Semester One Examination, 2021

Question/Answer Booklet

MATHEMATICS METHODS

ATAR Year 12
Section One: Calculator-free

Student Name: _____

Please circle your teacher's name

Teacher: Miss Hosking Miss Rowden

Time allowed for this paper

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

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Formula Sheet

Number of additional answer booklets used (if applicable): ☐

To be provided by the candidate

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

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	Suggested working time (minutes)	Marks available	Percentage of examination
Section One: Calculator free	8	8	50	52	35
Section Two: Calculator-assumed	13	13	100	98	65
				Total	100

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.

See next page

Section One: Calculator-free **35% (52 Marks)**

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.

Working time: 50 minutes.

Question 1 **(6 marks)**

(a) Determine $\frac{d}{dx}(\cos^4(x))$. (2 marks)

(b) Evaluate $f'\left(\frac{\pi}{2}\right)$ when $f(x) = \frac{x + \sin x}{\cos 2x}$. (4 marks)

Question 2 **(5 marks)**

A small body is initially at the origin. It is moving along the x-axis with velocity at time t seconds given by

$$v(t) = \left(\frac{t}{2} - 2\right)^3 \text{ cm/s.}$$

(a) Determine $x(t)$, a function for the displacement of the body at time t. (3 marks)

The small body is stationary when $t = T$.

(b) Determine the displacement of the body at $T + 8$ seconds. (2 marks)

Question 3 **(6 marks)**

Determine the area of the finite region bounded by $y = \sqrt{2x}$ and $y = \frac{x}{2}$.

See next page

Question 4 **(8 marks)**

(a) Simplify $\log_2(32) \times \log_3(27^2)$. (3 marks)

(b) Solve for x:

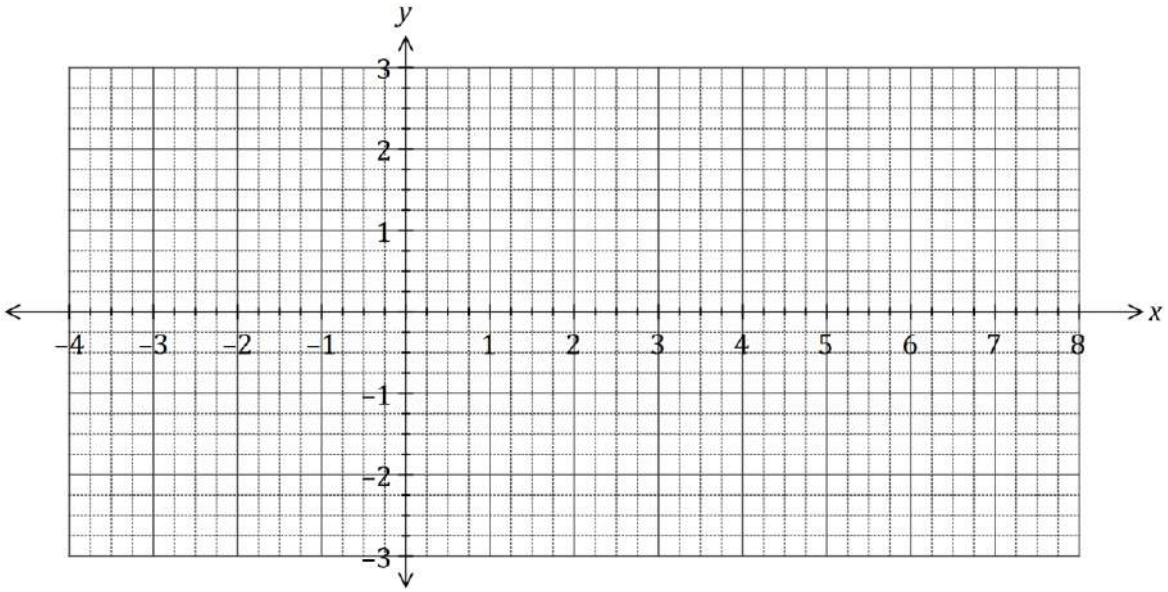
(i) $\log_2 \frac{x}{3} = 4$ (2 marks)

(ii) $\log_m(x+2) - \log_m 4 = \log_m 3x$ (3 marks)

See next page

Question 5 **(8 marks)**

(a) Sketch the graph of $y = \log_3(x + 3) - 1$ on the axes below, clearly showing the location of all asymptotes and axes intercepts. (3 marks)



(b) Determine the coordinates of the y-intercept of the graph of $y = 5\log_2(x + 0.5) + 1$. (2 marks)

(c) The graph of $y = \log_a(x + a)$, where $a > 1$, passes through $(6, 2)$. Determine the coordinates of the root of the graph. (3 marks)

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Question 6 **(5 marks)**

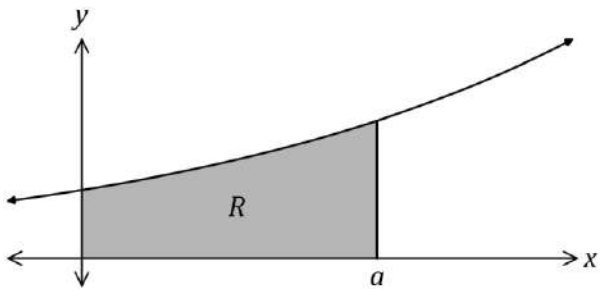
(a) Determine $\frac{d}{dx}\left(3x \cdot \sqrt[3]{e^x}\right)$. (2 marks)

(b) Hence, or otherwise, determine $\int \left(3x \cdot \sqrt[3]{e^x}\right) dx$. (3 marks)

See next page

Question 7 **(6 marks)**

The shaded region R, shown on the graph below, is bounded by the curve $y = e^{3x}$ and the lines $y = 0$, $x = 0$ and $x = a$.



(a) Determine the area of R in terms of a. (3 marks)

(b) Determine the value of a for which the area of R is 21 square units in terms of log base 10.

(3 marks)

Question 8 **(8 marks)**

The function f is defined by $f(x) = \frac{4}{x^2 + 12}$, so that $f''(x) = \frac{24(x^2 - 4)}{(x^2 + 12)^3}$.

(a) Describe the concavity of the graph of $y = f(x)$. (4 marks)

(b) Determine, with justification, the range of $f'(x)$. (4 marks)

End of questions

Supplementary page

Question number: _____

Supplementary page

Question number: _____