



# EXAM PAPERS PRACTICE

GCSE OCR Math J560

Quadratic Simultaneous Equations

Answers

*"We will help you to  
achieve A Star "*



**Answer 1**

Solve the simultaneous equations

$$\textcircled{1} \quad y = 2x - 3$$

$$\textcircled{2} \quad x^2 + y^2 = 2$$

Sub  $\textcircled{1}$  into  $\textcircled{2}$

$$x^2 + (2x - 3)^2 = 2$$

$$x^2 + \overset{\text{Foil}}{4x^2 - 12x + 9} = 2$$

collect terms.

$$5x^2 - 12x + 9 = 2$$

$$\overset{\text{Factorise}}{5x^2 - 12x + 7} = 0$$

$$(5x - 7)(x - 1) = 0 \quad / \quad \text{or use quadratic formula}$$

$$\therefore x = \frac{7}{5} \text{ or } 1$$

$$\text{if } x = 1, \quad y = 2(1) - 3 = -1$$

$$\text{if } x = \frac{7}{5}, \quad y = 2\left(\frac{7}{5}\right) - 3 = -\frac{1}{5}$$

$$\left(1, -1\right) \quad \left(\frac{7}{5}, -\frac{1}{5}\right)$$



**Answer 2**

Solve the simultaneous equations

$$y = 3x + 2 \quad (1)$$

$$x^2 + y^2 = 20 \quad (2)$$

Show clear algebraic working.

Sub (1) into (2)

$$x^2 + (3x+2)^2 = 20$$

$$x^2 + \overbrace{(3x+2)(3x+2)} = 20$$

$$x^2 + 9x^2 + 12x + 4 = 20$$

$$10x^2 + 12x - 16 = 0$$

$$5x^2 + 6x - 8 = 0$$

$$(5x - 4)(x + 2) = 0$$

$$\therefore x = \frac{4}{5}, -2$$

Sub  $x$  into (1)

$$\left(\frac{4}{5}, \frac{22}{5}\right), (-2, -4)$$

$$\underline{\hspace{2cm}} \quad \underline{\hspace{2cm}}$$

$$\underline{\left(\frac{4}{5}, \frac{22}{5}\right)}, \underline{(-2, -4)}$$



**Answer 3**

Solve the simultaneous equations

$$\begin{aligned} y &= 2x - 3 & \textcircled{1} \\ x^2 + y^2 &= 41 & \textcircled{2} \end{aligned}$$

Show clear algebraic working.

Substitute 1 into 2

$$x^2 + (2x - 3)^2 = 41$$

Expand with foil

$$x^2 + 4x^2 - 6x - 6x + 9 = 41$$

$$5x^2 - 12x - 32 = 0$$

$$(5x + 8)(x - 4) = 0$$

$$x = -8/5, + 4$$

By substituting these values into equation 1:

$$y = 2(-8/5) - 3$$

$$y = -31/5$$

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

$$y = 5$$

The two solutions are  $(-8/5, -31/5)$  and  $(4, 5)$



Answer 4

Solve the equations

$$\begin{aligned}x^2 + y^2 &= 36 \\ x &= 2y + 6\end{aligned}$$

[ NO DEGREE OF ACCURACY ASKED  
FOR  $\rightarrow$  QUADRATIC WILL FACTORISE ]

QUADRATIC  
(NON-LINEAR)  
SIMULTANEOUS  
EQUATIONS  
USE SUBSTITUTION  
METHOD

$$x^2 + y^2 = 36 \quad \text{--- (A)}$$

$$x = 2y + 6 \quad \text{--- (B)}$$

$$\text{(B)} \rightarrow \text{(A)} \quad (2y+6)^2 + y^2 = 36$$

$$(2y+6)(2y+6) + y^2 = 36$$

F O I L

$$4y^2 + 12y + 12y + 36 + y^2 = 36$$

$$5y^2 + 24y + 36 = 36$$

$$5y^2 + 24y = 0$$

$$y(5y + 24) = 0$$

$$\text{EITHER } y=0 \text{ OR } 5y + 24 = 0$$

$$\begin{aligned}5y &= -24 \\ \frac{5y}{5} &= \frac{-24}{5} \\ y &= -\frac{24}{5} \quad (= -4.8)\end{aligned}$$

