1.   Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25$$
$$y - 2x = 5$$

$$x^2 + y^2 = 25 \quad \text{Sub}$$
$$y = 2x + 5 \quad ①$$

$$y = 2x + 5$$

$$x^2 + (2x+5)^2 = 25$$
$$x^2 + (2x+5)(2x+5) = 25$$
$$x^2 + 4x^2 + 10x + 10x + 25 = 25$$
$$5x^2 + 20x + 25 = 25$$
$$5x^2 + 20x = 0$$
$$x^2 + 4x = 0 \quad ①$$
$$x(x+4) = 0 \quad ①$$

$$x = 0 \qquad x + 4 = 0$$
$$x = -4$$
$$①$$

$$y - 2x = 5$$

Sub $x = 0$	Sub $x = -4$
$y - 2(0) = 5$	$y - 2(-4) = 5$
$y = 5$	$y + 8 = 5$
	$y = -3$

$$x = 0, y = 5 \text{ and } x = -4, y = -3 \quad ①$$

2.   Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25$$
$$y - 3x = 13$$

$y - 3x = 13.$ $y = 13 + 3x$ ①

$x^2 + y^2 = 25.$ $x^2 + (13 + 3x)^2 = 25$

$x^2 + (13 + 3x)(13 + 3x) = 25.$ $x^2 + 169 + 39x + 39x + 9x^2$ ①

$= 10x^2 + 78x + 169 = 25.$ $10x^2 + 78x + 144 = 0.$ ①

$(5x + 24)(x + 3) = 0.$

$5x + 24 = 0.$ $x + 3 = 0.$

$5x = -24$ $x = -3$

$x = -\frac{24}{5}.$ ①

when $x = \frac{-24}{5}$:

$y = 13 + 3\left(-\frac{24}{5}\right) = -\frac{7}{5}$

when $x = -3$:

$y = 13 + 3(-3) = y = 4$ ①

$x = -\frac{24}{5},\ y = \frac{-7}{5}$

$x = -3,\ y = 4.$

....

(Total for Question   is 5 marks)

