



## Rossmoyne Senior High School

Semester One Examination, 2018

Question/Answer booklet

### MATHEMATICS METHODS UNIT 3

Section One:  
Calculator-free

Name: \_\_\_\_\_

Teacher's Name: \_\_\_\_\_

#### Time allowed for this section

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

#### 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	8	8	50	52	35
Section Two: Calculator-assumed	12	12	100	81	65
<b>Total</b>					100

## Instructions to candidates

1. 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.
2. Write your answers in this Question/Answer booklet.
3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.
4. 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.
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.

Working time: 50 minutes.

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**Question 1****(6 marks)**

(a) Solve exactly for  $x$  in the following:

$$10e^x = 2e^{2.1x}$$

**(3 marks)**

(b) If  $\log a = x^2$  and  $\log b = \frac{x^2}{2}$  determine  $\log \frac{\sqrt{a}}{b^2}$

**(3 marks)**

## Question 2

(6 marks)

Determine  $\frac{dy}{dx}$  for the following, simplifying each answer.

(a)  $y = \sqrt{8x + 1}$ .

(2 marks)

(b)  $y = 2x^5 \cos(5x)$ .

(2 marks)

(c)  $y = \int_x^3 t(1 - t^2)^3 dt$ .

(2 marks)

**Question 3****(4 marks)**

A particle travels in a straight line so that its distance  $x$  cm from a fixed point  $O$  on the line after  $t$  seconds is given by:

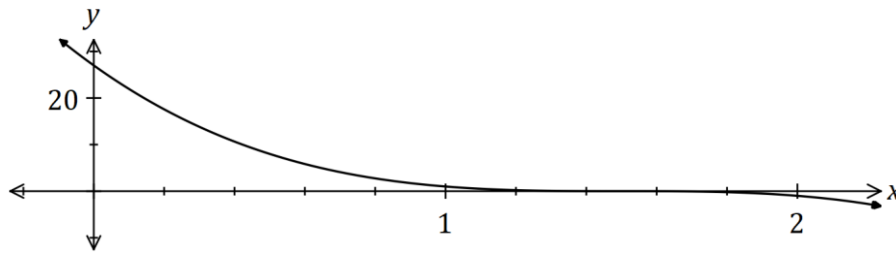
$$x = \frac{2t^3}{3t + 1}, t \geq 0.$$

Calculate the velocity of the particle when  $t = 1$ .

## Question 4

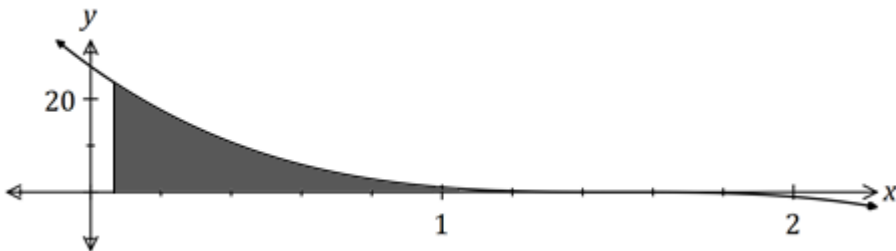
(8 marks)

The graph of  $y = (3 - 2x)^3$  is shown below.



- (a) Determine the area of the region enclosed by the curve and the coordinates axes. (4 marks)

- (b) For the diagram below, given that the area of the region bounded by the curve, the  $x$ -axis and the line  $x = k$  is 8 square units, determine the value of  $k$ , where  $0 < k < 1.5$ . (4 marks)



## Question 5

(5 marks)

(a) Determine  $\frac{d}{dx}(x \ln 3x)$

(2 marks)

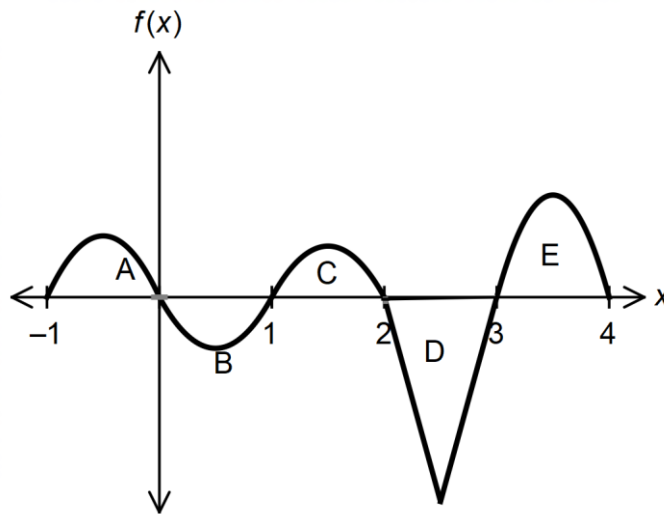
(b) Hence determine  $\int \ln 3x \, dx$

(3 marks)

## Question 6

(6 marks)

Consider the graph of  $y = f(x)$  for  $-1 \leq x \leq 4$ .



It is known that:

- $\int_{-1}^1 f(x) dx = 0$
- Areas C, D and E are 1, 5 and 4 units<sup>2</sup> respectively.
- When  $x = 1.5$ ,  $f(x) = 1$  and when  $x = 3.5$ ,  $f(x) = 2$

(a) Determine:

(i)  $\int_{-1}^4 f(x) dx$  (2 marks)

(ii) the area enclosed by the graph of  $f(x)$  and the  $x$ -axis between 0 and 4 given that Area A = 3 units<sup>2</sup> (2 marks)

(b) Determine the value of  $\int_{1.5}^{3.5} 2f'(x) dx$  (2 marks)



**Question 7****(12 marks)**

The function  $g$  is such that  $g'(x) = ax^2 - 12x + b$ , it has a point of inflection at  $(1, -11)$  and a stationary point when  $x = -1$

(a) Determine the values of  $a$  and  $b$ .

(4 marks)

(b) Determine  $g(x)$ .

(3 marks)

(c) Determine the coordinates and nature of all the stationary points in  $g(x)$

(5 marks)

**Question 8****(5 marks)**

The height, in metres, of a lift above the ground  $t$  seconds after it starts moving is given by

$$h = 4 \cos^2\left(\frac{t}{7}\right).$$

Use the increments formula to estimate the change in height of the lift from  $t = \frac{7\pi}{4}$  to  $t = \frac{88\pi}{50}$ .

**Supplementary Page**

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

