

Trapezium Rule (From OCR 4722)

Q1, (Jun 2006, Q9i,ii)

(i)		M1 A1 B1	3	Attempt sketch of any exponential graph, in at least first quadrant Correct graph – must be in both quadrants For identification of (0, 1)
(ii)	$A \approx \frac{1}{2} \times 0.5 \times \left\{ 1 + 2 \left(0.5^{\frac{1}{2}} + 0.5 + 0.5^{\frac{3}{2}} \right) + 0.5^2 \right\}$ ≈ 1.09	B1 M1 A1 A1	4	State, or imply, at least three correct y-values For correct use of trapezium rule, inc correct h For correct unsimplified expression For the correct value 1.09, or better

Q2, (Jan 2007, Q5b)

$\int_3^9 \log_{10} x dx \approx \frac{1}{2} \times 3 \times (\log_{10} 3 + 2 \log_{10} 6 + \log_{10} 9)$ ≈ 4.48	B1 M1 A1 A1	4	State, or imply, the 3 correct y-values only Attempt to use correct trapezium rule Obtain correct unsimplified expression Obtain 4.48, or better
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Q3, (Jan 2008, Q2)

$\text{area} \approx \frac{1}{2} \times 2 \times \left\{ 2 + 2(\sqrt{12} + \sqrt{28}) + \sqrt{52} \right\}$ ≈ 26.7	M1 M1 M1 A1	4	Attempt y-values at x = 1, 3, 5, 7 only Correct trapezium rule, any h, for their y values to find area between x = 1 and x = 7 Correct h (soi) for their y values Obtain 26.7 or better (correct working only)
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Q4, (Jun 2009, Q9)

(i)		B1	Sketch graph showing exponential growth (both quadrants)
		B1	2 State or imply (0, 4)

(ii)	$4k^x = 20k^2$ $k^x = 5k^2$ $x = \log_k 5k^2$ $x = \log_k 5 + \log_k k^2$ $x = 2\log_k k + \log_k 5$ $x = 2 + \log_k 5$ AG	M1	Equate $4k^x$ to $20k^2$ and take logs (any, or no, base)
		M1	Use $\log ab = \log a + \log b$
		M1	Use $\log a^b = b \log a$
		A1	4 Show given answer correctly

OR	$4k^x = 20k^2$ $k^x = 5k^2$ $k^{x-2} = 5$ $x - 2 = \log_k 5$ $x = 2 + \log_k 5$ AG	M1	Attempt to rewrite as single index
		A1	Obtain $k^{x-2} = 5$ or equiv eg $4k^{x-2} = 20$
		M1	Take logs (to any base)
		A1	Show given answer correctly

(iii) (a)	$\text{area} \approx \frac{1}{2} \times \frac{1}{2} \times \left(4k^0 + 8k^{\frac{1}{2}} + 4k^1 \right)$ $\approx 1 + 2k^{\frac{1}{2}} + k$	M1	Attempt y -values at $x = 0, \frac{1}{2}$ and 1, and no others
		M1	Attempt to use correct trapezium rule, 3 y -values, $h = \frac{1}{2}$
		A1	3 Obtain a correct expression, allow unsimplified

(b)	$1 + 2k^{\frac{1}{2}} + k = 16$ $\left(k^{\frac{1}{2}} + 1 \right)^2 = 16$ $k^{\frac{1}{2}} = 3$ $k = 9$	M1	Equate attempt at area to 16
		M1	Attempt to solve 'disguised' 3 term quadratic
		A1	3 Obtain $k = 9$ only

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Q5, (Jan 2010, Q4)

(i)	$\int_3^5 \log_{10}(2+x) dx \approx \frac{1}{2} \times \frac{1}{2} \times (\log 5 + 2 \log 5.5 + 2 \log 6 + 2 \log 6.5 + \log 7)$ ≈ 1.55	M1	Attempt y -coords for at least 4 of the correct 5 x -coords only
		M1	Use correct trapezium rule, any h , to find area between $x = 3$ and $x = 5$
		M1	Correct h (soi) for their y -values
		A1	4 Obtain 1.55

(ii)	$\int_3^5 \log_{10}(2+x)^{\frac{1}{2}} dx = \frac{1}{2} \int_3^5 \log_{10}(2+x) dx$ $\approx \frac{1}{2} \times 1.55$ ≈ 0.78	B1✓	Divide by 2, or equiv, at any stage to obtain 0.78 or 0.77, following their answer to (i)
		B1	2 Explicitly use $\log \sqrt{a} = \frac{1}{2} \log a$ on a single term

