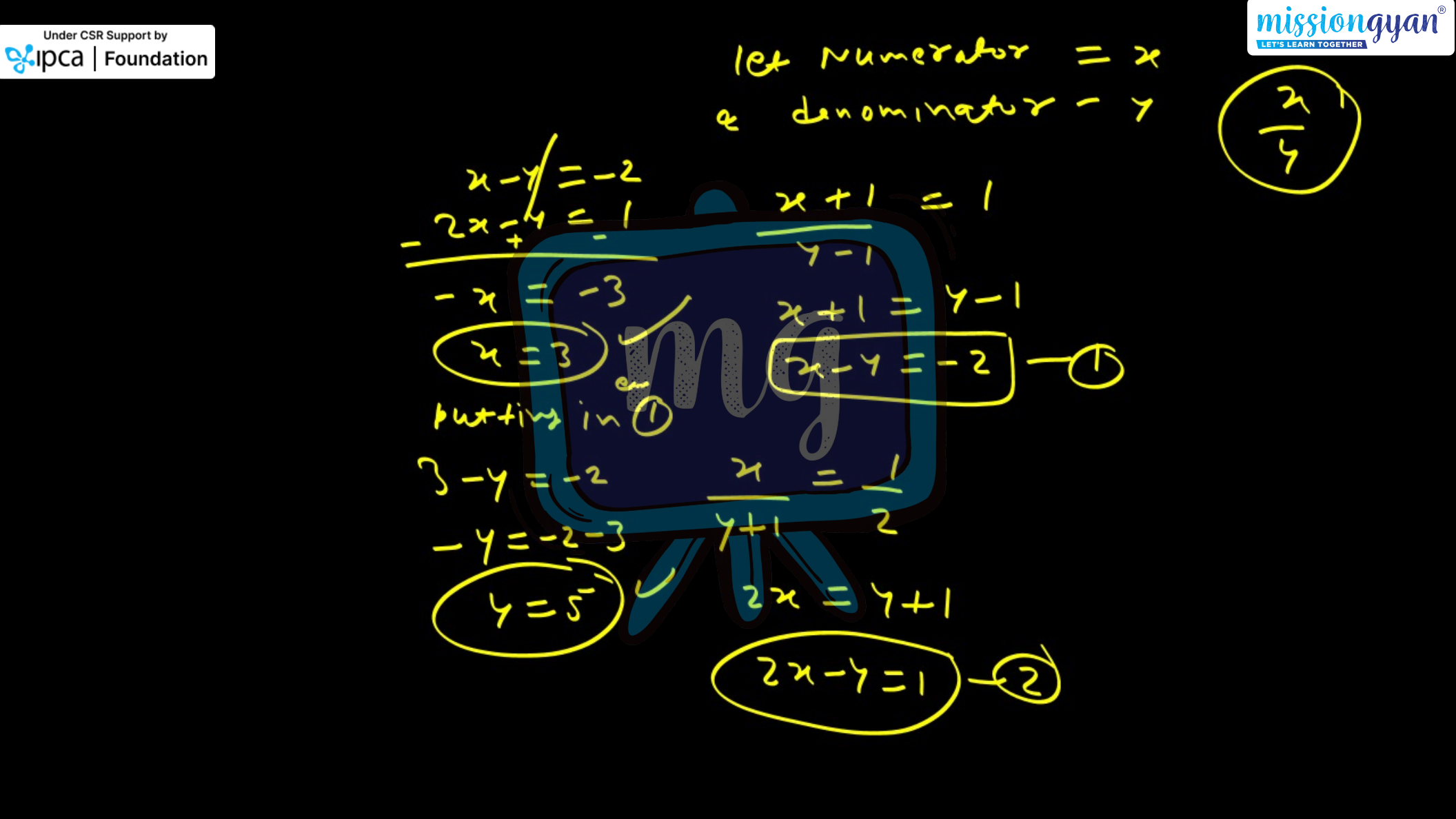
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(i) If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It becomes ½ if we only add 1 to the denominator. What is the fraction?

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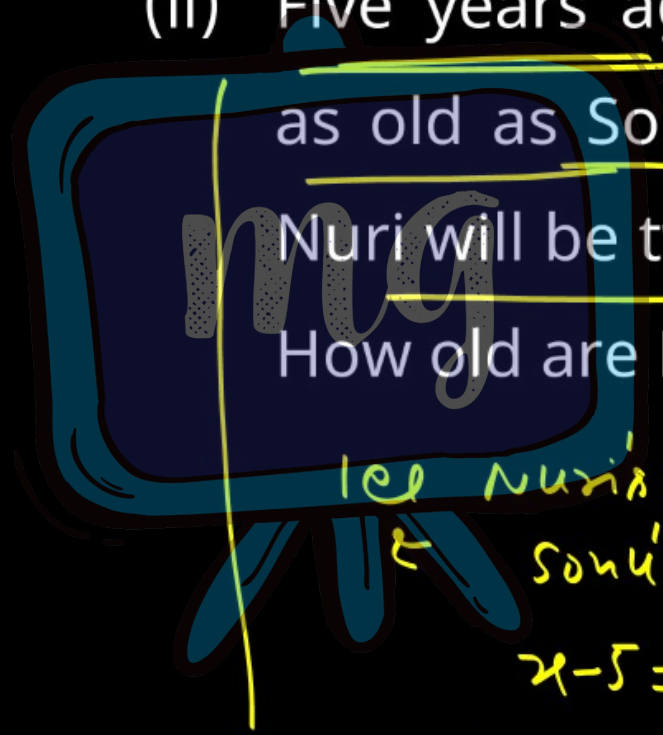


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(ii) Five years ago, Nuri was thrice as old as Sonu. Ten years later, Nuri will be twice as old as Sonu. How old are Nuri and Sonu?



