Algebra Exam Questions

2014

Question 4

(Suggested maximum time: 10 minutes)

(a) Factorise fully \(9a^2 - 6ab + 12ac - 8bc\).

(b) Factorise \(9x^2 - 16y^2\).

(c) Use factors to simplify the following: \(\frac{2x^2 + 4x}{2x^2 + x - 6}\).

Question 5

(Suggested maximum time: 5 minutes)

Solve the following inequality and show the solution on the number line.

\(-17 \leq 1 - 3x < 13, \quad x \in \mathbb{Z}\)
Question 11  
(Suggested maximum time: 10 minutes)

$x$ is a real number.
One new number is formed by increasing $x$ by 1.
A second new number is formed by decreasing $x$ by 2.

(i) Write down each of these new numbers, in terms of $x$.

<table>
<thead>
<tr>
<th>Increase $x$ by 1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease $x$ by 2:</td>
</tr>
</tbody>
</table>

(ii) The product of these two new numbers is 1.
Use this information to write an equation in $x$.

(iii) Solve this equation to find the two possible values of $x$.
Give each of your answers correct to 3 decimal places.

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Question 12  
(Suggested maximum time: 15 minutes)

(a) Simplify $(6x-3)(2x-1)$. 

| Simplify $(6x-3)(2x-1)$: |
(b) Simplify \( (3x^3 - 2x^2 - 3x + 2) + (x - 1) \).

(c) (i) Solve the simultaneous equations:
\[
2x - 3y = 18 \\
5x + 9y = -10.
\]

(ii) Verify your answer to (c)(i).
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Question 8

(Suggested maximum time: 20 minutes)

(a) Express in its simplest form: \( \frac{5 - x}{5} + \frac{x - 4}{4} \).

(b) Solve for \( x \): \( 3x^2 + 11x = 4 \).
(c) Divide $2x^2 + x^2 - 13x + 6$ by $x + 3$.

(d) A company employs two drivers, John and David. Each has use of a company car and small van. The company buys €30 worth of Toll Tags for each driver. Each time that a vehicle goes through the M50 Toll, a charge will be deducted from the Toll Tags.

John goes through the M50 toll five times in his car and four times in his small van. He then has €7-90 remaining on his Toll Tags. David goes through the M50 Toll twice in his car and six times in his small van. He then has €8-40 left on his Toll Tags.

Calculate how much it costs for a car and for a small van to go through the M50 Toll.
Question 9  
(Suggested maximum time: 5 minutes)

The ‘Multiplier’ is a variable used by economists to measure the affect of an increase in spending in an economy.

One version of the Multiplier is \( M = \frac{1}{S + P} \) where \( M \) is the Multiplier, \( S \) relates to savings and \( P \) relates to imports.

(a) Calculate the value of the \( M \), the Multiplier, if \( S = 0.2 \) and \( P = 0.1 \).

(b) Explain the effect on the size of \( M \) if the value of \( P \) increases.

(c) Sometimes the above formula is used to calculate \( P \). Rearrange the formula to make \( P \) its subject.
Question 10  

(Suggested maximum time: 10 minutes)

(a) If \( n = 7 \) find the value of \( 2n \) and also the value of \( 2n + 1 \).

(b) (i) \( x \) represents an even number. Explain why \( x + 2 \) is the next even number.

(ii) If one third of the smaller even number is subtracted from half of the larger even number the result is 8. Find the value of \( x \).
Question 11  
(Suggested maximum time: 10 minutes)

(a) Solve the following inequality and show the solution on the number line.

\[-2 \leq \frac{1}{2}x - 3 < 1, \ x \in \mathbb{N}.\]

(b) Josephine hopes to go to college. She has saved €3000. She will attend college for 32 weeks in her first year. She plans to have at least €800 left at the end of the year.

(i) If she spends €x each week, write an inequality to represent her spending during the year.

(ii) Hence, or otherwise, find the maximum amount Josephine can spend each week.
A capacitor is a device which stores electricity. The formula \( W = \frac{1}{2} CV^2 \) gives the energy stored in the capacitor, where \( W \) is the energy, \( C \) is the capacitance and \( V \) is the voltage, and standard units are used throughout.

(a) Find the amount of energy stored in a capacitor when \( C = 2500 \) and \( V = 32 \).

(b) Write \( V \) in terms of \( W \) and \( C \).
Question 11  

Factorise fully each of the following expressions:

(i)  \( 5x^3 - 10x^2 \)

(ii)  \( 4x^2 - 81y^2 \)

(iii)  \( a^2 - ab + 3a - 3b \)

Question 12  

(Suggested maximum time: 10 minutes)

(a)  Solve each of the following equations:

(i)  \( x^2 - 5x - 6 = 0 \)
(ii) \[ 8x^2 - 14x + 3 = 0 \]

(iii) \[ \frac{2x+5}{3} - \frac{4x-1}{2} = -\frac{1}{2} \]

(b) Find the roots of the equation \( 2x^2 - 7x - 6 = 0 \). Give your answers correct to two decimal places.