

Full name:

Teacher name:

U6 A Level Maths PURE MOCK

Tuesday 5th February 2019 PM

Time: 2 hours

Total Marks: 100

You must have: Mathematical Formulae and Statistical Tables, Calculator

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in your name at the top of this page and the name of your teacher
- Answer all questions and ensure that your answers to parts of questions are clearly labelled.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit. Answers found from the calculator without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

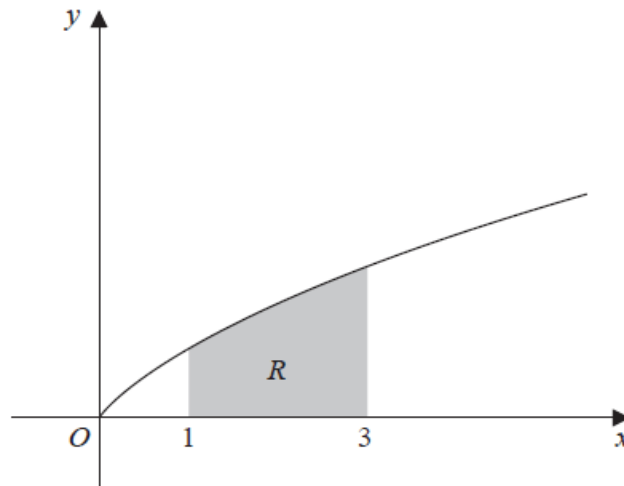
- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 14 questions. The total mark for this paper is 100.
- The marks for each question are shown in brackets
 - use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	
6	5	4	10	4	6	5	
Q8	Q9	Q10	Q11	Q12	Q13	Q14	Total
5	10	7	7	10	11	10	100
Grade							

1.



The diagram shows a sketch of the curve with equation $y = \frac{x}{1 + \sqrt{x}}$, $x \geq 0$.

The finite region R , shown shaded the diagram, is bounded by the curve, the line with equation $x = 1$, the x -axis and the line with equation $x = 3$.

The table below shows corresponding values of x and y for $y = \frac{x}{1 + \sqrt{x}}$.

x	1	1.5	2	2.5	3
y	0.5	0.6742	0.8284	0.9686	1.0981

- (a) Use the trapezium rule, with all the values of y in the table, to find an estimate for the area of R , giving your answer to 3 decimal places. (3)
- (b) Explain how the trapezium rule can be used to give a better approximation for the area of R . (1)
- (c) Giving your answer to 3 decimal places in each case, use your answer to part (a) to deduce an estimate for
- (i) $\int_1^3 \frac{5x}{1 + \sqrt{x}} dx$, (ii) $\int_1^3 6 + \frac{x}{1 + \sqrt{x}} dx$. (2)

(6 marks)

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6. Complete the table below. The first one has been done for you.

For each statement below you must state if it is always true, sometimes true or never true, giving a reason in each case.

Statement	Always True	Sometimes True	Never True	Reason
The quadratic equation $ax^2 + bx + c = 0$ ($a \neq 0$) has 2 real roots.		✓		It only has 2 real roots when $b^2 - 4ac > 0$ When $b^2 - 4ac = 0$ it has 1 real root and when $b^2 - 4ac < 0$ it has 0 real roots.
(i) When a real value of x is substituted into $x^2 - 6x + 10$ the result is positive. (2)				
(ii) If $ax > b$ then $x > \frac{b}{a}$ (2)				
(iii) The difference between consecutive square numbers is odd. (2)				

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13. (a) Express $2 \sin \theta - 1.5 \cos \theta$ in the form $R \sin(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$.
State the value of R and give the value of α to 4 decimal places. (3)

Tom models the depth of water, D metres, at Southview harbour on 18th October 2017 by the formula

$$D = 6 + 2 \sin\left(\frac{4\pi t}{25}\right) - 1.5 \cos\left(\frac{4\pi t}{25}\right), \quad 0 \leq t \leq 24,$$

where t is the time, in hours, after 00:00 hours on 18th October 2017.

Use Tom's model to

- (b) find the depth of water at 00:00 hours on 18th October 2017, (1)
- (c) find the maximum depth of water, (1)
- (d) find the time, in the afternoon, when the maximum depth of water occurs.
Give your answer to the nearest minute. (3)

Tom's model is supported by measurements of D taken at regular intervals on 18th October 2017. Jolene attempts to use a similar model in order to model the depth of water at Southview harbour on 19th October 2017.

Jolene models the depth of water, H metres, at Southview harbour on 19th October 2017 by the formula

$$H = 6 + 2 \sin\left(\frac{4\pi x}{25}\right) - 1.5 \cos\left(\frac{4\pi x}{25}\right), \quad 0 \leq x \leq 24,$$

where x is the time, in hours, after 00:00 hours on 19th October 2017.

By considering the depth of water at 00:00 hours on 19th October 2017 for both models,

- (e) (i) explain why Jolene's model is not correct,
(ii) hence find a suitable model for H in terms of x . (3)

(11 marks)

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