

**MATHEMATICS 3CD**

**Semester 1 Examination 2014**

**Perth Modern School**

**Question/Answer Booklet**



Exceptional school, exceptional students.

**Calculator-Free**

**Section Two:**

**MATHEMATICS 3CD**

**Time allowed for this section**

Reading time before commencing work: five minutes  
Working time for this section: fifty minutes

Name of Teacher:

Name of Student:

**Materials required/recommended for this section**

**To be provided by the supervisor**

This Question/Answer Booklet

Formula Sheet

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid/tape, ruler, highlighters

**To be provided by the candidate**

Special items: nil

**Important note to candidates**

No other items may be used in this section of the examination. 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.

PO Box 445 Claremont WA 6910  
Published by WA Examination Papers

Copying or communication for any other purposes can only be done within the terms of the Copyright Act or with prior written permission of WA Examination Papers.

Papers is acknowledged as the copyright owner. Teachers within Perth Modern School may change the paper provided that WA Examination Papers moral rights are not infringed.

This examination paper may be freely copied, or communicated on an internet, for non-commercial purposes within educational institutions that have purchased the paper from WA Examination Papers, or communicated on an internet, for non-commercial purposes within written permission of WA Examination Papers.

**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	33½%
Section Two: Calculator-assumed	12	12	100	100	66%
		<b>Total</b>		150	100

**Additional working space**

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

**Instructions to candidates**

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2013*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in the spaces provided in this Question/Answer Booklet. 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(s) that you are continuing to answer at the top of the page.
3. **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.
4. It is recommended that you **do not use pencil**, except in diagrams.

(5 marks)

Question 1

Working time for this section is 50 minutes.

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

Section One: Calculator-free  
(50 Marks)

(8 marks)

**Question 2**

The function with derivative  $f'(x) = (9x + 10)(3x - 2)$  passes through the point  $(1, 2)$ .

- (a) Determine the equation of the tangent to the graph of  $y = f(x)$  at the point where  $x = 1$ .  
(2 marks)

- (b) Determine the equation of the function  $f(x)$ .  
(3 marks)

- (c) Calculate the coordinates of the minimum turning point of the graph of  $y = f(x)$ .  
(3 marks)

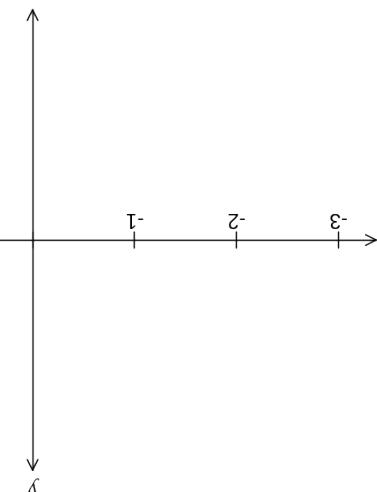
**Question 7**

The height of a solid metal cylinder is equal to its diameter.

- (a) Show that the total surface area,  $S$ , of the cylinder is given by  $S = 6\pi r^2$ .  
(1 mark)

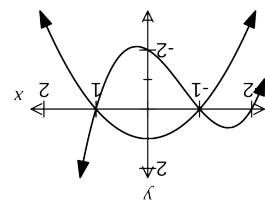
- (b) Using the formula  $\delta S \approx \frac{dS}{dr} \delta r$ , show that when the radius of the cylinder increases by 2%,  
the approximate percentage increase in the total surface area of the cylinder is 4%.  
(4 marks)

- (c) Explain why the increments formula in (b) would not produce a suitable approximation for  
the increase in total surface area if the radius increased from 10 cm to 15 cm.  
(2 marks)



(4 marks)

(4 marks)



(b)

area enclosed by the two functions between  $x = -1$  and  $x = 1$ .The graphs of  $f(x) = x^3 + 2x^2 - x - 2$  and  $g(x) = 1 - x^2$  are shown below. Determine the

$$(iii) \int_{-2}^2 (1 - x^3)^4 dx$$

(3 marks)

(2 marks)

(b) Is  $c$  positive or negative? Explain your answer.

(2 marks)

(a) At the point where the curve intersects the  $y$ -axis, is it concave up or concave down?

Explain your answer.

$$(i) \int_{-2}^2 x^3 dx$$

(2 marks)

(a) Determine

Question 3 (8 marks)

(9 marks)

- $f''(0) > 0$
- $f'(x) < 0$  only for  $-1 < x < 0$  and  $x < 1$
- $f'(x) = 0$  only for  $x = -1, x = 0$  and  $x = 1$
- $f(x) = 0$  only for  $x = -2$  and  $x = 2$

features:

A polynomial function  $f(x) = ax^4 + bx^2 + c$ , where  $a, b$  and  $c$  are real constants, has the following

features:

(5 marks)

**Question 4**

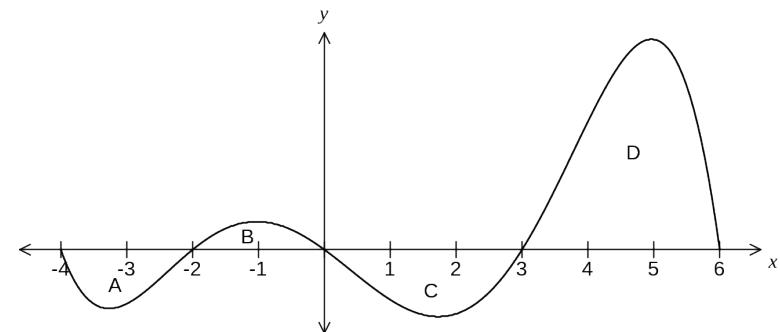
$\frac{d}{dx} \left( e^{3x} (1+x^2)^3 \right)$  can be written in the form  $a(bx+c)^2 e^{3x} (1+x^2)^2$ .

Determine the values of  $a$ ,  $b$  and  $c$ .

**Question 5**

(8 marks)

The graph of the function  $y = f(x)$  is shown below for  $-4 \leq x \leq 6$ .



The area of each region enclosed by the curve and the  $x$ -axis is shown in the following table.

Region	A	B	C	D
Area of region	5	3	11	25

- (a) Determine the area enclosed between the graph of  $y = f(x)$  and the  $x$ -axis, from  $x = -4$  to  $x = 6$ . (2 marks)

- (b) Determine the value of

$$(i) \int_{-2}^6 f(x) \, dx .$$

(2 marks)

$$(ii) \int_0^6 4 - f(x) \, dx .$$

(2 marks)

$$(iii) \int_{-4}^6 f\left(\frac{x}{2}\right) \, dx .$$

(2 marks)