5.11 Simultaneous Equations: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the value of x and y that satisfy both equations.

$x = 3$

$2x + y = 8$

(Total for Question 1 is 1 mark)

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2 Solve the simultaneous equations:

$2x + y = 11$

$2x - y = 5$

(Total for Question 2 is 3 marks)

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3 Alf and Bea share some pens and pencils.

Alf buys 2 pens and 3 pencils for £9.
Bea buys 1 pen and 4 pencils for £7.

Let p be the price of a pen, in pounds, and q be the price of a pencil, in pounds. Write the simultaneous equations and solve for p and q.

(Total for Question 3 is 3 marks)

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4 Solve the simultaneous equations. Give your answers as integers.

$3x - y = 5$
$x + y = 7$

(Total for Question 4 is 4 marks)

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5 Priya is x years old and her brother Kwame is y years old. The sum of their ages is 31. Kwame is 5 years older than Priya.

$x + y = 31$
$y = x + 5$
Find the ages of Priya and Kwame.

(Total for Question 5 is 5 marks)

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6 A grocer mixes two sizes of fruit bags. A small bag contains 2 apples and 3 pears. A large bag contains 5 apples and 2 pears.

He makes some small bags and some large bags. In total there are 34 apples and 29 pears.

Let s be the number of small bags and L the number of large bags. Form the simultaneous equations and solve for s and L. Give your answers as integers.

(Total for Question 6 is 7 marks)

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7 At a summer fair, adult tickets cost a pounds each and child tickets cost c pounds each. 3 adult tickets and 2 child tickets cost £28 in total. 5 adult tickets and 1 child ticket cost £42 in total.

(a) Write down a pair of simultaneous equations for this information. **(2)**

(b) Solve your equations to find the price of an adult ticket and the price of a child ticket. **(4)**

(Total for Question 7 is 6 marks)

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8 Line L1 has equation $y = 3x - 4$. Line L2 has equation $y = -2x + 11$. Find the coordinates of the point where L1 and L2 intersect.

(Total for Question 8 is 4 marks)

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9 Show that the system $y = x^2 - x$ and $y = 3x - 4$ has exactly one real solution, and find that solution.

(Total for Question 9 is 4 marks)

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10 Mobile phone Tariff A costs £15 plus 2p per minute of calls. Tariff B costs £9 plus 5p per minute of calls. Let m be the number of minutes of calls in a month.

(a) Write an expression, in pence, for the total monthly cost of Tariff A and for the total monthly cost of Tariff B. **(2)**

(b) Find the number of minutes of calls for which the total cost of Tariff A equals the total cost of Tariff B. **(3)**

(c) State the total cost, in pounds, at this number of minutes. **(1)**

(Total for Question 10 is 6 marks)

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11 Solve the following system of three equations in three variables:

$x + y + z = 6$

$2x - y + 3z = 14$

$x + 4y - z = 2$

Give the values of x, y and z.

(Total for Question 11 is 5 marks)

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12 Show that the line $y = x + 6$ does not intersect the curve $x^2 + y^2 = 10$. You must show your working, including the value of the discriminant.

(Total for Question 12 is 5 marks)

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Mark scheme · 5.11 Simultaneous Equations: Test Pack

Question 1

x = 3, y = 2 cao	**B1**

Answer: x = 3, y = 2

Question 2

adds the two equations to eliminate y	**M1**
x = 4	**A1**
y = 3 cao	**A1**

Answer: x = 4, y = 3

Question 3

form equations: 2p + 3q = 9 and 1p + 4q = 7	**M1**
solve the two equations to find p and q, e.g. substitute or eliminate	**M1**
p = 3, q = 1 cao	**A1**

Answer: p = 3, q = 1

Question 4

add the two equations to eliminate y giving 4x = 12	**M1**
x = 3 cao	**A1**
substitute x = 3 into x + y = 7 to find y	**M1**
y = 4 cao	**A1**

Answer: x = 3, y = 4

Question 5

substitutes y = x + 5 into x + y = 31	**M1**
forms and simplifies 2x + 5 = 31	**M1**
x = 13 (Priya's age)	**A1**
y = 18 (Kwame's age) cao	**A1**
correct check shown, e.g. 13 + 18 = 31 and 18 - 13 = 5	**B1**

Answer: Priya is 13, Kwame is 18

Question 6

form equations: 2s + 5L = 34 and 3s + 2L = 29	**M1**
eliminate a variable, e.g. multiply first equation by 3 and second by 2 to align s: 6s + 15L = 102 and 6s + 4L = 58	**M1**
subtract to get 11L = 44	**M1**
L = 4 cao	**A1**
substitute L = 4 into 2s + 5L = 34 to find s	**M1**
s = 7 cao	**A1**
final answers s = 7, L = 4 cao	**A1**

Answer: s = 7, L = 4

Question 7

(a) 3a + 2c = 28 oe	**B1**
(a) 5a + c = 42 oe	**B1**

(a) Answer: 3a + 2c = 28 and 5a + c = 42

(b) rearranges 5a + c = 42 to c = 42 - 5a (or equivalent elimination approach)	**M1**
(b) substitutes to form a single equation in a, e.g. 3a + 2(42 - 5a) = 28	**M1**
(b) simplifies correctly to -7a = -56 (or equivalent) and solves for a	**M1**
(b) adult ticket = £8 and child ticket = £2 cao	**A1**

(b) Answer: Adult ticket = £8, child ticket = £2

Question 8

sets the two expressions for y equal, 3x - 4 = -2x + 11	**M1**
solves to find x = 3	**M1**
y = 5 (ft their x substituted into either equation)	**A1**
states the coordinates (3, 5) cao	**A1**

Answer: (3, 5)

Question 9

substitute 3x - 4 for y to get x^2 - x = 3x - 4 and rearrange	**M1**
complete square or factor the quadratic correctly to show $(x - 2)^2 = 0$	**dM1**
x = 2 cao	**A1**
y = 2 cao	**A1**

Answer: One solution: x = 2, y = 2

Question 10

(a) Tariff A: 1500 + 2m	**B1**
(a) Tariff B: 900 + 5m	**B1**

(a) Answer: Tariff A = 1500 + 2m pence, Tariff B = 900 + 5m pence

(b) sets 1500 + 2m = 900 + 5m	**M1**
(b) rearranges to 600 = 3m (or equivalent)	**M1**
(b) m = 200 cao	**A1**

(b) Answer: 200 minutes

(c) £19.00 (ft their m)	**B1**

(c) Answer: £19.00

Question 11

use first equation to express z = 6 - x - y and substitute into one other equation	**M1**
get two linear equations in x and y, e.g. x + 4y = 4 and 2x + 5y = 8	**M1**
solve the 2x2 system to find x and y	**M1**
x = 4 cao	**A1**
y = 0 and z = 2 cao	**A1**

Answer: x = 4, y = 0, z = 2

Question 12

substitutes y = x + 6 into $x^2 + y^2 = 10$	**M1**
expands $(x+6)^2$ correctly to $x^2 + 12x + 36$	**M1**
rearranges to the 3-term quadratic $2x^2 + 12x + 26 = 0$ (or equivalent, e.g. $x^2 + 6x + 13 = 0$)	**M1**
correctly calculates the discriminant, $b^2 - 4ac = 36 - 52 = -16$	**M1**
correct conclusion with reason: since the discriminant is negative, there are no real solutions, so the line does not intersect the curve	**A1**

Answer: Discriminant = -16, which is less than 0, so there are no real solutions and the line does not intersect the curve.

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