1. Solve the inequality $5x^2 - 28x - 12 \leqslant 0$.

[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	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 $(5x - 14)^2 \leq 256$
	boundary values –0.4 oe and 6 soi	A1	A0 for just $\frac{28 \pm \sqrt{1024}}{10}$ 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	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
	$-0.4 \leq x \leq 6$ 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 $3(x + 1/3)(x + 3)$	

			x –3 [or]	A1	or for –1/3 and –3 found as endpoints eg by use of formula mark final answers; allow only A1 for –3 > x > –1/3 oe as final answer or for $x \leq$ –3 and $x \geq$ –1/3 if M0, allow SC1 for sketch of parabola the right way up with their solns ft their endpoints	
			x > –1/3 oe	1	**Examiner's Comments** In solving the quadratic inequality, most candidates were able to factorise the quadratic expression correctly, though a few produced incorrect factors. A small number resorted to using the formula to determine the end points, often failing to do so correctly. It was very clear that those candidates who drew a sketch to help them were generally successful in identifying the two different regions. But without a diagram many either just gave the single region between the end points, or having written down two correct inequalities tried to combine them into a 'doubleended' inequality, which, of course, they were unable to do. Another error often seen was to believe that since $(3x + 1)(x + 3) > 0$, then $(3x + 1) > 0$ and/or $(x + 3) > 0$.	A0 for combinations with only one part correct eg –3 > x –1/3, though this would earn M1 if not already awarded
			Total	**3**		
3		i	x < –11/2 oe www as final answer	2	**M1** for –2x > 11 oe or x < 11/–2	if working with equals throughout, give 2 for correct final answer, 0 otherwise

		ii	$250c^{10}d^{-2}$ or $\frac{250c^{10}}{d^2}$ as final answer	2	**B1** for two correct elements; must be multiplied if B0, allow **SC1** for $125c^6d^8$ obtained from numerator or for all elements correct but added	**Examiner's Comments** 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^2.
			Total	**4**		
4			Boundary values –2, 7 $\{x : x \leq -2\} \cup \{x : x \geq 7\}$	**B1(AO 3.1a)** **B1(AO 2.3)** **B1(AO 2.5)** **[3]**	BC For both of $x < -2$, $x > 7$ or better For completely correct answer expressed in Ignore use of either 'or' or 'and' here Must be ≤ and ≥ for this mark	

					correct set notation	
			Total	3		
5			$6 - x > 5x - 15$ $21 > 6x$ or $-6x > -21$ oe or ft $x < \frac{21}{6}$ or $\frac{21}{6} > x$ oe isw or ft	M1 M1 M1 [3]	for correctly collecting x terms on one side and number terms on the other and simplifying ft their ax [inequality] b, where $b \neq 0$ and $a \neq 0$ or ± 1	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

					Examiner's Comments 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.	
			Total	**3**		
6			Use of discriminant $8^2 - 4 \times a \times 2 < 0$ $a > 8$	**M1(AO3.1a)** **A1(AO1.1)** **A1(AO1.1)** **[3]**	Accept = or any inequality Accept $8 < a$ Values must be substituted **Examiner's Comments** Almost all candidates realised that they needed to use the discriminant. Many stated that the discriminant needed to be less than 0 and worked competently to get the correct inequality. Others made slips in the algebra, especially by reversing signs without changing the inequality. Quite a number of candidates found the value of a for which the discriminant is 0, and worked out that the answer is a > 8 by checking values, or by reasoning.	
			Total	**3**		

7			DR $x^2 > 5x - 6$ $x^2 - 5x + 6 > 0$ $(x - 2)(x - 3) > 0$ $x < 2$ or $x > 3$	M1(AO 3.1a) M1(AO 1.1) A1(AO 1.1) A1(AO 2.2a) [4]	Correct factors or values 2, 3 oe, e.g. $\{x : x < 2 \cup x > 3\}$	
			Total	4		