Question Number	Scheme	Notes	Marks
1(a)	$h = 0.5$	Correct strip width	B1
	$A \approx \frac{1}{2}\times\frac{1}{2}\{6.792+5.113+2(6.298+5.858+5.466)\}$ Correct application of the trapezium rule with their *h*		M1
	= 11.79	Cao	A1
			(3)
(b)(i)	$A \approx 2\times"11.79"$	Multiplies their answer to (a) by 2	M1
	= 23.58	Correct answer or correct ft	A1ft
(b)(ii)	$A \approx "11.79"+6$	Adds 6 to their answer to (a)	M1
	= 17.79	Correct answer or correct ft	A1ft
			(4)
			Total 7

Notes:

(a)

B1: Correct value for *h* stated or implied by $\frac{1}{4}\{...\}$

M1: Attempts the trapezium rule with their *h*. Must include the $\frac{1}{2}\times"h"$ but this may be implied by any multiple of the bracket if *h* is not identified separately. Must have the correct inner bracket structure, though allow if all that is wrong is a miscopy of numerals. May be written as separate trapezia.

Bracketing error $\frac{1}{4}(6.792+5.113)+2(6.298+5.858+5.466)$ is M0 unless recovered by their answer.

A1: cao 11.79. Must be to 2 d.p. (Note the actual value is 11.78 to 2 d.p. and score no marks if just this is seen)

(b)(i)

M1: For twice their answer to (a), allowing for rounding. No need to carry out the doubling, sight of 2 $2\times"\text{their }(a)"$ is sufficient.

A1ft: For 23.58 or awrt 23.57 following a correct part (a) rounded or truncated to 11.78 (if they use more than 2d.p. then 23.5745 is the value they should get) **or** follow through their answer to (a) using the same principle. May be given to more than 2 d.p. and isw. (Allow answer to less than 2d.p. if just trailing zeros are omitted.)

Note: accurate answer is 23.56 to 2 d.p., which is M0A0 if no method is shown.

(ii)

M1: For 6+ their (a) stated or implied (but see note). The 6 need not be simplified if evaluated from an integral (but the integral and substitution must be correct giving an evaluation that simplifies to 6).

A1ft: 17.79 or follow through their answer to (a) + 6 evaluated. May be given to more than 2 d.p. and isw

Note: accurate answer is 17.78 to 2 d.p., which is M0A0 if no method is shown.

Note: Repeated trapezium rule is M0 in (b).

Question Number	Scheme	Notes	Marks
2(a)	$y = 27x^{\frac{1}{2}} - x^{\frac{3}{2}} - 20$ $\Rightarrow \left(\frac{\mathrm{d}y}{\mathrm{d}x} =\right) \frac{27}{2}x^{-\frac{1}{2}} - \frac{3}{2}x^{\frac{1}{2}}$	$x^n \rightarrow x^{n-1}$	M1
		Correct simplified derivative	A1
			(2)
(b)	$\frac{27}{2}x^{-\frac{1}{2}} - \frac{3}{2}x^{\frac{1}{2}} = 0 \Rightarrow x = ...$	Sets their derivative = 0 attempts to solve for *x*	dM1
	$x = 9$	Correct *x* value	A1
	$x = 9 \Rightarrow y = ...$	Uses their *x* value to find a value for *y*	M1
	$y = 34$	Correct *y* value	A1
			(4)
(c)	$\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = \pm Ax^{-\frac{3}{2}} \pm Bx^{-\frac{1}{2}}$ $\left(\frac{\mathrm{d}^2y}{\mathrm{d}x^2}\right)_{x=9} = -\frac{27}{4}(9)^{-\frac{3}{2}} - \frac{3}{4}(9)^{-\frac{1}{2}} \left(= -\frac{1}{2}\right)$	Attempts second derivative and substitutes their *x* **or** considers the sign (for *x* >0)	M1
	$\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = -\frac{27}{4}x^{-\frac{3}{2}} - \frac{3}{4}x^{-\frac{1}{2}}$ $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} < 0$ for x > 0 / when *x* = 9 so maximum	Correct second derivative and conclusion with correct reason	A1
			(2)
			Total 8

Notes

(a)

M1: Power decreased by 1 in at least one term in *x*

A1: Correct, simplified derivative. Accept as shown or $\frac{27}{2\sqrt{x}} - \frac{3}{2}\sqrt{x}$ or with decimal equivalents for coefficients. No need to see the $\frac{\mathrm{d}y}{\mathrm{d}x}$, score for a correct expression.

(b)

Note: Answer only with no initial equation set up scores no marks.

dM1: **Depends on the M in (a).** Sets their derivative equal to 0 and reaches a value *x*. The "=0" may be implied by a clear attempt to solve it. Do not be concerned about the method for solving as long as a value of *x* is reached. If substituting $a = \sqrt{x}$ (or similar) must return to *x* for the method.

A1: Correct value for *x* from correct work. Ignore references to *x* = 0 or any negative values but A0 if extra positive values.

M1: Substitutes their positive *x* value into the curve equation to find a value for *y*. May need to check if no substitution is shown.

A1: Correct *y* value. Ignore reference to any point at *x* = 0 or negative values but A0 if other coordinates with positive *x* are given.

(c) Ignore work relating to *x* = 0 in (c)

M1: Attempts the second derivative achieving the form $\pm Ax^{-\frac{3}{2}} \pm Bx^{-\frac{1}{2}}$ and attempts to use it to classify the stationary point. Look for an attempt at substituting their value or a consideration of the sign.