Vidya Bhawan, Balika Vidyapith

Shakti Utthan Ashram, Lakhisarai – 811311 (Bihar)

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Solution of a Pair of Linear Equations in Two Variables

Word Problems (Use Elimination Method)

Solve for x and y.

(I) $7x - 2y/xy = 5$_____ (a)

$8x + 7y/xy = 15$_____ (b)

Solution: **Taking eqn. (a)**

$7x - 2y/xy = 5$

$\Rightarrow 7x/xy - 2y/xy = 5$

$\Rightarrow 7/y - 2/x = 5$ ... (i)

Taking eqn. (b)

$\Rightarrow 8x + 7y/xy = 15$

$\Rightarrow 8x/xy + 7y/xy = 15$

$\Rightarrow 8/y + 7/x = 15$ ... (ii)

Let $1/x = p$ and $1/y = q$ in (i) and (ii) we get,

$7q - 2p = 5$ ... (iii)

$8q + 7p = 15$ ... (iv)

Multiplying equation (iii) by 7 and multiplying equation (iv) by 2 we get,

$49q - 14p = 35$ ... (v)

$16q + 14p = 30$ ... (vi)

Now, adding equation (v) and (vi) we get,

$49q - 14p + 16q + 14p = 35 + 30$

$\Rightarrow 65q = 65$

$\Rightarrow q = 1$

Putting the value of q in equation (iv)

$8 + 7p = 15$

$\Rightarrow 7p = 7 \Rightarrow p = 1$

Now,

$p = 1/x = 1$

$\Rightarrow 1/x = 1 \Rightarrow x = 1$

also, $q = 1 = 1/y$

$\Rightarrow 1/y = 1$

$\Rightarrow y = 1$

Hence, $x = 1$ and $y = 1$ is the solution.

Do your Self

(i) $6x + 3y = 6xy$

$2x + 4y = 5xy$

(ii) $\frac{7x-2y}{xy} = 5$

$\frac{8x+7y}{xy} = 15$, $(x \neq 0$ and $y \neq 0)$

(iii) $3(x+2y) = 7xy$

$3(x+3y) = 11xy$, $(x \neq 0$ and $y \neq 0)$

(iv) $\frac{xy}{x+y} = \frac{6}{5}$

$\frac{xy}{y-x} = 6$ $(x \neq 0, y \neq 0$ and $x \neq y)$

(ii) $(a-b)x + (a+b)y = a^2 - 2ab - b^2$ ——— (i)

$(a+b)(x+y) = a^2 + b^2$ ——— (ii)

$(a+b)x + (a+b)y = a^2 + b^2$ ——— (iii)

~~Adding~~ eqn (i) − (iii)

$(a-b)x + (a+b)y = a^2 - 2ab - b^2$

$(a+b)x + (a+b)y = a^2 + b^2$

$\Rightarrow (a-b-a-b)x = -2ab - 2b^2$

$\Rightarrow -2bx = -2b(a+b)$

$\therefore x = a+b$

Putting the value of x in eq (iii)

$(a+b)x + (a+b)y = a^2 + b^2$

$\Rightarrow (a+b)(a+b) + (a+b)y = a^2 + b^2$

$\Rightarrow a^2 + 2ab + b^2 + (a+b)y = a^2 + b^2$

$\Rightarrow (a+b)y = -2ab$

$\therefore y = \frac{-2ab}{a+b}$

Hence $x = a+b$ and $y = \frac{-2ab}{a+b}$ Ans

Do yourself

$a^2x + b^2y = c^2$

$b^2x + a^2y = d^2$

(ii) $\frac{x}{a} + \frac{y}{b} = a+b$

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

(iii) $ax - by = a^2 + b^2$

$x + y = 2a$