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Q6, (Jun 2013, Q1)

(i)	$\frac{\sin A}{10} = \frac{\sin 63}{14}$ $A = 39.5^\circ$	M1	Attempt use of correct sine rule	<p>Must be correct sine rule, either way up Need to rearrange at least as far as $\sin A = \dots$, using a valid method Allow M1 even if subsequently evaluated in rads (0.120)</p>
		A1	Obtain 39.5° , or better	Actual answer is 39.52636581... so allow more accurate answer as long as it rounds to 39.53
(ii)	$c^2 = 10^2 + 14^2 - 2 \times 10 \times 14 \times \cos 77.5^\circ$ $c = 15.3$	M1	Attempt use of correct cosine rule, or equiv, inc attempt at 77.5°	<p>Angle used must be 77.5° or must come from a clear attempt at $180 - (63 + \text{their } A)$. NB Using 102.5° in sine rule will give 15.3, but this is M0. Must be correct formula seen or implied, but allow slip when evaluating eg omission of 2, incorrect extra 'big bracket' Allow M1 if expression is not square rooted, as long as LHS was intended to be correct ie $c^2 = \dots$ or $AB^2 = \dots$ Allow M1 even if subsequently evaluated in rad mode Allow any equiv method, including sine rule (as far as $\sin C = \dots$) or right-angled triangle trig (must be full and valid method)</p>
		A1	Obtain 15.3, or better	Allow more accurate answer as long as it rounds to 15.34
		[2]		

Q7, (Jun 2014, Q9i,ii)

(i)	$0.5 \times 2.5 \times (1 + 2(-3 + 2\sqrt{6.5}) + 3)$ $= 10.2$	<p>M1*</p> <p>M1d*</p> <p>A1</p> <p>[3]</p>	<p>Attempt y-values at $x = 0, 2.5, 5$ only</p> <p>Attempt correct trapezium rule, inc $h = 2.5$</p> <p>Obtain 10.2, or better</p>	<p>M0 if additional y-values found, unless not used y_1 can be exact or decimal (2.1 or better) Allow M1 for using incorrect function as long as still clearly y-values that are intended to be the original function eg $-3 + 2\sqrt{x+4}$ (from $\sqrt{(x+4)} = \sqrt{x+4}$)</p> <p>Fully correct structure reqd, including placing of y-values The 'big brackets' must be seen, or implied by later working Could be implied by stating general rule in terms of y_0 etc, as long as these have been attempted elsewhere and clearly labelled Using x-values is M0 Can give M1, even if error in evaluating y-values as long correct intention is clear</p> <p>Allow answers in the range [10.24, 10.25] if >3sf A0 if exact surd value given as final answer</p> <p>Answer only is 0/3 Using 2 separate trapezia can get full marks Using anything other than 2 strips of width 2.5 is M0 Using the trapezium rule on result of an integration attempt is 0/3</p>
(ii)	$(5 \times 3) - 10.2 = 4.8$	<p>M1</p> <p>A1FT</p> <p>[2]</p>	<p>Attempt area of rectangle – their (i)</p> <p>Obtain 4.8, or better</p>	<p>As long as $0 < \text{their (i)} < 15$</p> <p>Allow for exact surd value as well Allow answers in range [4.75, 4.80] if > 2sf</p>

Q9, (Jun 2016, Q8v)

$$0.5 \times 1.5 \times \{3^{-1} + 2 \times 3^{0.5} + 3^2\}$$

$$= 9.60$$

B1	State the 3 correct y -values, and no others	B0 if other y -values also found (unless not used) Allow for unsimplified, even if subsequent error made Allow decimal equivs
M1	Attempt use of correct trapezium rule to attempt area between $x = 1$ and $x = 4$	Correct placing of y -values required y -values may not necessarily be correct, but must be from attempt at using correct x -values The 'big brackets' must be seen, or implied by later working Could be implied by stating general rule in terms of y_0 etc, as long as these have been attempted elsewhere and clearly labelled Could use other than 2 strips as long as of equal width (but M0 for just one strip) Must have h as 1.5, or a value consistent with the number of strips used if not 2
A1	Obtain 9.60, or better (allow 9.6)	Allow answers in the range [9.595, 9.600] if > 3sf
[3]		Answer only is 0/3 Using the trap. rule on the result of an integration attempt is 0/3, even if integration is not explicit Using two separate trapezia can get full marks Using other than 2 trapezia (but not just 1) can get M1 only