CONTINUED

$$y = 0 \text{ OR } y = -4.8$$

$\rightarrow$  (B)

$$x = 6 \text{ OR } x = -3.6$$



**Answer 5**

Solve the simultaneous equations

$$\textcircled{1} \quad y = 2x^2$$

$$\textcircled{2} \quad y = 20 - 3x$$

Show clear algebraic working.

Sub  $\textcircled{1}$  into  $\textcircled{2}$

$$2x^2 = 20 - 3x$$

$$2x^2 - 3x - 20 = 0$$

$$(2x - 5)(x + 4) = 0$$

$$x = 5/2, \quad x = -4$$

$$\therefore y = 25/2, \quad y = \underline{32}$$

$$\left(\frac{5}{2}, \frac{25}{2}\right) \text{ or } (-4, 32)$$



**Answer 6**

Solve the simultaneous equations

$$x^2 + y^2 = 26 \quad (1)$$

$$y = 3 - 2x \quad (2)$$

Show clear algebraic working.

Sub equation 2 into equation 1

$$x^2 + (3 - 2x)^2 = 26$$

Simplify

$$x^2 + (9 - 12x + 4x^2) = 26$$

$$5x^2 - 12x + 9 - 26 = 0$$

Factorise

$$5x^2 - 12x - 17 = 0$$

$$(5x - 17)(x + 1)$$

$$x = \frac{17}{5}, \quad x = -1$$

Substitute values of X back into equation 2

$$y = 3 - 2\left(\frac{17}{5}\right), \quad y = 3 - 2(-1)$$
$$= -3.8, \quad = 5$$

$$\left(\underline{\underline{3.4}}, \underline{\underline{-3.8}}\right), \left(\underline{\underline{-1}}, \underline{\underline{5}}\right)$$

$$\left(\underline{\underline{3.4}}, \underline{\underline{3.8}}\right), \left(\underline{\underline{-1}}, \underline{\underline{5}}\right)$$



**Answer 7**

Solve  $x^2 + y^2 = 20$  ①  
 $y = 10 - 2x$  ②

Show clear algebraic working.

Sub 2 into 1

$$x^2 + (10 - 2x)^2 = 20$$

$$x^2 + 100 - 20x - 20x + 4x^2 = 20$$

$$5x^2 - 40x + 80 = 0$$

$$x^2 - 8x + 16 = 0$$

$$(x-4)(x-4) = 0$$

$$x = 4$$

Sub back into equation 2:

$$y = 10 - 2(4) = 2$$

$$(4, 2)$$

---





Answer 8

QUADRATIC SIMULTANEOUS EQUATIONS  
USE "SUBSTITUTION" METHOD

Solve algebraically the simultaneous equations

$$\begin{aligned} x^2 + y^2 &= 25 & \text{--- (A)} \\ y - 3x &= 13 & \text{--- (B)} \end{aligned}$$

$$\textcircled{B}: \begin{array}{r} y - 3x = 13 \\ \quad +3x \quad +3x \\ \hline y = 3x + 13 \end{array}$$

$$\begin{aligned} \rightarrow \textcircled{A}: x^2 + (3x+13)^2 &= 25 \\ x^2 + (3x+13)(3x+13) &= 25 \\ \begin{array}{cccc} & F & O & I & L \\ x^2 + 9x^2 + 39x + 39x + 169 & & & & = 25 \\ & & & & \underline{-25} \quad \underline{-25} \end{array} \end{aligned}$$

$$\begin{array}{r} 10 \times 13 = 130 \\ + 3 \times 13 = 39 \\ \hline 13 \times 13 = 169 \end{array}$$

$$\begin{array}{r} 10 \times 72 = 720 \\ 5 \times 72 = 360 \end{array}$$

$$\begin{aligned} 10x^2 + 78x + 144 &= 0 \\ \textcircled{\div 2} \quad 5x^2 + 39x + 72 &= 0 \end{aligned}$$

