HIGHER

8.1 Quadratic Simultaneous Equations: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 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)

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2 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 2 is 2 marks)

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3 Show that the simultaneous equations

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

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

(Total for Question 3 is 3 marks)

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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)

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5 Solve the simultaneous equations

$y = 2x^2 - 3$
$x - y = 1$

(Total for Question 5 is 4 marks)

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6 Solve the simultaneous equations

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

(Total for Question 6 is 4 marks)

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7 Solve the simultaneous equations $y = 2x + 10$ and $x^2 + y^2 = 25$.

(Total for Question 7 is 5 marks)

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

(Total for Question 8 is 5 marks)

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9 Solve the simultaneous equations $x + y = 4$ and $x^2 + y^2 = 10$.

(Total for Question 9 is 5 marks)

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10 Solve the simultaneous equations $x + y = -1$ and $x^2 + y^2 = 5$.

(Total for Question 10 is 5 marks)

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11 The line $y = -x + k$ is a tangent to the curve $y = x^2 - 2x - 4$. Work out the value of k.

(Total for Question 11 is 4 marks)

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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)

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Mark scheme · 8.1 Quadratic Simultaneous Equations: Test Pack

Question 1

equate the two expressions: $x^2 = 2x + 3$	**M1**
rearrange and factorise: $x^2 - 2x - 3 = (x - 3)(x + 1)$	**M1**
both solution pairs (3, 9) and (-1, 1) cao	**A1**

Answer: (x, y) = (3, 9) and (-1, 1). (So x = 3 or -1, with corresponding y values 9 and 1.)

Question 2

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

Answer: k = 0.

Question 3

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	**M1**
conclude x = 2 and x = 4 cao cso	**A1**

Answer: x = 2 and x = 4 (so the solution pairs are (2, 0) and (4, 0)).

Question 4

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

Answer: k = 0.

Question 5

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

Answer: $x = (1 \pm \sqrt{17})/4$. Corresponding $y = x - 1 = (1 \pm \sqrt{17})/4 - 1$.

Question 6

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

Answer: $x = (-1 \pm \sqrt{41})/4$. Corresponding y values $y = x^2 + x$ evaluated at these x.

Question 7

substitutes y = mx + c into the circle equation	**M1**
expands and simplifies to a quadratic	**M1**
solves the quadratic	**M1**
x = -5 and x = -3	**A1**
(-5, 0) and (-3, 4)	**A1**

Answer: (-5, 0) and (-3, 4)

Question 8

substitutes y = -16 - x	**M1**
expands and simplifies to a quadratic	**M1**
solves the quadratic	**M1**
both x values correct	**A1**
(-9, -7) and (-7, -9)	**A1**

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

Question 9

substitutes y = 4 - x	**M1**
expands and simplifies to a quadratic	**M1**
solves the quadratic	**M1**
both x values correct	**A1**
(1, 3) and (3, 1)	**A1**

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

Question 10

substitutes y = -1 - x	**M1**
expands and simplifies to a quadratic	**M1**
solves the quadratic	**M1**
both x values correct	**A1**
(-2, 1) and (1, -2)	**A1**

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

Question 11

equates the expressions for y	**M1**
rearranges to $x^2 - x + (-4 - k) = 0$ or equivalent	**M1**
uses discriminant $b^2 - 4ac = 0$	**M1**
k = -17/4	**A1**

Answer: k = -17/4

Question 12

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: $(a - 2)^2 - 4*1*1 = 0$	**M1**
solve $(a - 2)^2 = 4$ so a - 2 = 2 or a - 2 = -2	**A1**
give a = 4 or a = 0 cao	**A1**

Answer: a = 4 or a = 0.

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