2.5 Simultaneous Equations: Linear and Quadratic: Test Pack

Total Marks

AQA 8365 · Calculator allowed · about 65 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Solve the simultaneous equations $3x + 2y = 16$ and $x - y = 2$.

(Total for Question 1 is 3 marks)

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2 A line has equation $y = x - 1$ and a curve has equation $y = x^2 - 7$. Which one of these pairs gives both solutions of the simultaneous equations?

- ☐ A) (3, 2) and (-2, -3)
- ☐ B) (2, 3) and (-3, -2)
- ☐ C) (3, 2) only
- ☐ D) (7, 6) and (-2, -3)

(Total for Question 2 is 1 mark)

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3 Solve the simultaneous equations $3x - 2y = 4$ and $x + y = 8$.

(Total for Question 3 is 1 mark)

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4 A line has equation $y = 2x - 1$. Substitute this into $y = x^2 - 3x + 5$ to form a quadratic equation in x, giving your answer in the form $x^2 + bx + c = 0$.

(Total for Question 4 is 1 mark)

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5 Solve the simultaneous equations $x + 3y = 14$ and $x - 3y = 2$.

(Total for Question 5 is 1 mark)

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

(Total for Question 6 is 5 marks)

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7 The line $y = (3/4)x + k$ is a tangent to the circle $x^2 + y^2 = 64$. Find the possible values of k.

(Total for Question 7 is 5 marks)

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8 Solve the simultaneous equations $x^2 + y^2 = 73$ and $x + y = 5$.

(Total for Question 8 is 5 marks)

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9 A rectangular allotment plot has a perimeter of 26 metres and an area of 40 square metres. The length of the plot is greater than its width. Form a pair of simultaneous equations and solve them to find the length and width of the plot.

(Total for Question 9 is 5 marks)

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10 A curve has equation $x^2 + y^2 = 17$. A line has equation $y = x + 3$. Find the coordinates of the two points where the line intersects the curve.

(Total for Question 10 is 6 marks)

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11 Show that the line $y = 5x + 3$ does not intersect the curve $y = x^2 + 3x + 9$.

(Total for Question 11 is 2 marks)

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12 A circle has equation $x^2 + y^2 = 20$. A line has equation $y = 2x + c$. Given that the line is a tangent to the circle, find the possible values of c.

(Total for Question 12 is 6 marks)

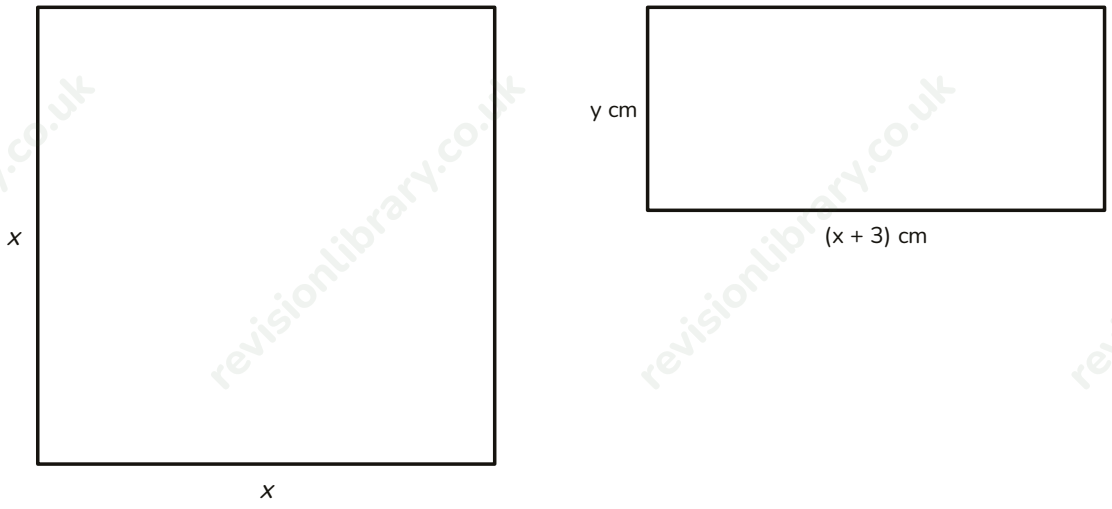
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13 Two numbers, x and y, satisfy $x + y = 5$ and $x^2 + y^2 = 15$. Find the values of x and y, giving your answers as simplified surds.

(Total for Question 13 is 6 marks)

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14 A square has side length x cm. A rectangle has length (x + 3) cm and width y cm. The square and the rectangle have equal areas. The perimeter of the rectangle is 26 cm. Given that $x > 0$, find the value of x and the value of y.



