Question	Scheme	Marks
4(a)	$\frac{\mathrm{d}y}{\mathrm{d}x} = ax^2 + b + \frac{c}{x^2}$	M1
	$\frac{\mathrm{d}y}{\mathrm{d}x} = 6x^2 + 7 - \frac{3}{x^2}$	A1
	$6x^2 + 7 - \frac{3}{x^2} = 0 \Rightarrow 6x^4 + 7x^2 - 3 = 0 \Rightarrow (3x^2 - 1)(2x^2 + 3) = 0 \Rightarrow x^2 = \ldots$	M1
	$\left[x^2 = -\frac{3}{2} \text{ impossible}\right] x^2 = \frac{1}{3} \Rightarrow (x =) \pm \frac{1}{\sqrt{3}}$	A1
		(4)
(b)	$6x^2 + 7 - \frac{3}{x^2} \geqslant 0 \Rightarrow 6x^4 + 7x^2 - 3 \geqslant 0 \ (\text{as } x^2 \geqslant 0)$	
	So need $"3x^2 - 1" \geqslant 0 \Rightarrow x \leqslant "-\frac{1}{\sqrt{3}}", x \geqslant "\frac{1}{\sqrt{3}}"$	M1
	$x \leqslant -\frac{1}{\sqrt{3}}, x \geqslant \frac{1}{\sqrt{3}}$ or $x < -\frac{1}{\sqrt{3}}, x > \frac{1}{\sqrt{3}}$	A1
		(2)
		(6 marks)

Notes:

(a)

M1: Differentiates with power decreased by 1 in at least two of the three terms

A1: Correct derivative. Coefficients need not be simplified, but indices must be simplified.

M1: Sets equal to 0, multiplies through and attempts to solve the **quadratic** in x^2 vis a non-calculator method reaching at least **one value for x^2. They must show us their method for solving the 3TQ in x^2 explicitly.** (Allow any letter to substitute for x^2)

A1: Correct values only with no other values given.

(b)

M1: Selects the outside region for **their** values.

A1: Correct range, accept with loose or strict inequalities.

Accept any valid notation.

For example:

$\left\{x : x \leqslant -\frac{1}{\sqrt{3}}\right\} \cup \left\{x : x \geqslant \frac{1}{\sqrt{3}}\right\}$ or $\left\{x : x < -\frac{1}{\sqrt{3}}\right\} \cup \left\{x : x > \frac{1}{\sqrt{3}}\right\}$

$x \leqslant -\frac{1}{\sqrt{3}}$ OR $x \geqslant \frac{1}{\sqrt{3}}$ Do not accept $x \leqslant -\frac{1}{\sqrt{3}}$ AND $x \geqslant \frac{1}{\sqrt{3}}$ for the **A** mark

Question	Scheme	Marks
5(a)	$\frac{1}{2}\times\underline{0.25}\underline{\underline{\left(5.389+6.469+2\left(6.231+6.815+7.028+6.901+6.732\right)\right)}}$	**B1 M1**
	$\left(=\frac{1}{8}\times\left(11.858+2\left(33.707\right)\right)=\frac{1}{8}\times 79.272\right)$	
	= awrt 9.91	**A1**
		(3)
(b)	$\int\sqrt{x}\left(3+\frac{1}{x^2}\right)\mathrm{d}x=\int\left(3x^{\frac{1}{2}}+x^{-\frac{3}{2}}\right)\mathrm{d}x=...x^{\frac{3}{2}}\pm...x^{-\frac{1}{2}}$	**M1**
	$=2x^{\frac{3}{2}}-2x^{-\frac{1}{2}}\ (+c)$	**A1A1**
		(3)
(c)	$\int_3^{4.5}\sqrt{x}\left(3+\frac{1}{x^2}\right)\mathrm{d}x=\left(2(4.5)^{\frac{3}{2}}-2(4.5)^{-\frac{1}{2}}\right)-\left(2(3)^{\frac{3}{2}}-2(3)^{-\frac{1}{2}}\right)=...(8.911...)$ $\Rightarrow$ Area R = "9.909" – "8.911" = ...	**M1**
	= awrt 1.0	**A1**
		(2)
		(8 marks)

Notes:

(a)

B1: For using $h = 0.25$ or equivalent for the width in an attempt at the trapezium rule. Must be used as part of the attempt, not just stated separately.

M1: Correct bracket structure for the trapezium rule.

$$.....\underline{\underline{\left(5.389+6.469+2\left(6.231+6.815+7.028+6.901+6.732\right)\right)}}$$

Look for first + last y values + 2(attempt at sum of remaining values). If one value is missing, allow the M as a slip, but M0 if 1st or last value repeated. Must be y values used.

A1: awrt 9.91

(b)

M1: Expands the brackets and attempts to integrate, look for power increasing by 1 at least once in either a term with power $\frac{1}{2}$ or $-\frac{3}{2}$

A1: One of the two terms correct. Need not be simplified for this mark.

A1: Both terms correct (no need for c). Must be simplified coefficients. Accept equivalents, e.g. $2\left(\sqrt{x^3}-\frac{1}{\sqrt{x}}\right)$ or $2\left(\frac{x^2-1}{\sqrt{x}}\right)$

(c)

M1: Applies limits 3 and 4.5 to their answer to (b) and attempts to subtract the result from the answer to (a).

A1:, awrt 1.0 isw Note: Allow an answer of 9.91 – 8.91 = 1 following correct work.