



# EXAM PAPERS PRACTICE

GCSE Edexcel Math

1MA1

Quadratic Simultaneous  
Equation

Answers

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



Answer 1

Solve the equations

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

[ NO DEGREE OF ACCURACY ASKED  
FOR → 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

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

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

-36                    -36

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

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

EITHER  $y = 0$  OR  $5y + 24 = 0$

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

CONTINUED

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

→ (B)

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



**Answer 2**

Solve the simultaneous equations

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

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

Show clear algebraic working.

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

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

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

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

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

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

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



**Answer 3**

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

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

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

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



**Answer 4**

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:

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

$$(4, 2)$$

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Answer 5

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:

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

$$5x^2 - 12x + 7 = 0$$

Factorise

$$(5x - 7)(x - 1) = 0$$

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 6

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)

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

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



**Answer 7**

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 8

Solve the simultaneous equations  $x^2 + y^2 = 9$  (A)  
 $x + y = 2$  (B)

Give your answers correct to 2 decimal places.

(B)  $x + y = 2$   
 $-x$   $-x$   
 $y = 2 - x$

→ (A)  $x^2 + (2-x)^2 = 9$

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

F O I L

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

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

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

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

$x = 2.87$  or  $-0.87$

→ (B)  $y = -0.87$  or  $2.87$

NON-LINEAR  
SIMULTANEOUS  
EQUATIONS:  
USE SUBSTITUTION

QUADRATIC FORMULA  
 $ax^2 + bx + c = 0$   
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$a = 2$

$b = -4$

$c = -5$

$b^2 - 4ac = 16 - 4 \times 2 \times (-5)$   
 $= 16 + 40$   
 $= 56$

$x = 2.87$   $y = -0.87$

or  $x = -0.87$   $y = 2.87$



Answer 9

QUADRATIC SIMULTANEOUS EQUATIONS  
USE "SUBSTITUTION" METHOD

Solve algebraically the simultaneous equations

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

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

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

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

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

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

$$5x^2 + 20x + 25 = 25$$

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

USE SIMPLE  
FACTORIZATION

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

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

$$\underline{x = 0}$$

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

$$\begin{aligned}\rightarrow \text{② } y &= 5 + 2 \times 0 \\ \underline{y} &= 5\end{aligned}$$

$$\begin{aligned}y &= 5 + 2 \times (-4) \\ \underline{y} &= -3\end{aligned}$$



Answer 10

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

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

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



Answer 11

QUADRATIC SIMULTANEOUS EQUATIONS  
USE "SUBSTITUTION" METHOD

Solve algebraically the simultaneous equations

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

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

$$\rightarrow \text{(A) : } x^2 + (3x + 13)^2 = 25$$

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

$$x^2 + 9x^2 + 39x + 39x + 169 = 25$$

$$10x^2 + 78x + 144 = 0$$

$$\div 2 \quad 5x^2 + 39x + 72 = 0$$

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

UNCHEAT BY CANCELING

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

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

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

$$\rightarrow \text{(B) } y = 3(-3) + 13 \quad \text{OR} \quad y = 3\left(\frac{-24}{5}\right) + 13$$

$$y = 4 \quad \text{OR} \quad y = \frac{-72}{5} + \frac{65}{5}$$

$$y = \frac{-7}{5}$$

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

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

- 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 ✓



**Answer 12**

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

$$x^2 + (2x - 7)^2 = 34$$

$$x^2 + (2x - 7)(2x - 7) = 34$$

$$x^2 + 4x^2 - 14x - 14x + 49 = 34$$

$$5x^2 - 28x + 15 = 0$$

Factorise

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

$$5x = 3, x = 5$$

$$x = \frac{3}{5}, 5$$

Sub back into 1

$$2(3/5) - 7 = -5.8 = y$$

$$(0.6, -5.8)$$

Sub second value for x in

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

$$(5, 3)$$

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



Answer 13

Solve the simultaneous equations

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

REARRANGE ②

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

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

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

$$4 = 4 \checkmark$$

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

$$4 = 4 \checkmark$$

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