(Total for Question 14 is 7 marks)

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Mark scheme · 2.5 Simultaneous Equations: Linear and Quadratic: Test Pack

Question 1

rearrange x - y = 2 to x = y + 2 (or equivalent elimination step)	**M1**
substitute and solve to find one value, e.g. 5y = 10 leading to y = 2	**M1**
x = 4 and y = 2 cao	**A1**

Answer: x = 4, y = 2

Question 2

A selected cao	**B1**

Answer: A) (3, 2) and (-2, -3)

Question 3

x = 4 and y = 4 cao	**B1**

Answer: x = 4, y = 4

Question 4

x^2 - 5x + 6 = 0 cao	**B1**

Answer: x^2 - 5x + 6 = 0

Question 5

x = 8 and y = 2 cao	**B1**

Answer: x = 8, y = 2

Question 6

substitutes y = s - x	**M1**
forms and simplifies a quadratic	**M1**
solves the quadratic	**M1**
both x values correct	**A1**
(1, 3) and (3, 1) cao	**A1**

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

Question 7

substitutes the line into the circle equation	**M1**
forms a quadratic in x	**M1**
uses discriminant = 0	**M1**
$k^2 = 100$	**A1**
k = 10 or k = -10 cao	**A1**

Answer: k = 10 or k = -10

Question 8

substitutes y = s - x	**M1**
forms and simplifies a quadratic	**M1**
solves the quadratic	**M1**
both x values correct	**A1**
(-3, 8) and (8, -3) cao	**A1**

Answer: (-3, 8) and (8, -3)

Question 9

form the perimeter equation l + w = 13 oe	**B1**
form the area equation lw = 40 oe	**B1**
eliminate one variable to form a 3-term quadratic equal to zero, e.g. l^2 - 13l + 40 = 0 oe	**M1**
factorise or otherwise solve, (l - 5)(l - 8) = 0, giving l = 5 or l = 8	**A1**
length = 8 m and width = 5 m oe, with correct units	**A1**

Answer: Length = 8 m, width = 5 m

Question 10

substitute y = x + 3 into $x^2 + y^2 = 17$	**M1**
correct expansion, $x^2 + x^2 + 6x + 9 = 17$ oe	**A1**
rearrange to a correct 3-term quadratic equal to zero, $x^2 + 3x - 4 = 0$ oe	**M1**
correct quadratic $x^2 + 3x - 4 = 0$	**A1**
factorise or otherwise solve, (x + 4)(x - 1) = 0	**M1**
both coordinate pairs correct: (-4, -1) and (1, 4) cao	**A1**

Answer: (-4, -1) and (1, 4)

Question 11

set 5x+3 equal to x^2+3x+9 and rearrange to x^2-2x+6=0, then find the discriminant b^2-4ac = 4-24	**M1**
cso: discriminant = -20, and since -20 < 0 there are no real solutions, so the line does not intersect the curve	**A1**

Answer: Discriminant = -20 < 0, so no real intersection points exist.

Question 12

substitute y = 2x + c into $x^2 + y^2 = 20$	**M1**
correct expansion, $x^2 + 4x^2 + 4cx + c^2 = 20$ oe	**A1**
correct 3-term quadratic equal to zero, $5x^2 + 4cx + (c^2 - 20) = 0$ oe	**A1**
set the discriminant equal to zero (tangent condition), $(4c)^2 - 4(5)(c^2 - 20) = 0$	**M1**
correct simplified equation, $c^2 = 100$ oe	**A1**
c = 10 or c = -10, both values, cao	**A1**

Answer: c = 10 or c = -10

Question 13

square the sum, $(x + y)^2 = x^2 + 2xy + y^2 = 25$	**M1**
substitute $x^2 + y^2 = 15$ to find 2xy = 25 - 15	**M1**
xy = 5 oe	**A1**
form the quadratic t^2 - 5t + 5 = 0 and apply the quadratic formula	**M1**
$t = (5 \pm \sqrt{5}) / 2$ oe	**A1**
$x = (5 + \sqrt{5})/2$ and $y = (5 - \sqrt{5})/2$, or the values the other way round, cao	**A1**

Answer: x = $(5 + \sqrt{5})/2$, y = $(5 - \sqrt{5})/2$ (or vice versa)

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Question 14

form the equal-areas equation $x^2 = (x + 3)y$ oe	**B1**
form the perimeter equation $(x + 3) + y = 13$ oe	**B1**
rearrange the perimeter equation to $y = 10 - x$ and eliminate y, $x^2 = (10 - x)(x + 3)$ oe	**M1**
correct 3-term quadratic equal to zero, $2x^2 - 7x - 30 = 0$ oe	**A1**
factorise or otherwise solve, $(2x + 5)(x - 6) = 0$	**M1**
$x = 6$, rejecting $x = -2.5$ since $x > 0$	**A1**
y = 4 ft from their value of x	**A1**

Answer: x = 6, y = 4

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