

Simultaneous Equations

- 1) Eliminate a variable
- 2) Solve for the other variable
- 3) Substitute to find the eliminated variable

e.g. (i) $2x + 3y = 21 \dots (1)$

$$5x + 2y = 3 \dots (2)$$

Multiply (1) by 2 and (2) by 3

$$4x + 6y = 42 \quad -$$

$$\underline{15x + 6y = 9}$$

$$11x = -33$$

$$x = -3$$

$$\therefore 2(-3) + 3y = 21$$

$$3y = 27$$

$$y = 9$$

$$\underline{\therefore x = -3, y = 9}$$

$$(ii) 2x + y = 14 \dots (1)$$

$$x^2 - y^2 = 9 \dots (2)$$

Make y the subject in (1)

$$y = 14 - 2x$$

Substitute into (2)

$$x^2 - (14 - 2x)^2 = 9$$

$$x^2 - 196 + 56x - 4x^2 = 9$$

$$3x^2 - 56x + 205 = 0$$

$$(3x - 41)(x - 5) = 0$$

$$x = 5 \quad \text{or} \quad x = \frac{41}{3}$$

$$2(5) + y = 14 \quad \text{or} \quad 2\left(\frac{41}{3}\right) + y = 14$$

$$y = 4 \quad \text{or} \quad y = -\frac{40}{3}$$

$$\therefore x = 5, y = 4 \quad \text{or} \quad x = \frac{41}{3}, y = -\frac{40}{3}$$

$$(iii) \quad x + 2y - z = -5 \quad \dots(1)$$

$$2x - 3y + 4z = 28 \quad \dots(2)$$

$$4x + 5y - 3z = -10 \dots(3)$$

any time you have the same number of pronumerals as equations it should be possible to find their values

Create two pairs of two equations and eliminate the same variable from both

Multiply (1) by 2

$$2x + 4y - 2z = -10 \quad -$$

$$\underline{2x - 3y + 4z = 28}$$

$$7y - 6z = -38$$

Multiply (1) by 4

$$4x + 8y - 4z = -20 \quad -$$

$$\underline{4x + 5y - 3z = -10}$$

$$3y - z = -10$$

Solve these new equations simultaneously

$$7y - 6z = -38 \quad -$$

$$\underline{18y - 6z = -60}$$

$$11y = -22$$

$$y = -2$$

$$\therefore 3(-2) - z = -10$$

$$-z = -4$$

$$z = 4$$

$$\therefore x + 2(-2) - 4 = -5$$

$$x = 3$$

$$\underline{\therefore x = 3, y = -2, z = 4}$$

Exercise 1E; 3bh, 4cfi, 5ac, 6a, 7ad, 8b, 9

Exercise 9B; 20bc