Allow this mark if they add the areas of individual trapezia e.g.

$$\left\{\frac{"0.5"}{2}\right\}\times(1.319+"1.075")+\left\{\frac{"0.5"}{2}\right\}\times("1.075"+1.001)+...$$

A1: For awrt 2.96. Allow to come from answers in (a) incorrectly rounded or wrong accuracy.

FYI: Use of rounded figure gives 2.96225, use of calculated figures gives 2.9625726… Actual value is 2.89 to 2 decimal places.

(c) Condone all work in (c) written without the "10" in $\log_{10}(\sin(x))$

B1: Writes $3+\log_{10}(\sin(x))$ correctly in terms of $1-\log_{10}(\sin(x))$. May be implied.

M1: Integrates the K in $K\pm(1-\log_{10}(\sin(x)))$ to Kx, $K\neq 3$, substitutes in the limits 3 and 0.5 and subtracts oe e.g. 4×(3 – 0.5) and uses the answer to (b).

A1ft: Correct answer awrt 7.04, follow through their 2.96 if given to 3sf or better.

Alt:

B1: Rearranges integral to find $\int_{0.5}^{3}\log_{10}(\sin(x))\,dx=2.5-"2.96"$. May be implied.

M1: Integrates the 3 and substitutes in given limits and subtracts oe e.g. 3×(3 – 0.5) and adds their attempt at $\int_{0.5}^{3}\log_{10}(\sin(x))\,dx$ found using the answer to (b).

A1ft: Correct answer awrt 7.04, follow through their 2.96 if given to 3sf or better.

A common incorrect method in (c):

$$\int_{0.5}^{3}3+\log_{10}(\sin(x))\,dx=[3x]_{0.5}^{3}+"2.96"="10.46"$$

Scores no marks as they have not used the integral in part (b)

Attempts to use the trapezium rule again in (c) score no marks

Question	Scheme	Marks
3(i)	E.g. $n = 1: 2^3 - 1^3 = 7$, $n = 2: 3^3 - 2^3 = 19$, $n = 3: 4^3 - 3^3 = ...$ Or identifies counterexample directly.	**M1**
	e.g. $6^3 - 5^3 = 91 = 7 \times 13$ so not true for $n = 5$, hence statement is not true.	**A1**
		(2)
	Notes for part (i) **M1:** Shows evidence of trying to find a counter example for a positive integer (at least one attempt). $2^3 - 1^3$ is prime is sufficient. **A1:** Gives a correct counter example with reason (shows factorisation) and concludes e.g. "which is not prime". Ignore any previous "incorrect" attempts e.g. $6^3 - 5^3 = 91$ which is prime. Note $n = 7$ ($169 = 13 \times 13$) and $n = 8$ ($217 = 7 \times 31$) and $n = 12$ ($469 = 7 \times 67$) are the next few counter examples. (Bigger examples are not likely to be seen!) Allow equivalent reasons for not being prime e.g. 169/13 = 13 or 169 is divisible by 13 (condone "can be divided by 13") **Generally algebraic approaches score no marks unless they substitute numbers as indicated above.**	
3(ii)	**The majority of methods here will follow ways 1, 2 or 3 below** **In these cases the general guidance is as follows:** M1: Attempts to find • the gradient of any relevant line, e.g. *AC* or *BC* **or** • the length of any relevant line, e.g. *AB*/*AB*^{2} or *BC*/*BC*^{2} or *AC*/*AC*^{2} **or** • the mid-point *M* of line *AB* A1: Correct **relevant** calculation of • gradients *AC* and *BC* • lengths of lines *AB*/*AB*^{2}, *BC*/*BC*^{2} and *AC*/*AC*^{2} • mid-point of line *AB* dM1: Full attempt at combining all **relevant** information required to solve the problem • attempts product of gradients or equivalent • attempts to show Pythagoras $AB^2 = AC^2 + BC^2$ • attempts to show $MA^2 = MC^2$ A1: Correct calculations or equivalent providing required evidence for the above A1: Provides correct reason and conclusion with all previous marks scored.	

