

A formula sheet which may also be used for Section Two.
Question/answer booklet for Section One.

To be provided by the supervisor

No other items may be taken into the examination room. It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor before reading any further.

IMPORTANT NOTE TO CANDIDATES

Standard items: pens, pencils, pencil sharpener, highlighter, eraser, ruler.
To be provided by the candidate

MATERIAL REQUIRED / RECOMMENDED FOR THIS SECTION

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

TIME ALLOWED FOR THIS SECTION

Name: _____
Teacher: _____

(Calculator-free)
Section One

2016

REVISION 3
Units 3-4

MATHEMATICS METHODS

YEAR 12
SEMESTER TWO
Papers written by Australian Maths Software

Structure of this examination

	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One Calculator-free	5	5	50	50	35
Section Two Calculator—assumed	13	13	100	100	65
		Total marks	150	100	

Instructions to candidates

1. The rules for the conduct of this examination are detailed in the Information Handbook. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in the Question/Answer booklet.
3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Spare pages are provided at the end of this booklet. If you need to use them, indicate in the original answer space 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 an answer to 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.

END OF SECTION ONE

(3)

$$\frac{2 \log_9 9 \times (\log_9 2 - \log_9 1)}{(\log_9 2 + \log_9 4) \times (\log_9 3)}$$

(c) Simplify

(3)

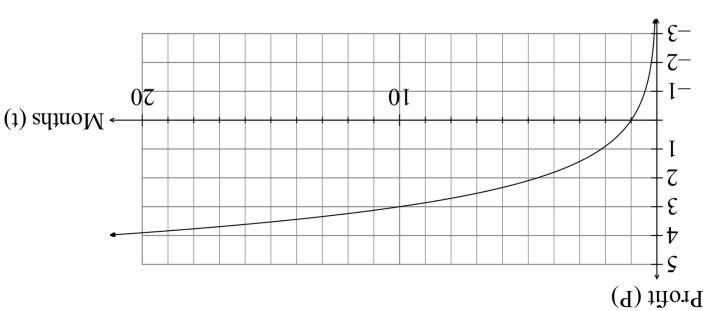
(b) Determine x given $\log_x 9 = -2$ for $x \geq 0$.

- (iii) Give three different types of bias that can be encountered when conducting a survey.
- (ii) Explain why the sampling distribution (of the sample means) has a very small standard deviation.
- (i) Explain why the company "break even" i.e. start to make a profit?

(2)

(ii) Determine the profit equation.

(1)



- (a) The profit of a small company is graphed below. The profit is measured in thousands of dollars and the time in months

1. (9 marks)

- (c) (i) Explain why the mean of many samples of the same size is a good approximation to the population mean.
- (ii) Calculate

2. (14 marks)

(a) Find the derivative of

$$(i) \quad f(x) = \ln(\sqrt{e^{-2x}})$$

(2)

$$(ii) \quad g(x) = \frac{\ln(x)}{x^2}$$

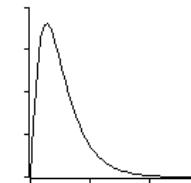
(3)

$$(iii) \quad h(x) = (e^x) \cos(2x)$$

(2)

5. (11 marks)

(a) 50 samples of size 20 of a highly skewed distribution population, as shown in the diagram, were taken and the mean of each calculated,



Sketch the shape of the distribution of the set of means of the samples. (2)

(b) Determine whether or not the function $f(x) = \begin{cases} x^2 & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$ represents a continuous probability density function. Give your reasons. (3)

(2)

(iii) Find the derivative of the functions where the derivative is not equal to $2x$.

(i) Which of the functions have a different derivative to most of the others? (2)

Many of the functions have the same derivative.

$$m(x) = \left\lfloor \frac{2}{x} \right\rfloor - 4$$

$$l(x) = \frac{2}{x} - (-x^2)$$

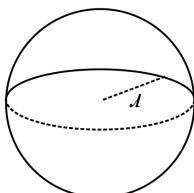
$$k(x) = \sqrt[4]{x+1}$$

$$j(x) = \sqrt[4]{x} - 1$$

$$i(x) = \frac{x}{x+e^x}$$

$$h(x) = \pi x + \pi$$

(c) Consider the functions

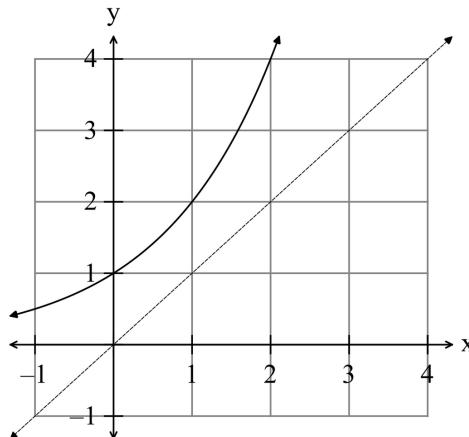


(3)

(b) The volume of a sphere is increasing at a rate of $3 \text{ cm}^3 \text{ s}^{-1}$. Find the rate of increase of the radius when $r = 2 \text{ cm}$.(b) If $y_1(x) = e^x$, find the expression for $y = g(x)$ given $g(0) = -1$. (2)

3. (7 marks)

- (a) The graph of
- $f(x) = 2^x$
- is shown on the set of axes below,



Sketch on the same set of axes

(i) $y = f^{-1}(x)$, the inverse of the function $f(x) = 2^x$. (2)

(ii) $y = f^{-1}(x - 2)$ (3)

(iii) $y = 1 - f^{-1}(x)$. (2)

4. (9 marks)

Evaluate the following

(a) (i) $\int (3y - 5)^{-2} dy$ (2)

(ii) $\int_{\frac{\pi}{4}}^{\frac{\pi}{6}} \cos^{-2}(x) dx$ (2)

(iii) $\int_1^3 \left(x^2 + x + 1 + \frac{1}{x} \right) dx$ (3)