Systems of Equations: exam practice

10 questions · 36 marks · worked solutions and markschemes

Name _____ Date _____ Score / 36

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/slai/systems-of-equations-exam-practice

1. **3 marks · Paper 1 style · calculator allowed**

At a cinema, 3 adult tickets and 2 child tickets cost €48.50. 2 adult tickets and 5 child tickets cost €55.25.

Find the cost of one adult ticket and of one child ticket. **[3]**

2. **3 marks · Paper 1 style · calculator allowed**

Solve the system $x + y + z = 6$, $2x - y + 3z = 9$, $x + 2y - z = 2$. **[3]**

3. **3 marks · Paper 1 style · calculator allowed**

Use your calculator to solve $x^3 - 4x^2 + x + 3 = 0$. **[3]**

4. **2 marks · Paper 1 style · calculator allowed**

Use your calculator to find the real solution of $x^3 = 2x + 5$. **[2]**

5. **5 marks · Paper 1 style · calculator allowed**

A dietician is planning a meal consisting of three foods: Food A, Food B, and Food C. One serving of Food A contains 2g of protein, 3g of carbs, and 1g of fat. One serving of Food B contains 1g of protein, 2g of carbs, and 2g of fat. One serving of Food C contains 3g of protein, 1g of carbs, and 2g of fat. The meal must provide exactly 16g of protein, 19g of carbs, and 15g of fat. Set up a system of equations and use your GDC to find the exact number of servings of Food B required.

6. **2 marks · Paper 2 style · calculator allowed**

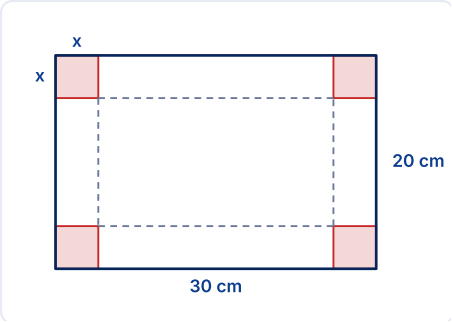
Use technology to solve the simultaneous equations $3x + 2y = 12$ and $x - y = -1$.

7. **4 marks · Paper 2 style · calculator allowed**

An open box is made from a rectangular sheet of card 30 cm by 20 cm by cutting a square of side x cm from each corner and folding up the sides. The volume of the box is $V = x(30 - 2x)(20 - 2x)$ cm^3, for $0 < x < 10$.

a. Find the volume of the box when $x = 4$. **[1]**

b. Find the possible values of x for which the volume is 1000 cm^3. **[3]**



Cut squares of side x, fold along the dashes

8. **4 marks · Paper 1 style · calculator allowed**

(a) Use your calculator to solve $2x^3 - 5x^2 - 4x + 3 = 0$. **[3]**

(b) Write down the number of positive solutions. **[1]**

9. **5 marks · Paper 2 style · calculator allowed**

A café sells coffee, tea and cake. Order 1: 2 coffees, 1 tea and 1 cake cost €12.90. Order 2: 1 coffee, 2 teas and 2 cakes cost €16.20. Order 3: 3 coffees and 2 cakes cost €17.60.

(a) Write down a system of three equations, using c, t and k for the prices of a coffee, a tea and a cake. **[3]**

(b) Find the price of each item. **[2]**

10. **5 marks · Paper 2 style · calculator allowed**

The graph of $y = ax^2 + bx + c$ passes through the points $(1, 2)$, $(2, 7)$ and $(-1, 4)$.

(a) Write down three equations in a, b and c. **[3]**

(b) Find the values of a, b and c. **[2]**

Answers and worked solutions

Question 1 — 3 marks

Answer: adult €12, child €6.25

$3a + 2c = 48.5$ and
$2a + 5c = 55.25$ **(M1)**

adult €12 **A1**

child €6.25 **A1**

Question 2 — 3 marks

Answer: $x = 1,\ y = 2,\ z = 3$

GDC or elimination **(M1)**

$x = 1,\ y = 2$ **A1**

$z = 3$ **A1**

Question 3 — 3 marks

Answer:

$x = -0.700,\ 1.24,\ 3.46$

$x = -0.700$ **A1**

$x = 1.24$ **A1**

$x = 3.46$ **A1**

Question 4 — 2 marks

Answer: $x = 2.09$

$x^3 - 2x - 5 = 0$ **(M1)**

$x = 2.09$ **A1**

Question 5 — 5 marks

Answer: 4

Let a, b, c be the servings of Foods A, B, C.
Protein: $2a + b + 3c = 16$ **A1**
Carbohydrate:
$3a + 2b + c = 19$ **A1**
Fat: $a + 2b + 2c = 15$ **A1**
Solve using the GDC (e.g. augmented matrix $\begin{pmatrix} 2 & 1 & 3 & 16 \\ 3 & 2 & 1 & 19 \\ 1 & 2 & 2 & 15 \end{pmatrix}$):
$a = 3,\ c = 2$ **(M1)**
Food B: $b = 4$ servings **A1**

Question 6 — 2 marks

Answer: $x = 2$; $y = 3$

$x = 2,\ y = 3$ **A1A1**

Question 7 — 4 marks

Answer: (a) 1056; (b) $x = 2.93, x = 5$

a. $4 \times 22 \times 12 = 1056\ \text{cm}^3$ **A1**

b. $x(30 - 2x)(20 - 2x) = 1000$ **(M1)**
$x = 2.93$ $(2.92893\ldots)$ **A1**
$x = 5$ **A1**

Question 8 — 4 marks

Answer: (a) $x = -1,\ 0.5,\ 3$; (b) 2

(a)

$x = -1$ **A1**

$x = 0.5$ **A1**

$x = 3$ **A1**

(b)

2 **A1**

Question 9 — 5 marks

Answer: (b) coffee €3.20, tea €2.50, cake €4.00

(a)

$2c + t + k = 12.9$,
$c + 2t + 2k = 16.2$ **A1**

$3c + 2k = 17.6$ **A1**

(b)

GDC **(M1)**

coffee €3.20, tea €2.50 **A1**

cake €4.00 **A1**

Question 10 — 5 marks

Answer: (b)

$a = 2,\ b = -1,\ c = 1$

(a)

$a + b + c = 2$ **A1**

$4a + 2b + c = 7$ **A1**

$a - b + c = 4$ **A1**

(b)

GDC **(M1)**

$a = 2,\ b = -1,\ c = 1$ **A1**

Every solution is also on ibmathrevision.com/slai/systems-of-equations-exam-practice
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