Way 1	$m_{AC} = \frac{-6-0}{7-1} = ...$ or $m_{BC} = \frac{-6-(-10)}{7-3} = ...$	**M1**
	$m_{AC} = -1$ and $m_{BC} = 1$	**A1**
	So $m_{AC} \times m_{BC} = -1 \times 1 = -1$ or e.g. m_{AC} is negative reciprocal of m_{BC}	**dM1A1**
	So e.g. angle (at C) is a right angle hence AB is a diameter (Or equivalent)	**A1**
		(5)

M1: Attempts the gradients of AC or BC. Allow slips but score M0 if both attempts are clearly incorrect.
A1: Correct gradients from correct formulae
dM1: Applies perpendicular condition. May be seen as shown but allow equivalent work.
A1: Correct calculations or equivalent
A1: Suitable explanation and conclusion given with no errors and all previous marks awarded with no incorrect statements seen.

Way 2	$AB = \sqrt{(3-1)^2 + (-10-0)^2} = ...$ or $AC = \sqrt{(7-1)^2 + (-6-0)^2} = ...$ or $BC = \sqrt{(7-3)^2 + (-6+10)^2} = ...$	**M1**
	$AB = \sqrt{104}\left(2\sqrt{26}\right), AC = \sqrt{72}\left(6\sqrt{2}\right), BC = \sqrt{32}\left(4\sqrt{2}\right)$	**A1**
	$AB^2 = 104 = 72 + 32 = AC^2 + BC^2$	**dM1A1**
	Hence ABC is a right-angle triangle with hypotenuse AB hence AB is a diameter. (Or equivalent)	**A1**
		(5)

M1: Attempts length of AB or AC or BC or their squares. Allow slips but score M0 if attempts are clearly incorrect.
A1: Correct values for AB, AC and BC or their squares.
dM1: Applies Pythagoras' theorem with their values. (May see cosine rule used.)
A1: All calculations correct for this approach.
A1: Suitable explanation and conclusion given with no errors and all previous marks awarded with no incorrect statements seen.

Way 3	If *AB* is diameter centre must be midpoint of *AB* ie $M\left(\frac{1+3}{2},\frac{0-10}{2}\right)$	**M1**
	$=(2,-5)$	**A1**
	$MA=\sqrt{(2-1)^2+(-5-0)^2}=\sqrt{26},\ MC=\sqrt{(2-7)^2+(-5-(-6))^2}=\sqrt{26}$	**dM1A1**
	$MA=\sqrt{26}, MC=\sqrt{26}$ so $MA=MC(=MB)$ As the length from *M* to each of *A* and *C* is the same *M* is the centre of the circle hence *AB* is a diameter. (Or equivalent)	**A1**
		(5)

M1: Attempts midpoint of *AB*. If no method is shown accept one correct coordinate as evidence.
A1: Correct midpoint
dM1: Attempts length of *MC* and at least one of *MA* or *MB*, or *AB*. *As M is midpoint of AB there is no need to find both MA and MB, these may be assumed to be the same.* If they find *AB* then they must halve it to find the radius.
A1: All required calculations correct for this approach.
A1: Suitable explanation made which may be in a preamble and conclusion given with no errors and all previous marks awarded.

The following approach is less common and should be marked as shown:

Way 4	If *AB* is diameter centre must be midpoint of *AB* ie $M\left(\frac{1+3}{2},\frac{0-10}{2}\right)$	**M1**
	$=(2,-5)$	**A1**
	$MA=r=\sqrt{(2-1)^2+(-5-0)^2}=\sqrt{26}$ $\Rightarrow (x-2)^2+(y+5)^2=26$ $C(7,-6)\Rightarrow (7-2)^2+(-6+5)^2=5^2+1^2=26$	**dM1A1**
	As *C* also satisfies the equation of the circle then *AB* must be the diameter (or equivalent) There must be some further justification as above rather than just "*AB* is a diameter" which may be in a preamble e.g. If *C* lies on the circle…	**A1**
		(5)

M1: Attempts midpoint of *AB*. If no method is shown accept one correct coordinate as evidence.
A1: Correct midpoint
dM1: Attempts length of *MA* or *MB* to find *r* or r^2, forms equation of the circle and substitutes the coordinates of *C*.
A1: All required calculations correct for this approach.
A1: Suitable explanation and conclusion given with no errors and all previous marks awarded.

SEE END OF MARKSCHEME FOR SOME OTHER MORE UNUSUAL METHODS THAT MAY BE SEEN DURING MARKING WITH SUGGESTED MARKING GUIDELINES.

There may be other methods. Choose the way that best fits the overall response.
If you are in any doubt if a particular response deserves credit then use Review.