3. Solve the simultaneous equations

① $3x + y = -4$ $y = -4 - 3x$

② $3x - 4y = 6$

② $3x - 4y = 6$

$3x - 4(-4 - 3x) = 6$

$3x + 16 + 12x = 6$

$15x + 16 = 6$ $\Big)\,-16$

$15x = -10$

$\div 15 \Big\downarrow x = -\dfrac{10}{15}$ $\Big)\,\div 15$ ①

① $3x + y = -4$

$y = -4 - 3x$

$y = -4 - 3\left(-\dfrac{10}{15}\right)$

$y = -4 + \dfrac{30}{15}$
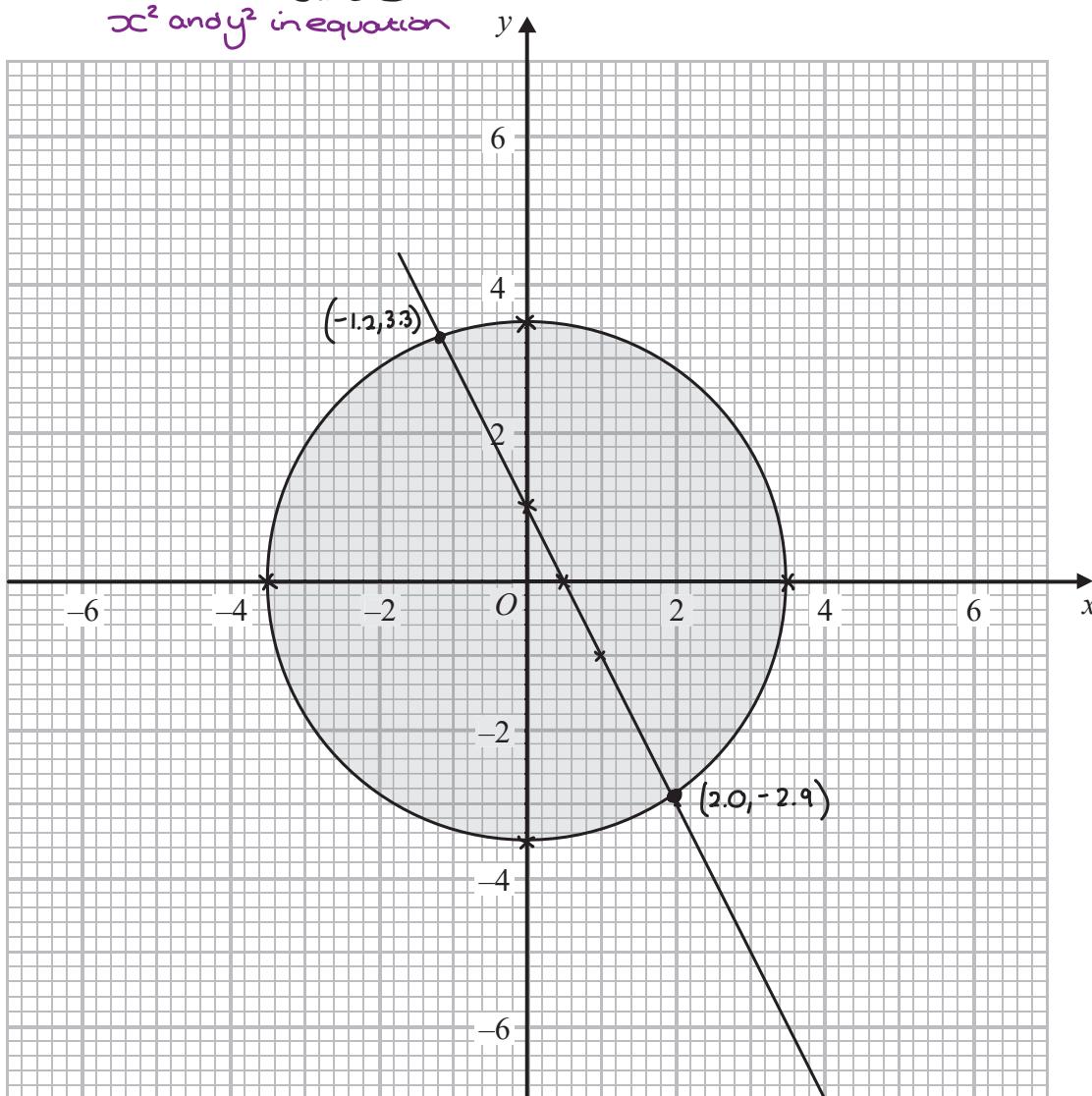
$y = -4 + 2$

$y = -2$ ①

①

$x = -\dfrac{2}{3}$

$y = -2$

$x = \dfrac{-2/3}{}$

$y = \dfrac{-2}{}$

(Total for Question   is 3 marks)

4. (a) On the grid, draw the graph of $x^2 + y^2 = 12.25$

Centre $(0,0)$

Circle

x^2 and y^2 in equation

radius $= \sqrt{12.25} = 3.5$

$(-1.2, 3.3)$

$(2.0, -2.9)$

(2)

(b) Hence find estimates for the solutions of the simultaneous equations

$$x^2 + y^2 = 12.25$$
$$2x + y = 1$$

① Draw on grid – find where it meets the circle

2 correct

① $x = 2.0 \quad y = -2.9, \quad x = -1.2 \quad y = 3.3$ ①

(3)

(Total for Question is 5 marks)

