



# Rossmoyne Senior High School

## Semester Two Examination, 2022

### Question/Answer booklet

# MATHEMATICS METHODS UNITS 3&4

## Section One: Calculator-free

If required by your examination administrator, please place your student identification label in this box

WA student number:      In figures

--	--	--	--	--	--	--	--	--	--

In words

---

---

Circle your Teacher's Name:

Mrs Alvaro

Mrs Bestall

Mrs Fraser-Jones

Mrs Greenaway

Mr Koulianos

Mr Luzuk

Mrs Murray

Mr Tanday

### Time allowed for this section

Reading time before commencing work: five minutes  
Working time: fifty minutes

Number of additional  
answer booklets used  
(if applicable):

--

### Materials required/recommended for this section

#### *To be provided by the supervisor*

This Question/Answer booklet  
Formula sheet

#### *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	Working time (minutes)	Marks available	Percentage of examination
Section One: Calculator-free	7	7	50	55	35
Section Two: Calculator-assumed	12	12	100	98	65
<b>Total</b>					100

## 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.
- 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.
- 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.

Markers use only		
Question	Maximum	Mark
1	7	
2	7	
3	11	
4	8	
5	6	
6	8	
7	8	
S1 Total	55	
S1 Wt ( $\times 0.6731$ )	35%	
S2 Wt	65%	
Total	100%	

Section One: Calculator-free

35% (55 Marks)

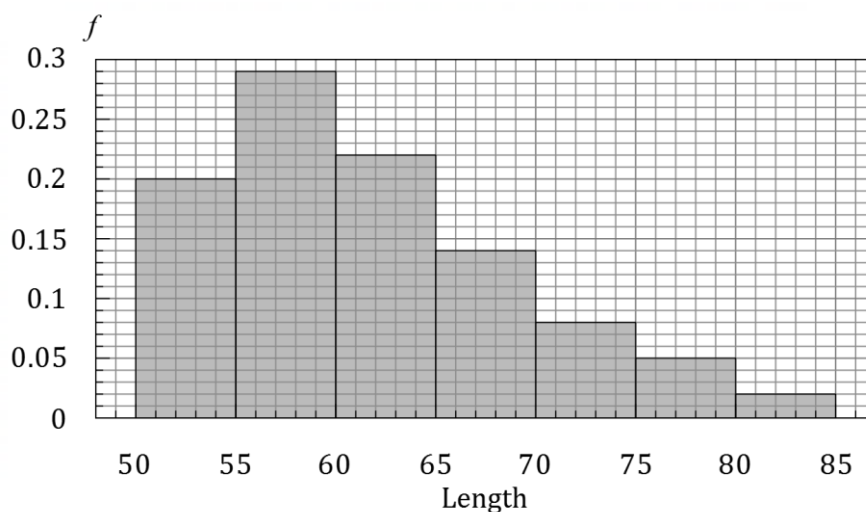
This section has **seven** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

Question 1

(7 marks)

- (a) The relative frequency histogram below shows the distribution of the lengths in centimetres of a large sample of fish bred in an offshore fish farm.



Use the distribution to determine the probability that

- (i) a randomly selected fish will be longer than 70 cm. (1 mark)
  
- (ii) a randomly selected fish will be exactly 71 cm long. (1 mark)
  
- (iii) when two fish are randomly selected, one is shorter than 55 cm and the other is not. (2 marks)

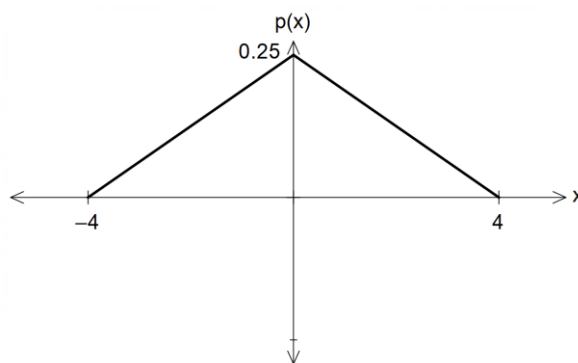
DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

- (b) Determine whether the following represent or do not represent a probability distribution.

