2.5 Simultaneous Equations: Linear and Quadratic: 1-hour Pack

Total Marks

AQA 8365 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Solve the simultaneous equations $y = 2x^2 - 11x - 3$ and $y = -x - 15$. Give your answers as coordinates.

(Total for Question 1 is 5 marks)

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2 Find the number of points where the curve $y = x^2 + 6x + 8$ meets the line $y = 4x + 9$. You must show your working.

(Total for Question 2 is 4 marks)

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3 The line $y = (12/5)x + k$ is a tangent to the circle $x^2 + y^2 = 225$. Find the possible values of k.

(Total for Question 3 is 5 marks)

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4 Solve the simultaneous equations $xy = -2$ and $y = x - 3$.

(Total for Question 4 is 5 marks)

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5 Find the number of points where the curve $y = x^2 + 2x + 8$ meets the line $y = -x - 6$. You must show your working.

(Total for Question 5 is 4 marks)

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6 A circle has equation $x^2 + y^2 = 145$. A line has equation $x - y = 11$. Find the coordinates of the points where the line meets the circle.

(Total for Question 6 is 5 marks)

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7 Solve the simultaneous equations $y = x^2 - 2x - 1$ and $y = 2x + 4$. Give your answers as coordinates.

(Total for Question 7 is 5 marks)

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8 Find the number of points where the curve $y = 3x^2 + 3x - 5$ meets the line $y = 4x + 7$. You must show your working.

(Total for Question 8 is 4 marks)

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9 Solve the simultaneous equations $x^2 + y^2 = 130$ and $x + y = 16$.

(Total for Question 9 is 5 marks)

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10 Solve the simultaneous equations $y = 2x^2 + 6x + 1$ and $y = 2x + 7$. Give your answers as coordinates.

(Total for Question 10 is 5 marks)

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11 Two numbers have a sum of 17. The sum of their squares is 145. Find the two numbers.

(Total for Question 11 is 3 marks)

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12 A line has equation $y = kx + 5$, where k is a constant. A curve has equation $y = x^2 + 3x + 9$.

(a) Show that the x-coordinates of the points of intersection of the line and the curve satisfy $x^2 + (3 - k)x + 4 = 0$. **(2)**

(b) Hence find the range of values of k for which the line intersects the curve at two distinct points. **(3)**

(Total for Question 12 is 5 marks)

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Mark scheme · 2.5 Simultaneous Equations: Linear and Quadratic: 1-hour Pack

Question 1

equates the two expressions for y	**M1**
rearranges to $2x^2 - 10x + 12 = 0$	**M1**
solves the quadratic	**M1**
x = 2 and x = 3	**A1**
(2, -17) and (3, -18) cao	**A1**

Answer: (2, -17) and (3, -18)

Question 2

equates the expressions for y	**M1**
rearranges to $x^2 + 2x - 1 = 0$	**M1**
discriminant ($b^2 - 4ac$) = 8	**M1**
2 points with a correct conclusion from the discriminant	**A1**

Answer: 2 points

Question 3

substitutes the line into the circle equation	**M1**
forms a quadratic in x	**M1**
uses discriminant = 0	**M1**
$k^2 = 1521$	**A1**
k = 39 or k = -39 cao	**A1**

Answer: k = 39 or k = -39

Question 4

substitutes y = x + d into xy = c	**M1**
rearranges to $x^2 - 3x + 2 = 0$	**M1**
solves	**M1**
both x values correct	**A1**
(1, -2) and (2, -1) cao	**A1**

Answer: (1, -2) and (2, -1)

Question 5

equates the expressions for y	**M1**
rearranges to $x^2 + 3x + 14 = 0$	**M1**
discriminant ($b^2 - 4ac$) = -47	**M1**
0 points (no intersection) with a correct conclusion from the discriminant	**A1**

Answer: 0 points (no intersection)

Question 6

rearranges the line to make x or y the subject and substitutes	**M1**
obtains a quadratic in one variable	**M1**
solves the quadratic	**M1**
both x values (or both y values) correct	**A1**
(-1, -12) and (12, 1) cao	**A1**

Answer: (-1, -12) and (12, 1)

Question 7

equates the two expressions for y	**M1**
rearranges to $x^2 - 4x - 5 = 0$	**M1**
solves the quadratic	**M1**
x = -1 and x = 5	**A1**
(-1, 2) and (5, 14) cao	**A1**

Answer: (-1, 2) and (5, 14)

Question 8

equates the expressions for y	**M1**
rearranges to $3x^2 - x - 12 = 0$	**M1**
discriminant ($b^2 - 4ac$) = 145	**M1**
2 points with a correct conclusion from the discriminant	**A1**

Answer: 2 points

Question 9

substitutes y = s - x	**M1**
forms and simplifies a quadratic	**M1**
solves the quadratic	**M1**
both x values correct	**A1**
(7, 9) and (9, 7) cao	**A1**

Answer: (7, 9) and (9, 7)

Question 10

equates the two expressions for y	**M1**
rearranges to $2x^2 + 4x - 6 = 0$	**M1**
solves the quadratic	**M1**
x = -3 and x = 1	**A1**
(-3, 1) and (1, 9) cao	**A1**

Answer: (-3, 1) and (1, 9)

Question 11

square the sum, $(x+y)^2 = x^2+2xy+y^2 = 289$	**M1**
substitute $x^2+y^2=145$ to find $2xy=289-145$, giving $xy=72$	**M1**
form and solve $t^2-17t+72=0$, e.g. $(t-8)(t-9)=0$, giving the numbers 8 and 9	**A1**

Answer: 8 and 9

Question 12

(a) set kx + 5 equal to $x^2 + 3x + 9$	**M1**
(a) cso: correctly rearrange to $x^2 + (3 - k)x + 4 = 0$	**A1**

(a) Answer: $x^2 + (3 - k)x + 4 = 0$ (shown)

(b) write the discriminant condition $(3 - k)^2 - 4(1)(4) > 0$	**M1**
(b) expand and simplify to $k^2 - 6k - 7 > 0$ oe	**M1**
(b) factorise or otherwise find the critical values k = 7 and k = -1, giving k > 7 or k < -1	**A1**

(b) Answer: k > 7 or k < -1

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