- 360
- 1 x 360
- 2 x 180
- 3 x 120
- 4 x 90
- 5 x 72
- 6 x 60
- 8 x 45
- 9 x 40
- 10 x 36
- 12 x 30
- 15 x 24 ✓

CHEAT  $\rightarrow (5x+15)(5x+24)$

UNCHEAT BY CANCELLING  $\rightarrow (x+3)(5x+24) = 0$

$$\underline{x = -3} \quad \text{OR} \quad \underline{x = -\frac{24}{5}}$$

$$\begin{aligned} 5x + 24 &= 0 \\ -24 & \quad -24 \\ \hline 5x &= -24 \\ \frac{5x}{5} &= \frac{-24}{5} \\ x &= -\frac{24}{5} \end{aligned}$$

$$\begin{aligned} \rightarrow \textcircled{B} \quad y &= 3(-3) + 13 \quad \text{OR} \quad y = 3\left(-\frac{24}{5}\right) + 13 \\ y &= 4 \quad \text{OR} \quad y = -\frac{72}{5} + \frac{65}{5} \\ & \quad \quad \quad \underline{y = -\frac{7}{5}} \end{aligned}$$



**Answer 9**

Solve the simultaneous equations

$$2x - y = 7$$

$$x^2 + y^2 = 34 \quad (2)$$

Show clear algebraic working.

$$2x - y = 7 \rightarrow 2x - 7 = y \quad (1)$$

Sub equation 1 into 2

$$\begin{aligned} x^2 + (2x - 7)^2 &= 34 \\ x^2 + (2x - 7)(2x - 7) &= 34 \\ x^2 + 4x^2 - 14x - 14x + 49 &= 34 \\ 5x^2 - 28x + 15 &= 0 \end{aligned}$$

Factorise

$$\begin{aligned} (5x - 3)(x - 5) &= 0 \\ 5x = 3, \quad x &= 5 \\ x = \frac{3}{5}, \quad 5 \end{aligned}$$

Sub back into 1

$$2\left(\frac{3}{5}\right) - 7 = -5.8 = y$$

$$(0.6, -5.8)$$

Sub second value for x in

$$2(5) - 7 = 3 = y$$

$$(5, 3)$$

$$(0.6, -5.8) \text{ \& \; } (5, 3)$$

---



Answer 10

Solve the simultaneous equations

①  $4x^2 + 2x - 6y = 4$   
②  $2x - 3y = -1$

REARRANGE ②

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

SUB INTO ①

$$4x^2 + 2x - 6\left(\frac{1}{3} + \frac{2}{3}x\right) = 4$$

$$4x^2 + 2x - 2 - 4x = 4$$

$$4x^2 - 2x - 6 = 0$$

$$x = \frac{3}{2} \quad x = -1$$

SUB INTO ②

$$2\left(\frac{3}{2}\right) - 3y = -1$$

$$3 - 3y = -1$$

$$-3y = -4$$

$$y = \frac{4}{3}$$

$$2(-1) - 3y = -1$$

$$-2 - 3y = -1$$

$$-3y = 1$$

$$y = -\frac{1}{3}$$

CHECK ①

$$4\left(\frac{3}{2}\right)^2 + 2\left(\frac{3}{2}\right) - 6\left(\frac{4}{3}\right) = 4$$

$$4 = 4 \checkmark$$

$$4(-1)^2 + 2(-1) - 6\left(-\frac{1}{3}\right) = 4$$

$$4 = 4 \checkmark$$

$$x = \frac{3}{2} \quad y = \frac{4}{3} \quad x = -1 \quad y = -\frac{1}{3}$$



Answer 11

Solve the simultaneous equations

$$\begin{aligned} x^2 + y^2 &= 9 \\ x + y &= 2 \end{aligned}$$

(A)  
(B)

Give your answers correct to 2 decimal places.

