SIMULTANEOUS EQUATIONS

XY1 PURE → ALGEBRA AND FUNCTIONS

lesson link: parkermaths.com/y1sim

☰ Objectives

- To solve simultaneous equations in two variables, including one linear and one non-linear equation.

- To understand the relationship between the algebraic solutions of simultaneous equations and the points of intersection on the corresponding graphs.

▷ Examples

6.1e. Solve the following linear simultaneous equations:

$$3x - 5y - 19 = 0$$
$$5x = 6y + 27$$

$$3x - 5y = 19 \quad ①$$
$$5x - 6y = 27 \quad ②$$

$① \times 5$

$$15x - 25y = 95 \quad ③$$

$② \times 3$

$$15x - 18y = 81 \quad ④$$

$③ - ④$

$$-7y = 14$$
$$y = -2$$

Sub $y = -2$ into ①:

$$3x - 5(-2) = 19$$
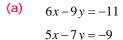$$3x = 9$$
$$x = 3$$

6.1p. Solve the following linear simultaneous equations:

$$7x = 2y + 1$$
$$10x + 7y = 31$$

💡 TOP TIP

- When solving linear simultaneous equations, it is generally acceptable to do so directly using your calculator.

6.2e. Use your calculator to solve the following linear simultaneous equations:

(a)
$$6x - 9y = -11$$
$$5x - 7y = -9$$

$$x = -\frac{4}{3}, \quad y = \frac{1}{3} \quad (BC)$$

(b)
$$9a + 11 = 5b$$
$$10a + 8b + 19 = 0$$

$$9a - 5b = 11$$
$$10a + 8b = -19$$
$$\uparrow \quad \uparrow$$
$$X \quad Y$$

$$a = -\frac{3}{2}, \quad b = -\frac{1}{2} \quad (BC)$$

6.2p. Use your calculator to solve the following linear simultaneous equations:

(a)
$$7x - 3y = -4$$
$$6x + 4y = 13$$

(b)
$$14 + 5p = -7q$$
$$10q + 17 = -8p$$

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6.3e. Solve the following non-linear simultaneous equations:
$$2x^2 - xy - y^2 = 36$$
$$x + 2y = 9$$

$2x^2 - xy - y^2 = 36$ ①

$x + 2y = 9$

$x = 9 - 2y$ ②

Sub ② into ①:

$2(9 - 2y)^2 - (9 - 2y)y - y^2 = 36$

$2(81 - 36y + 4y^2) - 9y + 2y^2 - y^2 = 36$

$162 - 72y + 8y^2 - 9y + 2y^2 - y^2 = 36$

$9y^2 - 81y + 126 = 0$

$y^2 - 9y + 14 = 0$

$(y - 7)(7 - 2) = 0$

$\therefore \quad y = 2 \ \text{ or } \ y = 7$
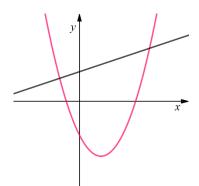
Sub $y = 2$ into ②:

$x = 9 - 2(2) = 5$

Sub $y = 7$ into ②:

$x = 9 - 2(7) = -5$

$\therefore \quad x = 5, y = 2 \ \text{ and } \ x = -5, y = 7$

6.3p. Solve the following non-linear simultaneous equations:
$$2x^2 + xy + y^2 = 22$$
$$x + 2y = 5$$

6.4e. Find the x–coordinates of the points of intersection between the curve $y = 2x^2 - 4x - 3$ and the line $3y - 2x = 8$.

$3y - 2x = 8$

$3y = 2x + 8$

$y = \dfrac{2}{3}x + \dfrac{8}{3}$

$\therefore \quad \dfrac{2}{3}x + \dfrac{8}{3} = 2x^2 - 4x - 3$

$2x + 8 = 6x^2 - 12x - 9$

$0 = 6x^2 - 14x - 17$

$\therefore \quad x = \dfrac{7 \pm \sqrt{151}}{6}$

6.4p. Find the x–coordinates of the points of intersection between the curve $y = 4 + 5x - 2x^2$ and the line $3x + y = 1$.