

## Section 1: Simultaneous equations

## Solutions to Exercise level 1

1. (i)

$$2x + 5y = 11 \quad (1)$$

$$2x - y = 5 \quad (2)$$

Subtracting:

$$6y = 6$$

$$y = 1$$

Substituting into (1):

$$2x + 5 \times 1 = 11$$

$$2x = 6$$

$$x = 3$$

The solution is  $x = 3, y = 1$ . Check:  $2x + 5y = 2 \times 3 + 5 \times 1 = 11$   
 $2x - y = 2 \times 3 - 1 = 5$

(ii)

$$x + 2y = 6 \quad (1) \times 4 \quad 4x + 8y = 24$$

$$4x + 3y = 4 \quad (2) \quad 4x + 3y = 4$$

Subtracting:

$$5y = 20$$

$$y = 4$$

Substituting into (1):

$$x + 2 \times 4 = 6$$

$$x = -2$$

The solution is  $x = -2, y = 4$ . Check:  $x + 2y = -2 + 8 = 6$   
 $4x + 3y = -8 + 12 = 4$

(iii)

$$3a - 2b = 4 \quad (1) \times 2 \quad 6a - 4b = 8$$

$$5a + 4b = 3 \quad (2) \quad 5a + 4b = 3$$

Adding:

$$11a = 11$$

$$a = 1$$

Substituting into (1):

$$3 \times 1 - 2b = 4$$

$$-2b = 1$$

$$b = -\frac{1}{2}$$

The solution is  $a = 1, b = -\frac{1}{2}$ . Check:  $3a - 2b = 3 + 1 = 4$   
 $5a + 4b = 5 - 2 = 3$

(iv)

$$2p - 5q = 5 \quad (1) \times 3 \quad 6p - 15q = 15$$

$$3p - 2q = -9 \quad (2) \times 2 \quad 6p - 4q = -18$$

Subtracting:

$$-11q = 33$$

$$q = -3$$

Substituting into (1):

$$2p - 5 \times -3 = 5$$

$$2p = -10$$

$$p = -5$$

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The solution is  $p = -5, q = -3$ . Check:  $2p - 5q = -10 + 15 = 5$   
 $3p - 2q = -15 + 6 = -9$

(v)  $5x + 3y = 9$  (1)

$$y = 3x - 4$$
 (2)

Substituting (2) into (1):  $5x + 3(3x - 4) = 9$

$$5x + 9x - 12 = 9$$

$$14x = 21$$

$$x = \frac{3}{2}$$

Substituting into (1):  $y = 3 \times \frac{3}{2} - 4 = \frac{9}{2} - 4 = \frac{1}{2}$

The solution is  $x = \frac{3}{2}, y = \frac{1}{2}$ . Check:  $5x + 3y = \frac{15}{2} + \frac{3}{2} = 9$

(vi)  $3a + 2b = 1$  (1)  $\times 2$        $6a + 4b = 2$

$$9a - 4b = 4$$
 (2)       $\underline{9a - 4b = 4}$

Adding:  $15a = 6$

$$a = \frac{2}{5}$$

Substituting into (1):  $3 \times \frac{2}{5} + 2b = 1$

$$2b = 1 - \frac{6}{5} = -\frac{1}{5}$$

$$b = -\frac{1}{10}$$

The solution is  $a = \frac{2}{5}, b = -\frac{1}{10}$ . Check:  $3a + 2b = \frac{6}{5} - \frac{1}{5} = 1$

$$9a - 4b = \frac{18}{5} + \frac{2}{5} = 4$$

2. (i)  $x - y = -1$  (A)

$$3x + 2y = 7$$
 (B)

$$(A) \Rightarrow 2x - 2y = -2$$
 (C)

$$(C) + (B) \Rightarrow 5x = 5$$

$$\Rightarrow x = 1, y = 2$$

(ii)  $2x + y = 0$  (A)

$$x - 3y = 7$$
 (B)

$$(B) \Rightarrow 2x - 6y = 14$$
 (C)

$$(A) - (C) \Rightarrow 7y = -14$$

$$\Rightarrow y = -2, x = 1$$

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$$(iii) \quad y - 5x = -8 \quad (A)$$

$$x + 3y = 0 \quad (B)$$

$$(B) \Rightarrow 5x + 15y = 0 \quad (C)$$

$$(A) + (C) \Rightarrow 16y = -8$$

$$\Rightarrow y = -\frac{1}{2}, x = \frac{3}{2}$$

$$(iv) \quad x = 2y - 1 \quad (A)$$

$$-x + 3y = -1 \quad (B)$$

$$(A) + (B) \Rightarrow 3y = 2y - 2 \quad (C)$$

$$\Rightarrow y = -2, x = -5$$

$$(v) \quad 2p - 4q = 14 \quad (A)$$

$$-p + 3q = -5 \quad (B)$$

$$(B) \Rightarrow -2p + 6q = -10 \quad (C)$$

$$(A) + (C) \Rightarrow 2q = 4$$

$$\Rightarrow q = 2, p = 11$$

$$(vi) \quad 3u - 2v = -26 \quad (A)$$

$$-u + 6v = 46 \quad (B)$$

$$(B) \Rightarrow -3u + 18v = 138 \quad (C)$$

$$(A) + (C) \Rightarrow 16v = 112$$

$$\Rightarrow v = 7, u = -4$$