Solving Simultaneous Equations

Contents

1. Why learn?

- As the title implies, learning to solve Simultaneous Equations of multiple unknowns

2. Objective

$$Solve > 1\ equation\ together$$

$$Solve\ for > 1\ unknown$$

3. Method 1 – Elimination

1

$$2x + 3y = 7 \rightarrow 1$$
$$3x - 4y = 2 \rightarrow 2$$

1 x 3:

$$6x + 9y = 21 \rightarrow 3$$

2 x 2:

$$6x - 8y = 4 \rightarrow 4$$

3 – 4:

$$6x + 9y - (6x - 8y) = 21 - 4$$
$$6x + 9y - 6x + 8y = 17$$
$$6x - 6x + 9y + 8y = 17$$
$$17y = 17$$
$$y = 1$$

From 1, find x:

$$2x + 3y = 7 \rightarrow x = \frac{7 - 3(1)}{2}$$
$$x = 2$$

4. Method 2 – Substitution (Linear Equation)

1

$$2x + 3y = 7 \rightarrow 1$$
$$3x - 4y = 2 \rightarrow 2$$

From 1:

$$2x + 3y = 7 \rightarrow x = \frac{7 - 3y}{2} \rightarrow 3$$

Sub 3 into 2:

$$3 * \frac{7 - 3y}{2} - 4y = 2$$
$$\frac{21 - 9y}{2} - 4y = 2$$
$$21 - 9y - 8y = 4$$
$$-17y = -17$$
$$y = 1$$

From 1, find x:

$$2x + 3y = 7 \rightarrow x = \frac{7 - 3(1)}{2}$$
$$x = 2$$

5. Method 2 – Substitution (Linear + Non-Linear Equation)

1	$$y^2 + (2x+3)^2 = 10 \rightarrow 1$$ $$2x + y = 1 \rightarrow 2$$ From 2: $$y = 1 - 2x \rightarrow 3$$ Sub 3 into 1: $$(1-2x)^2 + (2x+3)^2 = 10$$ $$1 - 4x + 4x^2 + 4x^2 + 12x + 9 = 10$$ $$8x^2 + 8x = 0$$ $$8x(x+1) = 0$$ $$x = 0, \qquad x = -1$$ From 2, find y: $$y = 1, \qquad y = 3$$
2	$$Find\ the\ coordinates of\ the\ points\ of\ intersection\ of$$ $$y - x = 3 \rightarrow 1$$ $$\frac{2}{x} - \frac{x}{y} = 1 \rightarrow 2$$ From 1: $$y = 3 + x \rightarrow 3$$ Sub 3 into 2: $$\frac{2}{x} - \frac{x}{3+x} = 1$$ $$\frac{6 + 2x - x^2}{3x + x^2} = 1$$ $$6 + 2x - x^2 = 3x + x^2$$ $$2x^2 + x - 6 = 0$$ $$(2x+3)(x-1)$$ $$x = \frac{3}{2}, \qquad x = 1$$ From3, find y: $$y = \frac{9}{2}, \qquad y = 4$$