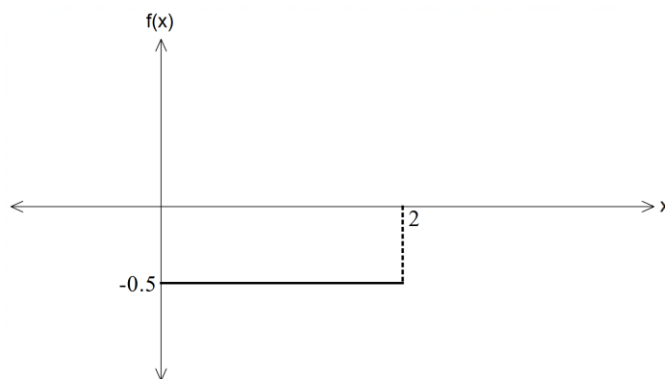
Justify each answer.

(i)  $f(x) = \frac{x}{x+2}$ ,  $x = 0, 1, 2$ . (1 mark)

(ii) (1 mark)



(iii) (1 mark)

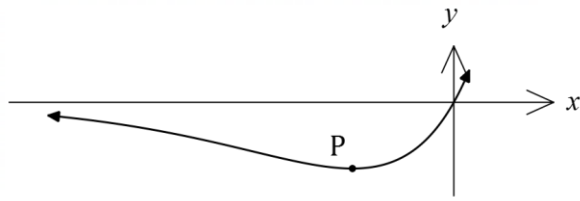


Question 2

(7 marks)

Let  $f(x) = 5xe^{(0.2x+1)}$ .

The graph of  $y = f(x)$  is shown. It has one stationary point, at  $P$ , and one point of inflection.



(a) Clearly show that  $f'(x) = (x + 5)e^{(0.2x+1)}$ . (2 marks)

(b) Determine the coordinates of point  $P$ . (2 marks)

(c) Determine the values of  $x$  for which the curve  $y = f(x)$  is concave down. (3 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

## Question 3

(11 marks)

Determine the following:

(a)  $\int 6e^{3x-2} dx.$

(1 mark)

(b)  $\int_0^{\frac{\pi}{6}} \cos(3x) dx.$

(2 marks)

(c)  $f' \left( \frac{\pi}{2} \right)$  when  $f(x) = \frac{\sin(4x)}{1 + \cos(x)}.$

(3 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

(d)  $\frac{d}{dx} \int_x^e \sin(t-1) dt.$

(1 mark)

(e)  $\int_0^2 \frac{d}{dx} (xe^{5x}) dx.$

(1 mark)

(f)  $\frac{d^2y}{dx^2}$  if  $y = \int \ln(\sin 2x) dx$

(3 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

**Question 4****(8 marks)**

A computer program scans selected text messages passing through a network to see if the message contains a particular keyword. The random variable  $X$  takes the value 0 if the keyword is not found, the value 1 if it is found, and has probability distribution

$$P(X = x) = \begin{cases} \frac{e^{kx}}{4} & x = 0, 1 \\ 0 & \text{elsewhere.} \end{cases}$$

- (a) Complete the table for the probability distribution of  $X$  (1 mark)

$x$	0	1
$P(X = x)$		

- (b) Show that the value of the constant  $k$  is  $\log_e(3)$ . (2 mark)

- (c) Determine the mean and standard deviation of  $X$ . (2 marks)

- (d) Determine the probability that the program finds the keyword in exactly three of the next four randomly selected text messages that it scans. (3 marks)



