

1. Solve the inequality $5x^2 - 28x - 12 \leq 0$. [4]

2. Solve the inequality $3x^2 + 10x + 3 > 0$. [3]

3. i. Solve the inequality $\frac{1-2x}{4} > 3$. [2]

ii. Simplify $(5c^2d)^3 \times \frac{2c^4}{d^5}$. [2]

4. James tries to solve the inequality $x^2 - 5x - 14 \geq 0$. He writes his answer as

$$\{x: x \leq 2\} \cup \{x: x < 7\}.$$

Correct all the errors in his answer. [3]

5. Solve the inequality $6 - x > 5(x - 3)$. [3]

6. Find the set of values of a for which the equation

$$ax^2 + 8x + 2 = 0$$

has no real roots. [3]

7. **In this question you must show detailed reasoning.**

Find the set of values of x for which the line $y = 5x - 6$ lies below the curve $y = x^2$. [4]

END OF QUESTION paper

Mark scheme

Question			Answer/Indicative content	Marks	Part marks and guidance
1			$(5x + 2)(x - 6)$	M1	for factors giving at least two out of three terms correct when expanded and collected
			boundary values -0.4 oe and 6 soi	A1	$\frac{28 \pm \sqrt{1024}}{10}$ A0 for just 10 may be separate inequalities; mark final answer A1 for one end correct eg $x \leq 6$ or for $-0.4 < x < 6$ oe or B1 for $a \leq x \leq b$ ft their boundary values
			$-0.4 \leq x \leq 6$ oe	A2	Examiner's Comments A few made basic mistakes in factorising and finding the end-points. Those who sketched the graph of the quadratic usually reached the correct inequality. Some used the quadratic formula, which often led to unsimplified end points. Those who did not sketch often made an error such as ' $(5x - 2) \leq 0$ or $(x - 6) \leq 0$ ' as their next step after factorising. Unusually, some candidates offered final answers such as $-0.4 \bullet 0 \bullet 6$.
			Total	4	
2			$(3x + 1)(x + 3)$	1	or $3(x + 1/3)(x + 3)$

or use of formula or completing the square with at most one error (comp square must reach $[5](x - a)^2 \leq b$ oe or $(5x - c)^2 \leq d$ oe stage)
 if correct: $5(x - 2.8)^2 \leq 51.2$ or $(x - 2.8)^2 \leq 10.24$ or $(5x - 14)^2 \leq 256$

condone unsimplified but correct

$$\frac{28 - \sqrt{1024}}{10} \leq x \leq \frac{28 + \sqrt{1024}}{10}$$

etc
 allow A1 for $-0.4 \leq 0 \leq 6$
 condone errors in the inequality signs during working towards final answer

		ii	$250c^{10}d^2 \text{ or } \frac{250c^{10}}{d^2} \text{ as final answer}$	2	<p>B1 for two correct elements; must be multiplied</p> <p>if B0, allow SC1 for $125c^6d^8$ obtained from numerator or for all elements correct but added</p>	<p>Examiner's Comments</p> <p>Nearly all candidates knew how to solve a linear inequality for the first part, and earned at least one of the two marks. When the rearrangement was done so that that the $2x$ term appeared on the right, already positive (so $-11 > 2x$) the vast majority of candidates went on to get the correct answer. However, when candidates arranged to $-2x > 11$, a considerable number neglected to reverse the inequality sign when dividing by the negative value of 2. While the majority of candidates scored both marks in the second part, a number failed to expand $(5c^2d)^3$ correctly, with many of these failing to cube the 5. It was common for candidates to achieve at least two correct elements – with nearly all getting c^{10} and an equal split between those getting one of 250 or d^2. Some candidates failed to deal with the two d terms correctly in both the numerator and denominator with many of these giving an answer of d^6.</p>						
			Total	4								
4			<p>Boundary values $-2, 7$</p> $\{x : x \leq -2\} \cup \{x : x \geq 7\}$	<p>B1(AO 3.1a) B1(AO 2.3)</p> <p>B1(AO 2.5)</p> <p>[3]</p>	<table border="1"> <tr> <td>BC</td> <td></td> </tr> <tr> <td>For both of $x < -2,$ $x > 7$ or better</td> <td>Ignore use of either 'or' or 'and' here</td> </tr> <tr> <td>For completely correct answer expressed in</td> <td>Must be \leq and \geq for this mark</td> </tr> </table>	BC		For both of $x < -2,$ $x > 7$ or better	Ignore use of either 'or' or 'and' here	For completely correct answer expressed in	Must be \leq and \geq for this mark	
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					correct set notation	
			Total	3		
5			$6 - x > 5x - 15$ $21 > 6x$ or $-6x > -21$ oe or ft $x < \frac{21}{6}$ or $\frac{21}{6} > x$ <small>oe isw or ft</small>	M1 M1 M1 [3]	the first two Ms may be earned with an equation or wrong inequality ft wrong first step award 3 marks only if correct answer obtained after equations or inequalities are used with no errors	

					<p>Examiner's Comments</p> <p>This was a straight-forward inequality with very few mistakes made. The most common mistake seen involved mistakenly multiplying out the bracket to give $5x - 3$ rather than $5x - 15$. Generally, candidates worked very well with the inequality sign in this question and most, if the need arose, remembered to change the sign of the inequality when dividing or multiplying by a negative value.</p>					
			Total	3						
6			<p>Use of discriminant</p> <p>$8^2 - 4 \times a \times 2 < 0$</p> <p>$a > 8$</p>	<p>M1(AO3.1a)</p> <p>A1(AO1.1)</p> <p>A1(AO1.1)</p> <p>[3]</p>	<table border="1"> <tr> <td>Accept = or any inequality</td> <td>Values must be substituted</td> </tr> <tr> <td>Accept $8 < a$</td> <td></td> </tr> </table>	Accept = or any inequality	Values must be substituted	Accept $8 < a$		
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			Total	3						

7		<p>DR</p> $x^2 > 5x - 6$ $x^2 - 5x + 6 > 0$ $(x - 2)(x - 3) > 0$ $x < 2 \text{ or } x > 3$	<p>M1(AO 3.1a) M1(AO 1.1) A1(AO 1.1) A1(AO 2.2a) [4]</p>	<div style="border: 1px solid black; padding: 5px;"> <p>Correct factors or values 2, 3 oe, e.g. $\{x : x < 2 \cup x > 3\}$</p> </div>	
		Total	4		