Question Number	Scheme	Marks
5. (i)	$3^a = 70 \Rightarrow a\log 3 = \log 70$	M1
	$\Rightarrow a = \dfrac{\log 70}{\log 3} = 3.867$	A1
		(2)
(ii)	$4 = \log_3 81$ or $3\log_3 b = \log_3 b^3$ or $\log_3 5b = \log_3 5 + \log_3 b$	B1
	$4 + 3\log_3 b = \log_3 5b \Rightarrow \log_3 81b^3 = \log_3 5b$	M1
	$\Rightarrow 81b^3 = 5b \Rightarrow b = ...$	dM1
	$\Rightarrow b = \sqrt{\dfrac{5}{81}}$	A1
		(4)
		(6 marks)

This question demands working from the candidates so answers cannot appear without appropriate methods

(i)

M1: Takes (the same) log of both sides and uses the power law.

Alternatively writes $a = \log_3 70$ with the correct base. But $a = \log 70$ is M0

A1: CSO. 3.867 following a suitable intermediate line. This is not awrt but isw after sight of 3.867

Cannot be achieved via Trial and Improvement

(ii) Note that this was marked **M1 A1 dM1 A1**. It is now being marked **B1 M1 dM1 A1**

B1: One correct log law used on a term **of the initial equation**.

Can be achieved without the bases being present

Look for $4 = \log_3 81$ or $3\log_3 b = \log_3 b^3$ or $\log_3 5b = \log_3 5 + \log_3 b$

M1: Correctly combines two terms **of the initial equation** to form a log equation of the correct form

$\log_3 ... = \log_3 ...$ or $\log_3 ... = \pm 4$.

Possible answers are; $\log_3 81b^3 = \log_3 5b$, $\log_3 81b^2 = \log_3 5$, $\log_3\left(\dfrac{b^3}{5b}\right) = -4$

For this mark you can condone a slip on the sign of the 4.

E.g. $4 + 3\log_3 b = \log_3 5b \Rightarrow \log_3 b^3 - \log_3 5b = 4 \Rightarrow \log_3 \dfrac{b^3}{5b} = 4$

dM1: Removes the logs correctly and proceeds to a value for b using a correct method.

Must follow M1 and an equation of the form $\log_3 ... = \log_3 ...$ or $\log_3 ... = \pm 4$

A1: $b = \sqrt{\dfrac{5}{81}}$ or exact equivalent such as $b = \dfrac{1}{9}\sqrt{5}$. The negative (and 0) solution, if found, must be discarded.

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Correct answer from incorrect working: Watch for solutions like the following

$$4 + 3\log_3 b = \log_3 5b \Rightarrow 4 = \log_3 5b - \log_3 b^3 \Rightarrow 4 = \frac{\log_3 5b}{\log_b b^3} \Rightarrow 81 = \frac{5b}{b^3} \Rightarrow b = \sqrt{\frac{5}{81}}$$

Score B1 M0 dM0 A0

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Question Number	Scheme	Marks
6. (a)	Identifies $h = 3$	B1
	Area = $\frac{3}{2}\{0+0+2(1.52+2.74+3.12+3.08)\}$	M1
	$= 31.38$ m^2	A1
		(3)
(b)	Calculates $"31.38"\times 1.5\times 60$	M1
	= awrt 2800 m^3	A1
		(2)
(c)	Underestimate with valid reason, e.g. area of trapezia are smaller than cross sectional area	B1
		(1)
		(6 marks)

(a)

B1: Identifies $h = 3$. This may be stated or implied by the sight of $\frac{\mathbf{3}}{2}\{....+2(...+...+...)\}$

M1: Correct method of finding area using the trapezium rule. The form of the rule is given so look for the form $\frac{3}{2}\{0+0+2(1.52+2.74+3.12+3.08)\}$ but you can condone slips on the digits of the heights, e.g 3.21 for 3.12. You may not see the zeros or the trailing $\}$ which is fine. The bracketing may be hard to decipher but the correct answer implies the method. If they state another value of h e.g. $\frac{15}{6}=2.5$ then look for $\frac{2.5}{2}\{0+0+2(1.52+2.74+3.12+3.08)\}$ condoning slips. If h is not stated, then this mark can be implied by $\frac{...}{2}\{0+0+2(1.52+2.74+3.12+3.08)\}$ condoning slips.

Condone an attempt using two triangles and three trapezia. Use the same criteria for this award. The area of any triangle and the area of any trapezium must be found from a correct formula.

A1: Accept 31.38 or awrt 31.4 (m^2) following correct expression for area.

Units are not necessary. The exact fractional answer is $\frac{1569}{50}$ is also acceptable

As the area is below the axis, a minority of candidates are taking h or the y values to be negative. This is fine for the first two marks and all three marks provided the modulus is taken.

(b)

M1: Attempts their (a) $\times 1.5\times 60$ or equivalent such as their (a) $\times 90$

A1: AWRT 2800 m^3 Units are not necessary

(c)

B1: States **underestim**ate AND gives a **valid reason**.

The reason, in almost all cases, should explicitly compare the area of the trapezia with the shaded area.

All reasons must make some reference to 'trapezia' or 'area of a trapezium'

The Figure could be used to explain their reasoning so look carefully at what the candidate states

Condone 'the trapezia are smaller than the cross section'

'the bottom lines of the trapezia are above the curve'

'the curve is above the lines of the trapezia' (remember the y axis is pointing down)

Do not accept any reference to convex or concave without further clarification.

Merely stating " the area we get from the trapezium rule is less than the shaded area" is too vague. There needs to be some explanation of why it is an underestimate, not just the fact that it is.