Let Nuri's age = x years
& Sonu's age = y years

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

$x-5 = 3y-15$

$x-3y = -10$

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

$x + 10 = 2y + 20$

$x - 2y = 10$

$x - 3y = -10$

$-\quad +\quad +$

$y = 20$

$x - 2(20) = 10$

$x - 40 = 10$

$x = 50$

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

(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.

let x be unit digit (yx)
and y be tenth digit

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$x + y = 9$ — (1)

reverse $= xy$

$yx = xy$

$9(10y + x) = 2(10x + y)$

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

number $= 18$

$11x - 88y = 0$

$x - 8y = 0$ — (2)

$-x \pm y = \pm 9$

$-9y = -9$

$y = 1$

$x + 1 = 9$

$x = 8$

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

$x + y = 25$

let 50 ₹ Note $= x$

100 ₹ — $= y$

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$x + y = 25$ — (1)

$50x + 100y = 2000$

$x + 2y = 40$ — (2)

$-y = -15$

$y = 15$

$x + 15 = 25$

$x = 10$

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(v) A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid ₹ 27 for a book kept for seven days, while Susy paid ₹ 21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

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let fix charge for three dal = x

& extra charge = y

$x + 4y = 27$ — (1)

$x + 2y = 21$ — (2)

$2y = 6$

$y = 3$

$x + 6 = 21$

$x = 15$

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Q.1 If twice the first number x is 5 less than 7 times the second number y, then which of the following equations is correct?

x , y

$2x + 5 = 7y$

$2x = 7y - 5$

(A) $2x = 7y + 5$

(B) $5x = 7y + 2$

(C) $7x = 2y - 5$

(D) $2x = 7y - 5$

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Q.2 For which value of k does the following pair of linear equations have no solution?

$3x + y = 1$; $(2k - 1)x + y = 2k + 1$

$\frac{3}{2k-1} = \frac{1}{1}$

$2k - 1 = 3$

$2k = 4$

$k = 2$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

A 2

B 4

C 1

D 3

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

= (x)

1 + x − 1

↓

y = 5 + 3(x − 1)

Q.3 The taxi fare in a city is ₹5 for the first kilometer and ₹3 thereafter. If the distance covered is x km and the fare is ₹y, then express it in the form of equation.

distance = x km

y = 5 + 3(x − 1)

y = 5 + 3x − 3

3x − y + 2 = 0

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Q.4 The total price of 2 exercise books and 3 pencils is ₹ 17, while the total price of 3 exercise books and 4 pencils is ₹ 24. Express this problem in algebraic form and solve it.

$2x + 3y = 17$

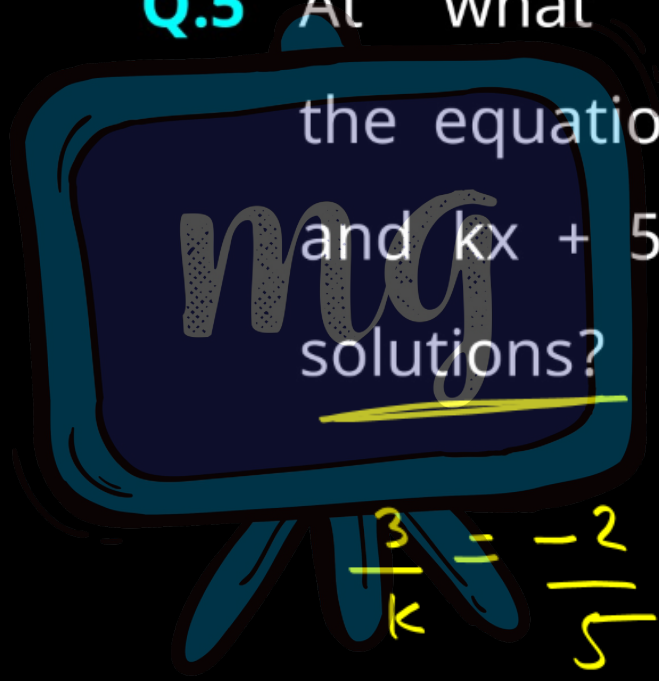
$3x + 4y = 24$

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Q.5 At what value of k will the equation pair $3x - 2y = 0$ and $kx + 5y = 0$ have infinite solutions?



$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\frac{3}{k} = \frac{-2}{5}$$

$$15 = -2k$$

$$\Rightarrow k = \frac{-15}{2}$$