

Semester One Examination, 2023 Question/Answer booklet

| Section One: Calculator-free | |
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| E TINU | If required by your examination administrator, please place your student identification label in this box |
| METHODS | |
| MATHEMATICS | |

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|---------------------------------------|-------------------------------|------------|--|
| Number of additional (if applicable): | sətunim əvif fifty minutes | cing work: | ime allowed for this steading time before commentations time: |
| | e | Your name | |
| | | ln words | |
| | | ln figures | :nedmun fudent AW |

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

correction fluid/tape, eraser, ruler, highlighters

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,

it to the supervisor before reading any further.

Important note to candidates

To be provided by the candidate

Special items: nil

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METHODS UNIT 3 2 CALCULATOR-FREE

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

BE CUT OFF

DO NOT WRITE IN THIS AREA AS IT WILL

Instructions to candidates

- 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.
- Write your answers in this Question/Answer booklet preferably using a blue/black pen.
 Do not use erasable or gel pens.
- 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.
- It is recommended that you do not use pencil, except in diagrams.
- S. 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.
- The Formula sheet is not to be handed in with your Question/Answer booklet.

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|-----------------|-----------------|------|
| 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% | |

| Question number: |
|------------------|
| |
| |

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METHODS UNIT 3

CALCULATOR-FREE

Supplementary page

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CALCULATOR-FREE 3 METHODS UNIT 3 Section One: Calculator-free 35% (50 Marks)
This section has seven questions. Answer all questions. Write your answers in the spaces provided.

See next page

Working time: 50 minutes.

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METHODS UNIT 3 10 CALCULATOR-FREE Question 7 (7 marks)

An 8 cm length of thin straight wire is bent once and laid on a level surface to form side BC and diagonal CE of rectangle BCDE. Let the length of BC=x.

(a) Show that the area of the rectangle is $x\sqrt{64-16x}$ cm². (3 marks)

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(b) Determine the maximum possible area of the rectangle. (4 marks)

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METHODS UNIT 3

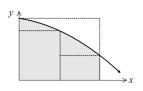
CALCULATOR-FREE

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.

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



(3 marks)

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(6 marks)

Determine the area of the shaded region.

(3 marks)

(6 marks)

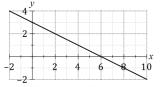
Question 6

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

Another function is defined as

$$A(t) = \int_{2}^{t} f(x) \, dx$$



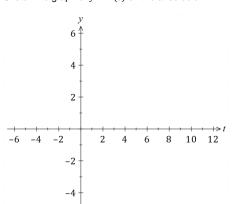
Using the graph of y = f(x), or otherwise, evaluate A(2) and A(6).

(2 marks)

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

-6

(4 marks)



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CALCULATOR-FREE

(8 marks)

Question 2

$$t = x$$
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The probability function for the random variable
$$X$$
 is $P(X=x) = \begin{cases} k^2 - k + x, & x=0 \\ 5k^2 x, & x=1 \end{cases}$ otherwise

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(4 marks)

Determine the value of the constant k.

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(S marks)

Determine the mean and variance of X.

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

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(8 marks)

METHODS UNIT 3

Question 5

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The graph of $y = e^{6x} \sin(6x)$ is shown.

the first local maximum of the curve Determine the x-coordinate of point P,

(4 marks) as x increases from 0.

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

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METHODS UNIT 3

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CALCULATOR-FREE

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)

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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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METHODS UNIT 3

Question 4

(9 marks)

(3 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.

) Determine f(x). (4 marks)

(c) Determine $\frac{d}{dt} \int_{t}^{-1} (3x - f'(x)) dx$. (2 marks)

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