5.   Solve the simultaneous equations

① $5x + y = 21$
② $x - 3y = 9$

① × 3

$5x + y = 21$

$\downarrow \times 3$ $\downarrow \times 3$

③ $15x + 3y = 63$

② + ③

$x - 3y = 9$
$15x + 3y = 63$ +
$16x \quad\quad = 72$ ✓

$\downarrow \div 8$ $\downarrow \div 8$

$2x \quad = 9$

$\downarrow \div 2$ $\downarrow \div 2$

$x \quad = 4.5$

$x - 3y = 9$

When $x = 4.5$
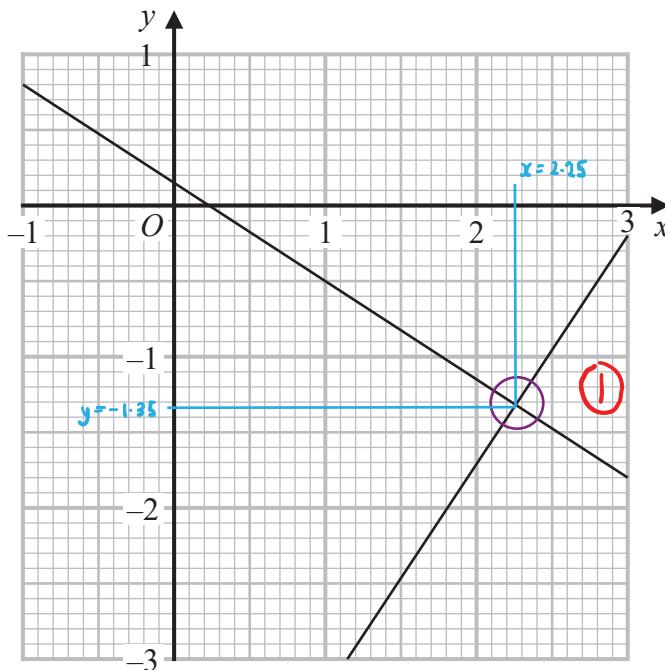
$4.5 - 3y = 9$
$\quad + 3y \quad\quad + 3y$ ✓

$4.5 = 9 + 3y$
$-9 \quad\quad -9$

$-4.5 = 3y$
$\div 3 \quad \div 3$

$-1.5 = y$

$x =$ ....4.5.......................

$y =$ ....-1.5....... ✓

(Total for Question   is 3 marks)

6. The graphs with equations $3y + 2x = \dfrac{1}{2}$ and $2y - 3x = -\dfrac{113}{12}$ have been drawn on the grid below.

Using the graphs, find estimates of the solutions of the simultaneous equations

$$3y + 2x = \frac{1}{2}$$

$$2y - 3x = -\frac{113}{12}$$

solution found at
the point at which
the two lines intersect.

$x =$ 2.25 ①

$y =$ −1.35

(Total for Question   is 2 marks)

7.   Solve algebraically the simultaneous equations

$$x^2 - 4y^2 = 9$$
$$3x + 4y = 7$$

① $3x + 4y = 7$

$3x = 7 - 4y$

$x = \dfrac{7 - 4y}{3}$ ①

② $x^2 - 4y^2 = 9$

$\left(\dfrac{7-4y}{3}\right)^2 - 4y^2 = 9$

$\dfrac{49 - 56y + 16y^2}{9} - \boxed{4y^2} = 9$ $\equiv \dfrac{36y^2}{9}$ ①

③ $\dfrac{49 - 56y + 16y^2}{9} - \dfrac{36y^2}{9} = 9$ $\therefore \dfrac{49 - 56y + 16y^2 - 36y^2}{9} = 9$

$49 - 56y + \boxed{16y^2 - 36y^2} = 81.$ $16y^2 - 36y^2 = -20y^2$

$-32 - 56y - 20y^2 = 0$ $\therefore -20y^2 - 56y - 32 = 0$ we can multiply both sides by -1

$20y^2 + 56y + 32 = 0.$ $\xrightarrow{\div 4}$ $5y^2 + 14y + 8 = 0.$ ①

④ $5y^2 + 14y + 8 = 0.$

$(5y + 4)(y + 2) = 0$

$\therefore y = -2, \; y = -\dfrac{4}{5}$

$x = \dfrac{7 - 4y}{3}$ ①

⑤ when $y = -2$:

$x = \dfrac{7 - 4(-2)}{3} = 5.$ $x = 5, \; y = -2.$

when $y = -\dfrac{4}{5}$:

$x = \dfrac{7 - 4\left(-\frac{4}{5}\right)}{3} = \dfrac{17}{5}$ $x = \dfrac{17}{5}, \; y = -\dfrac{4}{5}$

$$\boxed{x = 5, \; y = -2 \text{ and } x = \dfrac{17}{5}, \; y = -\dfrac{4}{5}}$$

①

$x = 5, \; y = -2 \text{ and } x = \dfrac{17}{5}, \; y = -\dfrac{4}{5}$

(Total for Question   is 5 marks)