

# Methods To Substitution & Elimination

## Substitution

1. Put equations side by side

$$2x - y = 0 \quad 3x - 5y = -21$$

2. Isolate a variable from one equation

$$2x - y = 0 \sim 2x = y$$

3. Substitute in to where the variable would have been.

$$3x - 5(2x) = -21$$

4. Solve the equation

$$3x - 5(2x) = -21$$

$$3x - 10x = -21$$

$$\frac{-7x}{-7} = \frac{-21}{-7}$$

$$\boxed{x = +3}$$

5. Then substitute again to solve for the other variable

$$\downarrow$$

$$(x = +3)$$

$$2x = y$$

$$2(+3) = +6$$

$$\boxed{\begin{array}{l} x = +3 \\ y = +6 \end{array}}$$

## SUBSTITUTION METHOD

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1. Place equations side by side.

$$2x - y = 0 \quad 3x - 5y = -21$$

2. Isolate a variable on one of the equations.

$$3x - 5y + 5y = -21 + 5y \rightarrow \frac{3x}{3} = \frac{5y - 21}{3} \rightarrow x = \frac{5}{3}y - 7 \quad 2x - y = 0$$

3. Substitute variable into the other equation.

$$2\left(\frac{5}{3}y - 7\right) - y = 0 \rightarrow \frac{10}{3}y - 14 - \frac{3}{3}y = 0 \rightarrow \frac{7}{3}y - 14 + 14 = 0 + 14$$
$$3\left(\frac{7}{3}y\right) = 3(14)$$
$$\frac{7y}{7} = \frac{42}{7}$$
$$\boxed{y = 6}$$

4. Place known variable into either equation.

$$2x - 6 = 0 \rightarrow 2x - 6 + 6 = 0 + 6 \rightarrow \frac{2x}{2} = \frac{6}{2}$$
$$\boxed{x = 3}$$

5. Verify solution by placing points into both equations.

$$2(3) - (6) = 0 \quad 3(3) - 5(6) = -21$$
$$6 - 6 = 0 \quad 9 - 30 = -21$$
$$0 = 0 \quad \checkmark \quad -21 = -21 \quad \checkmark$$