



8.1D Quadratic Simultaneous Equations: Fluency and Exam Drill

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 75 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Solve the simultaneous equations

$$y = x^2$$

$$y = 2x + 3$$

(Total for Question 1 is 3 marks)

2 Solve the simultaneous equations

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

$$y = x - 1$$

(Total for Question 2 is 3 marks)

3 Solve the simultaneous equations

$$y = x^2 - 4$$

$$x + y = 6$$

(Total for Question 3 is 4 marks)

- 4 For which value(s) of k does the line $y = kx + 1$ meet the parabola $y = x^2 + 1$ at exactly one point?

(Total for Question 4 is 2 marks)

- 5 Solve the simultaneous equations

$$y = x^2 - x$$

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

(Total for Question 5 is 3 marks)

- 6 Solve the simultaneous equations

$$y = 2x^2 - 3$$

$$x - y = 1$$

(Total for Question 6 is 4 marks)

- 7 Show that the simultaneous equations

$$y = x^2 - 6x + 8$$

$$y = 0$$

have solutions $x = 2$ and $x = 4$.

(Total for Question 7 is 3 marks)

- 8** Find the value of k for which the horizontal line $y = k$ meets the parabola $y = x^2 - 2x$ at $x = 0$ and $x = 2$.

(Total for Question 8 is 2 marks)

- 9** Solve the simultaneous equations

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

$$y = x + 1$$

(Total for Question 9 is 4 marks)

- 10** Solve the simultaneous equations

$$y = x^2 + x$$

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

(Total for Question 10 is 4 marks)

- 11** Solve the simultaneous equations

$$y = x^2 + 4x + 1$$

$$y = -x - 3$$

(Total for Question 11 is 3 marks)

- 12** For which value(s) of a does the line $y = 2x + 3$ meet the parabola $y = x^2 + ax + 4$ at exactly one point? Give all real values of a .

(Total for Question 12 is 4 marks)

Mark scheme · 8.1D Quadratic Simultaneous Equations: Fluency and Exam Drill

Question 1

- **M1** equate the two expressions: $x^2 = 2x + 3$
- **M1** rearrange and factorise: $x^2 - 2x - 3 = (x - 3)(x + 1)$
- **A1** both solution pairs (3, 9) and (-1, 1) cao
- **Answer:** $(x, y) = (3, 9)$ and $(-1, 1)$. (So $x = 3$ or -1 , with corresponding y values 9 and 1.)

Question 2

- **M1** equate the two expressions: $-x^2 + 5 = x - 1$
- **M1** rearrange and factorise: $x^2 + x - 6 = (x + 3)(x - 2)$
- **A1** both solution pairs (-3, -4) and (2, 1) cao
- **Answer:** $(x, y) = (-3, -4)$ and $(2, 1)$.

Question 3

- **M1** substitute y from the first equation into the second: $x + x^2 - 4 = 6$
- **M1** rearrange to a quadratic and apply the quadratic formula: $x^2 + x - 10 = 0$
- **A1** $x = (-1 \pm \sqrt{41})/2$ and $x = (-1 - \sqrt{41})/2$ (exact values) cao
- **A1** corresponding y values $y = (13 - \sqrt{41})/2$ and $y = (13 + \sqrt{41})/2$ cao
- **Answer:** $x = (-1 \pm \sqrt{41})/2$. Corresponding $y = 6 - x$ so $y = (13 \mp \sqrt{41})/2$. (Two solution pairs.)

Question 4

- **M1** equate: $x^2 + 1 = kx + 1$ so $x^2 - kx = 0$
- **A1** for a repeated root need $k = 0$ so $k = 0$ cao
- **Answer:** $k = 0$.

Question 5

- **M1** equate and rearrange: $x^2 - x = -x^2 + 3x - 2 \Rightarrow 2x^2 - 4x + 2 = 0$
- **M1** divide by 2 and factorise: $x^2 - 2x + 1 = (x - 1)^2$
- **A1** single solution $(x, y) = (1, 0)$ cao
- **Answer:** $(x, y) = (1, 0)$.

Question 6

- **M1** substitute $y = x - 1$ into $2x^2 - 3 = x - 1$ to form $2x^2 - x - 2 = 0$
- **M1** apply quadratic formula: $x = [1 \pm \sqrt{1 + 16}]/4 = [1 \pm \sqrt{17}]/4$
- **A1** $x = (1 + \sqrt{17})/4$ and $x = (1 - \sqrt{17})/4$ (exact) cao
- **A1** corresponding $y = x - 1$ so $y = (1 + \sqrt{17})/4 - 1$ and $y = (1 - \sqrt{17})/4 - 1$ cao
- **Answer:** $x = (1 \pm \sqrt{17})/4$. Corresponding $y = x - 1 = (1 \pm \sqrt{17})/4 - 1$.

Question 7

- **M1** substitute $y = 0$ into $y = x^2 - 6x + 8$ to get $x^2 - 6x + 8 = 0$ cso
- **M1** factorise to $(x - 2)(x - 4) = 0$ cso
- **A1** conclude $x = 2$ and $x = 4$ cao cso
- **Answer:** $x = 2$ and $x = 4$ (so the solution pairs are (2, 0) and (4, 0)).

Question 8

- **M1** compute k from either $x = 0$ or $x = 2$: $k = 0^2 - 0 = 0$ or $k = 2^2 - 4 = 0$
- **A1** $k = 0$ cao
- **Answer:** $k = 0$.

Question 9

- **M1** substitute $y = x + 1$ into $x^2 + y^2 = 25$ to get $x^2 + (x + 1)^2 = 25$
- **M1** simplify to $2x^2 + 2x - 24 = 0$ and divide by 2 to get $x^2 + x - 12 = 0$
- **A1** factorise to $(x + 4)(x - 3)$ so $x = -4$ or $x = 3$
- **A1** corresponding pairs $(x, y) = (-4, -3)$ and $(3, 4)$ cao
- **Answer: $(x, y) = (-4, -3)$ and $(3, 4)$.**

Question 10

- **M1** equate and rearrange: $x^2 + x = -x^2 + 5 \Rightarrow 2x^2 + x - 5 = 0$
- **M1** use quadratic formula: $x = \frac{-1 \pm \sqrt{1 + 40}}{4} = \frac{-1 \pm \sqrt{41}}{4}$
- **A1** $x = \frac{-1 + \sqrt{41}}{4}$ and $x = \frac{-1 - \sqrt{41}}{4}$ (exact) cao
- **A1** corresponding $y = x^2 + x$ evaluated at these x values cao
- **Answer: $x = \frac{-1 \pm \sqrt{41}}{4}$. Corresponding y values $y = x^2 + x$ evaluated at these x .**

Question 11

- **M1** equate and rearrange: $x^2 + 4x + 1 = -x - 3 \Rightarrow x^2 + 5x + 4 = 0$
- **M1** factorise: $(x + 1)(x + 4) = 0$
- **A1** solution pairs $(x, y) = (-1, -2)$ and $(-4, 1)$ cao
- **Answer: $(x, y) = (-1, -2)$ and $(-4, 1)$.**

Question 12

- **M1** equate and form quadratic: $x^2 + ax + 4 = 2x + 3 \Rightarrow x^2 + (a - 2)x + 1 = 0$
- **M1** require discriminant $= 0$ for exactly one point: $(a - 2)^2 - 4 \cdot 1 \cdot 1 = 0$
- **A1** solve $(a - 2)^2 = 4$ so $a - 2 = 2$ or $a - 2 = -2$
- **A1** give $a = 4$ or $a = 0$ cao
- **Answer: $a = 4$ or $a = 0$.**