



Semester One Examination, 2023
Question/Answer booklet

MATHEMATICS

METHODS

UNIT 3

Section One: Calculator-free

WA student number:

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 in figures

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In words _____

Your name _____

Time allowed for this section

<p>Time allowed for this section</p> <p>Reading time before commencing work: five minutes</p> <p>Working time: fifty minutes</p>	<p>Number of additional answer booklets used (if applicable):</p>
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Materials required/recommended for this section

To be provided by the supervisor
This Question/Answer booklet
Formula sheet

Formula sheet

To be provided by the candidate

Category	Item	Quantity	Unit	Value
Standard items:	pens (blue/black preferred), pencils (including coloured), sharpener,			
	correction fluid/tape, eraser, ruler, highlighters			
Special items:	nil			

Special items: nil

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of examination
Section One: Calculator-free	7	7	50	50	35
Section Two: Calculator-assumed	12	12	100	100	65
Total					100

Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
3. You must be careful to confine your answers to the specific question asked and to follow any instructions that are specific to a particular question.
4. Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.
5. It is recommended that you do not use pencil, except in diagrams.
6. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.
7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Markers use only		
Question	Maximum	Mark
1	6	
2	8	
3	6	
4	9	
5	8	
6	6	
7	7	
S1 Total	50	
S1 Wt (×0.7)	35%	
S2 Wt	65%	
Total	100%	

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Supplementary page

Question number: _____

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(b) Determine the maximum possible area of the rectangle.

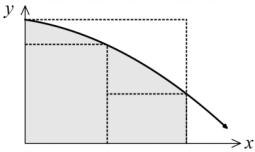
(4 marks)

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Question 1

The curve $y = 15 - 2x - x^2$ is shown, with a bounding rectangle and two inscribed rectangles of equal width.

The shaded region is bounded by the curve, the x -axis, the y -axis and the line $x = 2$.



- (a) Use areas of rectangles to explain why the area of the shaded region must be between 19 and 30 square units.

(6 marks)

(3 marks)

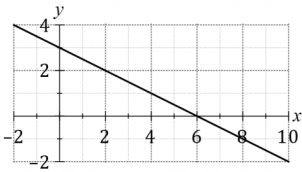
- (b) Determine the area of the shaded region.

(3 marks)

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Question 6

The graph of the linear function $y = f(x)$ is shown.



Another function is defined as

$$A(t) = \int_2^t f(x) \, dx$$

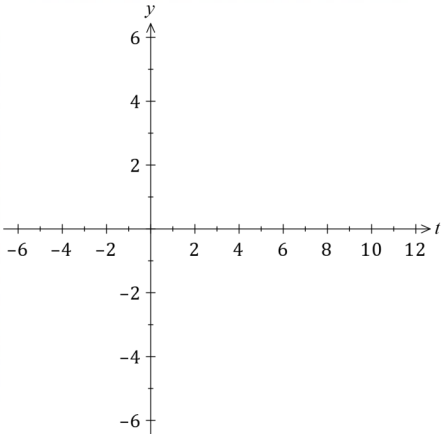
- (a) Using the graph of $y = f(x)$, or otherwise, evaluate $A(2)$ and $A(6)$.

(6 marks)

(2 marks)

- (b) Sketch the graph of $y = A(t)$ on the axes below.

(4 marks)



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Question 2

(8 marks)

$$\begin{cases} k^2 - k + x, & x = 0 \\ 5k^2x, & x = 1 \\ 0, & \text{otherwise.} \end{cases} = P(X = x)$$

(a) Determine the value of the constant k . (4 marks)

(b) Determine the mean and variance of X . (2 marks)

(c) The random variable $Y = 3X + 1$. Determine the mean and variance of Y . (2 marks)

See next page

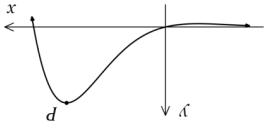
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Question 5

(8 marks)

The graph of $y = e^{6x} \sin(6x)$ is shown.
(a) Determine the x -coordinate of point P , the first local maximum of the curve as x increases from 0.



(4 marks)

(b) Determine the value of $\frac{d^2y}{dx^2}$ when $x = \frac{2}{3\pi}$ and hence describe the concavity of the curve at this point. (4 marks)

See next page

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Question 3

(6 marks)

- (a) Determine $f'(x)$ when $f(x) = \frac{5 + \cos(x)}{5 + \sin(2x)}$. There is no need to simplify the derivative.
(2 marks)

- (b) Let $y = \cos(x)$, so that when $x = 30^\circ$, $y \approx 0.8660$. Given that $1^\circ \approx 0.017$ radians, use the increments formula to determine an approximate value for $\cos(29^\circ)$.
(4 marks)

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Question 4

(9 marks)

The function $f(x)$ is defined for $x > -2.5$, has derivative $f'(x) = \frac{6}{(2x + 5)^2}$, and passes through the point $(-2, 3)$.

- (a) Determine the rate of change of $f'(x)$ when $x = -1$.
(3 marks)

- (b) Determine $f(x)$.
(4 marks)

- (c) Determine $\frac{d}{dt} \int_t^{-1} (3x - f'(x)) \, dx$.
(2 marks)

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