Semester One Examination, 2020

Question/Answer Booklet

MATHEMATICS METHODS

ATAR Year 12
Section One: Calculator-free

Student Name: _____

Please circle your teacher's name

Teacher: Miss Long Miss Rowden Ms Stone

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	97	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 2020*. 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.

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 **(5 marks)**

Determine the area bounded by the line $y=x$ and the parabola $y=x^2+4x$.

See next page

Question 2 **(7 marks)**

Determine the following

(a) $\int 4\sin 2x + \frac{1}{e^{2x}}\,dx$.

(2 marks)

(b) $\int 6x^3(3x^4 - 8)^4\,dx$.

(2 marks)

(c) Evaluate $\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \frac{1}{\cos^2 x}\,dx$.

(3 marks)

See next page

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Question 3 **(8 marks)**

Determine the following

(a) $f'(x)$ when $f(x)=\sqrt{4x-3}$.

(2 marks)

(b) $\frac{d}{dx}\left(x^3e^{4x}\right)$ when $x=2$.

(3 marks)

(c) $f'\left(\frac{\pi}{4}\right)$ when $f(t)=\frac{1+\cos t}{\sin t}$.

(3 marks)

See next page

Question 8 **(8 marks)**

Initially, particle P is stationary and at the origin. Particle P moves in a straight line so that at time t seconds its acceleration a cms^{-2} is given by $a=16-15\sqrt{t}$ where $t\geq 0$.

(a) Determine the speed of P after 1 second.

(3 marks)

(b) Determine the speed of P when it returns to the origin.

(5 marks)

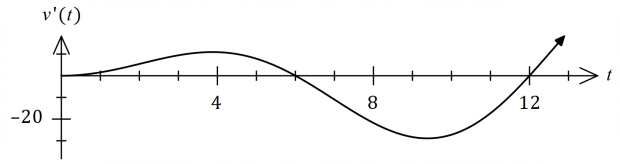
End of questions

Question 7 **(7 marks)**

(a) Determine an expression for $\frac{d}{dt}\left(6t\cos\left(\frac{\pi t}{6}\right)\right)$.

(2 marks)

The volume of water in a tank, v litres, is changing at a rate given by $v'(t)=\pi t\sin\left(\frac{\pi t}{6}\right)$, where t is the time in hours. The rate of change is shown in the graph below.



(b) Using the result from part (a) or otherwise, determine the change in volume of water in the tank between $t=0$ and $t=12$ hours.

(5 marks)

Question 4 **(7 marks)**

(a) Find x if:

(i) $\log_4 128 = x$.

(2 marks)

(ii) $\log 125 - x = \log\frac{1}{8}$.

(3 marks)

(b) Simplify $\ln(8x)^{\frac{1}{2}} + \ln(4x)^2 - \ln(16x)^{\frac{1}{2}}$.

(2 marks)

Question 5 **(5 marks)**

The graph of $y=f(x)$ has a stationary point at $(4,-3)$ and $f'(x)=ax^2+6x+8$, where a is a constant.

Determine the interval over which $f'(x)>0$ and $f''(x)>0$.

Question 6 **(5 marks)**

A curve, defined for $x>0$, passes through the point $B(2,5)$ and its gradient is given by

$$\frac{dy}{dx}=3x^2-\frac{12}{x^2}-9$$

(a) Verify using calculus that B is a stationary point, determine the value of the second derivative at B and hence describe the nature of the stationary point.

(3 marks)

(b) Determine using calculus the equation of the curve.

(2 marks)