

Perth Modern School



PERTH MODERN SCHOOL  
Exceptional schooling. Exceptional students.

Semester Two Examination, 2019  
Question/Answer booklet

12 METHODS  
UNITS 3 & 4  
Section One:  
Calculator-free

Your Name \_\_\_\_\_

Your 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.

Question	Mark	Max	Question	Mark	Max
1		6	5		9
2		5	6		7
3		6	7		7
4		10			

**Structure of this paper**

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	7	7	50	50	35
Section Two: Calculator-assumed	14	14	100	105	65
<b>Total</b>				155	100

**Additional working space**

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

**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.
- 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.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
  - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
  - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.
- 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.
- The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 50 minutes.

**Section One: Calculator-free**

**(6 marks)**

- (a) Differentiate  $\frac{e^x}{x}$  using the quotient rule and simplify. (3 marks)

- (b) **Hence**, determine the definite integral  $\int_1^0 \frac{1-x}{2e^x} dx$ . (3 marks)

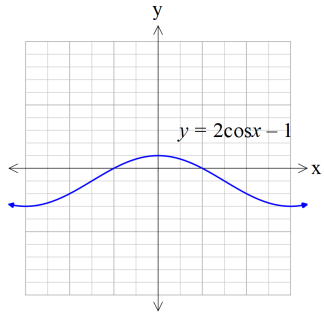
Additional working space

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

Question 2

(5 marks)

Determine the area between the  $x$ -axis and the curve  $y = 2\cos|x| - 1$  for  $0 \leq x \leq \pi$ .

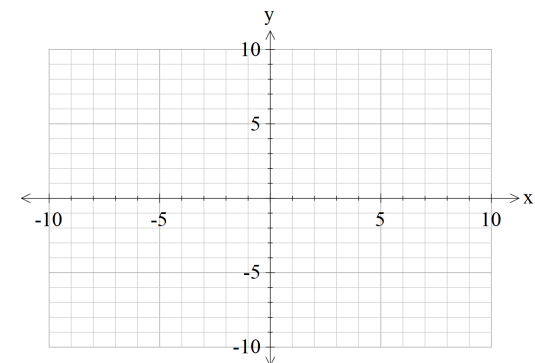


Question 7

(7 marks)

Sketch the graph of a continuous function  $y = f(x)$  which satisfies all the following conditions:

- Domain of  $f(x)$  is  $-10 \leq x \leq 10$
- $f(-3) = -1$ ,  $f(4) = 2$ ,  $f(7) = 8$
- $f'(x) \geq 0$  for  $-10 \leq x \leq 7$ ,  $f'(x) < 0$  for  $7 < x \leq 10$
- $f'(-3) = 0 = f'(7)$
- $f''(-3) = 0 = f''(4)$
- $f''(4) \neq 0$

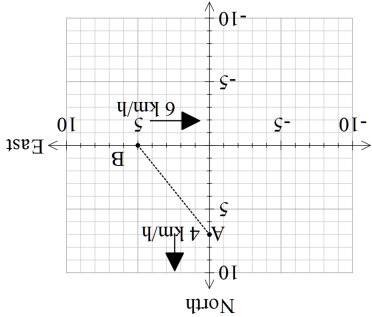


Question 3 (6 marks)

Determine whether the following could be a probability density function on the given interval. Explain with reasons. (Assume that  $f(x) = 0$  for all values other than what is specified.)

(a)  $f(x) = \frac{3}{2}(x^2 - x)$  for the interval  $-1 \leq x \leq 2$ . (2 marks)

(2 marks)



(a) Show that the distance between the two cars at time  $t$  hours is given by  $D = \sqrt{(5 - 6t)^2 + (7 + 4t)^2}$  km.

Two very slow cars are positioned at the positions shown in the diagram below. Car A is moving North at 4 km/h while car B is moving West at 6 km/h.

(7 marks)

Question 6

(b) Determine using calculus, the time in hours that the separation is a minimum. Show that this is indeed a minimum.

(5 marks)

(c)  $f(x) = \frac{x^2 + 1}{x - 1}$ ,  $-1 < x < 1$ .

(2 marks)

**CALCULATOR FREE**

**METHODS UNIT 3 AND 4**

**Question 4**

**(8 marks)**

(a) Given that  $\log_7 x = 2$ ,  $\log_7 343 = y$  &  $\log_7 125 = z$ , determine  $x + y - z$ . (4 marks)

(b) Solve for  $x$  if  $3\log_3(x) + \log_3(2x-1) - 2\log_3(x) = 1$  (4 marks)

**METHODS UNIT 3 AND 4**

**CALCULATOR FREE**

**Question 5**

**(10 marks)**

(a) Determine  $f(t)$  if  $f''(t) = 2e^t + 3\sin(t)$  and  $f(0) = 0$ ,  $f'(0) = 0$ . (4 marks)

(b) Evaluate  $\int \frac{2x}{5x^2 - 1} dx$  (3 marks)

(c) Determine  $\frac{d}{dx}(x^3 \cos 2x)$  (3 marks)