(B)

$$\begin{array}{r} x + y = 2 \\ -x \phantom{+ y} = -x \end{array}$$

$$y = 2 - x$$

$$\rightarrow (A) \quad x^2 + (2-x)^2 = 9$$

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

F O I L

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

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

$$2x^2 - 4x - 5 = 0$$

$$\text{QUAD FORMULA: } x = \frac{4 \pm \sqrt{56}}{4}$$

$$x = 2.87 \text{ or } -0.87$$

$$\rightarrow (B) \quad y = -0.87 \text{ or } 2.87$$

NON-LINEAR

SIMULTANEOUS EQUATIONS:

USE SUBSTITUTION

QUADRATIC FORMULA

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a = 2$$

$$b = -4$$

$$c = -5$$

$$b^2 - 4ac = 16 - 4 \times 2 \times (-5)$$

$$= 16 + 40$$

$$= 56$$

$$x = \frac{2.87}{\dots} \quad y = \frac{-0.87}{\dots}$$

$$\text{or } x = \frac{-0.87}{\dots} \quad y = \frac{2.87}{\dots}$$



Answer 12

QUADRATIC SIMULTANEOUS EQUATIONS  
USE "SUBSTITUTION" METHOD

Solve algebraically the simultaneous equations

$$\begin{aligned}x^2 + y^2 &= 25 & \text{--- ①} \\y - 2x &= 5 & \text{--- ②}\end{aligned}$$

$$\textcircled{2} \quad \begin{array}{r} y - 2x = 5 \\ +2x \quad +2x \\ \hline \end{array}$$

$$y = 5 + 2x$$

$$\rightarrow \textcircled{1} \quad x^2 + (5 + 2x)^2 = 25$$

$$x^2 + (5 + 2x)(5 + 2x) = 25$$

$$\downarrow \quad \quad \quad \text{F} \quad \text{O} \quad \text{I} \quad \text{L} \quad \downarrow$$

$$x^2 + 25 + 10x + 10x + 4x^2 = 25$$

$$5x^2 + 20x + 25 = 25$$
$$\quad \quad \quad -25 \quad -25$$

$$5x^2 + 20x = 0$$

USE SIMPLE  
FACTORIZATION

$$5x(x + 4) = 0$$

$$5x = 0 \quad \text{or} \quad x + 4 = 0$$
$$\quad \quad \quad -4 \quad -4$$

$$\underline{x = 0}$$

$$\underline{x = -4}$$

$$\rightarrow \textcircled{2} \quad y = 5 + 2 \times 0$$

$$\underline{y = 5}$$

$$y = 5 + 2 \times (-4)$$

$$\underline{y = -3}$$



**Answer 13**

Solve the simultaneous equations

①  $x + y = 4$

②  $x^2 - 4x - 3y = 0$

REARRANGE ①  $y = 4 - x$

SUB INTO ②

$$x^2 - 4x - 3(4 - x) = 0$$
$$x^2 - 4x - 12 + 3x = 0$$
$$x^2 - x - 12 = 0$$
$$x = 4 \quad x = -3$$

SUB INTO ①

$$4 + y = 4 \quad -3 + y = 4$$
$$y = 0 \quad y = 7$$

CHECK IN ②

$$(4)^2 - 4(4) - 3(0) = 0$$
$$16 - 16 - 0 = 0 \checkmark$$
$$(-3)^2 - 4(-3) - 3(7) = 0$$
$$9 + 12 - 21 = 0 \checkmark$$

$x = 4 \quad y = 0 \quad x = -3 \quad y = 7$