**Question 5**

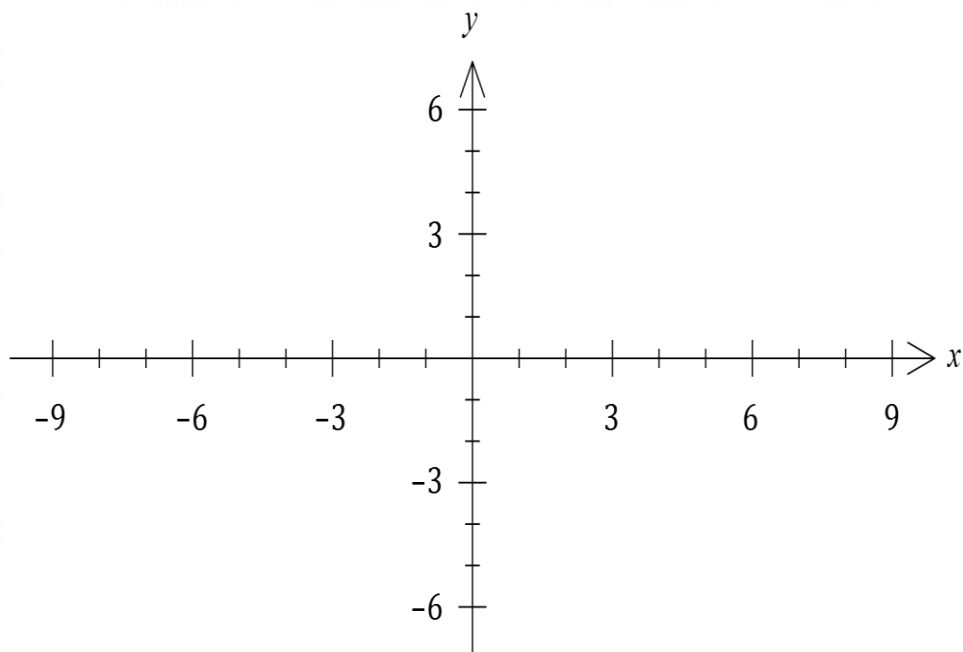
**(6 marks)**

Let  $f(x) = k \log_6(x + 6) + c$ , where  $k$  and  $c$  are constants.

The graph of  $y = f(x)$  intersects line  $L$  with equation  $5y + 2x + 15 = 0$  when  $x = 0$  and  $x = -5$ .

- (a) Determine the value of the constant  $c$  and the value of the constant  $k$ . (3 marks)

- (b) Sketch the graph of  $y = f(x)$  on the axes below. (3 marks)



DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

**Question 6****(8 marks)**

Components A and B form part of an electronic circuit, and properties of these components are measured  $t$  seconds after the circuit is turned on.

- (a) The rate of change of temperature,  $T$  °C, of component A is given by  $\frac{dT}{dt} = \frac{18t}{3t^2 + 8}$ .  
Determine, in simplest form, the increase in temperature of this component during the first 4 seconds. (4 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

- (b) The current,  $I$  amps, flowing through component B **reaches a peak very quickly and then declines** as time goes on, as modelled by  $I(t) = \frac{2 + \ln(t)}{4t}$ . Determine, in simplest form, the maximum current that flows through this component. (4 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

## Question 7

(8 marks)

- (a) The velocity,  $v$  cm per second, of electrically powered model car A at time  $t$  seconds is given by  $v = \sqrt{4t + 2}$ . Determine the change in displacement of this car between  $t = 0.5$  and  $t = 3.5$  seconds.

(4 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

- (b) The speed,  $s$  cm per second, of model car B at time  $t$  seconds is given by  $s = e^{\sqrt{4t+2}}$ , so that when  $t = 3.5$ , its speed was 54.6 cm per second. Use the **increments formula** to determine a **decimal approximation** for the speed of this car when  $t = 3.6$ . (4 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Supplementary page

Question number: \_\_\_\_\_

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Supplementary page

Question number: \_\_\_\_\_

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

