

You, hand it to the supervisor **before** reading any further.
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

Important note to Candidates

Special items: **nil**

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
correction fluid/tape, eraser, ruler, highlighters

To be provided by the candidate

<input type="checkbox"/>	Number of additional answer books used (if applicable):
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Materials required/recommended for this paper

Working time for paper: 50 minutes
Reading time before commencing work: 5 minutes

Time allowed for this paper

Teacher: **Miss Hosking** **Miss Rowden**

Please circle your teacher's name

Student Name: _____

MATHEMATICS
METHODS
ATAR Year 12
Section One:
Calculator-free

Question/Answer Booklet

Semester Two Examination, 2021



Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One: Calculator free	8	8	50	51	35
Section Two: Calculator-assumed	13	13	100	97	65
Total					100

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Instructions to candidates

1. The rules for the conduct of the ATAR course examinations are detailed in the *Year 12 Information Handbook 2021*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer booklet.
3. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Supplementary pages for the use planning/continuing your answer to a question have been provided at the end of the 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.
5. 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.
6. It is recommended that you do not use pencil, except in diagrams.
7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Supplementary pages for the use of planning/continuing your answer to a question have been 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.

Section One: Calculator-free
35% (51 Marks)

CALCULATOR-FREE
3
MATHEMATICS METHODS

(5 marks)

Question 1

(a) Determine $\int \frac{2x^2+x-5}{4x+1} dx, x > 1$. (2 marks)

(b) The line $y = 12 - 2x$ intersects the curve $y = \frac{x}{10}$ at $(1, 10)$ and $(5, 2)$. Determine the area trapped between line and the curve. (3 marks)

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DO NOT WORKING TIME IS 50 MINUTES IT WILL BE CUT OFF

Supplementary pages for the use of planning/continuing your answer to a question have been 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.

This section has eight (8) questions. Answer all questions. Write your answers in the spaces provided.

Supplementary pages for the use of planning/continuing your answer to a question have been 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.

Section One: Calculator-free
35% (51 Marks)

CALCULATOR-FREE
3
MATHEMATICS METHODS

See next page

(5 marks)

Question 2

A summary of the lengths of a large sample of nails from a production line are shown below.

Length, L mm	Relative frequency
$147 < L \leq 148$	0.17
$148 < L \leq 149$	0.13
$149 < L \leq 150$	0.21
$150 < L \leq 151$	0.19
$151 < L \leq 152$	0.16
$152 < L \leq 153$	0.14

- (a) What proportion of nails are longer than 149 mm? (1 mark)
- (b) Determine the probability that a randomly selected nail from the production line is longer than 150 mm given that it is no longer than 152 mm. (2 marks)
- (c) State, with reasons, whether the data suggests that the nail lengths are normally distributed. (2 marks)

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Supplementary page

Question number: _____

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Question 3

(7 marks)

The curve $y = 8x - \frac{x^2}{4}$ has one stationary point.

(2 marks)

- (a) Obtain expressions for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

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(4 marks)

(b)

(1 mark)

- (c) Explain why the curve has no point of inflection.

In triangle ABC, the length of the side opposite angle A is given by $a = \sqrt{13 - 6\cos A}$ cm.

(6 marks)

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Question 4

(7 marks)

(a) Let $F(x) = \int_0^x \sin 2\theta d\theta$.

Express $F(x)$ as a function of x and hence evaluate $F\left(\frac{\pi}{6}\right)$.

(3 marks)

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(iii) $\text{Var}(3Y+1)$.

(2 marks)

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Question /

Question 4 continued

$$\text{Let } g(x) = \frac{e^{2x-1}}{2^x+1}. \quad (\text{b})$$

(2 marks)

Show that $g'(x) = \frac{4xe^{2x-1}}{(2x+1)^2}$.

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(2 marks)

The random variable X is defined by $P(X=x) = \begin{cases} k \log_3(x+2) & x=1, 25, 79 \\ ? & \text{elsewhere?} \end{cases}$

(a) Determine the value of the constant k .

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The Bernoulli random variable Y is solely dependent on X , so that $Y=1$ when $X=1$, and $Y=0$ otherwise.

(b) Calculate the expected value of X .

(2 marks)

(2 marks)

(ii) Hence, or otherwise, evaluate $\int_1^0 x e^{2x-1} dx$.

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$\cdot (A)E$ (!!)

$\cdot(0=\lambda)d$ (!)

(c) Determine

1 mark)

$$\cdot(0=\lambda)d \quad (!)$$

$y=0$ for all other values

Question 5**(7 marks)**

- (a) By first using log laws, or otherwise, determine $\frac{d}{dx} \left(\ln(e^{3x} \sqrt{x^2+3}) \right)$ in simplest form.
(3 marks)

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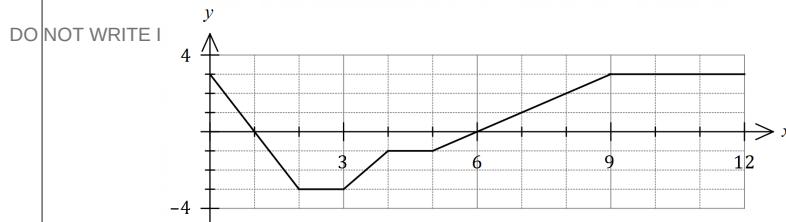
- (b) The function $f(x) = x^2 \ln(2x)$ for $x > 0$ has one stationary point, a global minimum.

Determine the minimum value of the function. (4 marks)

See next page

Question 6**(6 marks)**

The graph of $y = f(x)$ consists of line segments, as shown below.



Evaluate each of the following:

(a) $\int_7^{10} f(x) dx.$ (1 mark)

(b) $\int_3^8 f(x) dx.$ (2 marks)

(c) $\int_0^9 |f(x)+2| dx.$ (3 marks)

See next page