Q	Marking Instructions	AO	Marks	Typical Solution
7(a)	Finds 2nd derivative and sets up an inequality	AO3.1a	M1	$\frac{dy}{dx} = -2xe^{-x^2}$
	Obtains correct first derivative	AO1.1b	A1	$\frac{d^2y}{dx^2} = -2e^{-x^2} + 4x^2e^{-x^2}$
	Obtains second derivative correct from 'their' first derivative	AO1.1b	A1F	
	Deduces correct final inequality (could use set notation)	AO2.2a	A1	$-2e^{-x^2} + 4x^2e^{-x^2} < 0$ $4x^2 - 2 < 0$ $-\frac{\sqrt{2}}{2} < x < \frac{\sqrt{2}}{2}$
(b)	Uses trapezium rule	AO1.1a	M1	$\int_{0.1}^{0.5} e^{-x^2}\,dx \approx \frac{0.1}{2}(e^{-0.01} + e^{-0.25} + 2(e^{-0.04} + e^{-0.09} + e^{-0.16}))$
	Trapezium rule entries all correct	AO1.1b	A1	
	Finds correct value	AO1.1b	A1	≈ 0.3611
(c)	References area being completely within **concave** section So…	AO2.4	E1	$[0.1, 0.5] \subset \left[-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right]$ $\therefore$ area is completely within concave section
	Trapezia all fall completely underneath the curve therefore underestimate (only award this mark if previous E1 has been awarded)	AO2.4	E1	Hence trapezia lie below curve and give an under-estimate for the area
(d)	Uses suitable rectangle to obtain over-estimate	AO3.1a	B1	Using a rectangle with the left hand edge the same height as the curve will produce an over-estimate
	Explains that this rectangle lies above the curve	AO2.4	E1	Area of rectangle = $0.4 \times e^{-0.1^2} = 0.396...$
	Constructs rigorous mathematical argument about accuracy, which leads to required result Only award if they have a completely correct solution, which is clear, easy to follow and contains no slips.	AO2.1	R1	$\therefore\ 0.36 < A < 0.40$ So A = 0.4 to 1 dp
	Total		**12**	