

MATHEMATICS
3C/3D

Section One:
Calculator-free

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In words

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Student Number: In figures

Time allowed for this section

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

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet

Formula Sheet

To be provided by the candidate

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

Published by the Curriculum Council of Western Australia
27 Walters Drive
OSBORNE PARK WA 6017

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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	8	8	50	40	
Section Two: Calculator-assumed	12	12	100	80	
Total				120	100

Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2011*. Sitting this examination implies that you agree to abide by these rules.
- 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.
- 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.
- It is recommended that you **do not use pencil**, except in diagrams.

See next page

Additional working space

Question number: _____

Section One: Calculator-free (40 Marks)

This section has **eight (8)** questions. Answer **all** questions. Write your answers in the spaces provided.

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.

Working time: 50 minutes.

Question 1 (6 marks)

Differentiate the following with respect to x , without simplifying.

(a) $f(x) = \frac{4x+1}{\sqrt{x^2+1}}$ (2 marks)

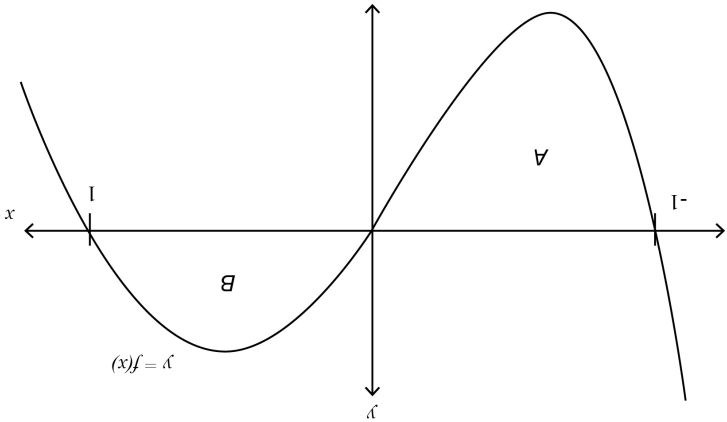
(b) $g(x) = xe^{x^2+1}$ (2 marks)

(c) $h(x) = \int_1^x (1+2t)^{\frac{1}{2}} dt$ (2 marks)

See next page

Question 8 (5 marks)

Part of the graph of $y = f(x)$ is shown below. The areas of the bounded regions A and B are 7 and 4 square units respectively.



(a) Evaluate $\int_0^1 f(-x) dx$ (2 marks)

(b) Evaluate $\int_1^{-1} (2 - f(x)) dx$ (3 marks)

End of questions

Question 2

(4 marks)

Calculate the maximum and minimum values of $x^2(6 - x)$ in the interval $1 \leq x \leq 5$.

See next page

Question 7

(8 marks)

Let S denote {1000, 1001, 1002, ..., 9998, 9999}, the set of four-digit whole numbers.

- (a) How many numbers in S are palindromes (that is, read the same forward as backward) like 2002 and 7777? (2 marks)
- (b) How many numbers in S are multiples of either 4 or 5, but not both, like 3404 and 4025? For example, 3404 is a multiple of 4 but not 5 and 4025 is a multiple of 5 but not 4. (3 marks)
- (c) How many numbers in S contain at least **two (2)** consecutive 5s, like 5529, 1555 and 5255? (3 marks)

See next page

Question 3

Solve the inequality

$$\frac{3x+2}{x-6} > 1$$

Question 6

The cubic polynomial $p(x) = ax + bx^2 + cx^3$ has the following properties:

- $p(3) = 135$
- $p(x)$ has a turning point at $x = 6$
- $p(x)$ has a point of inflection at $x = 2$

(a) Explain why the constants a , b and c satisfy the simultaneous equations: (3 marks)

$$a + 12b + 108c = 0, \quad b + 6c = 0 \quad \text{and} \quad a + 3b + 9c = 45.$$

(b) Evaluate the constants a , b and c by solving the equations in part (a). (3 marks)

Question 4

(4 marks)

Let $f(x) = e^x$ and $g(x) = \sqrt{1-x}$.

(a) Determine expressions for $f(g(x))$ and $g(f(x))$.

(2 marks)

(b) Determine the range of $f(g(x))$.

(1 mark)

(c) Determine the domain of $g(f(x))$.

(1 mark)

Question 5

(4 marks)

(a) Evaluate $\int_{-0.5}^0 3(1-x)^2 dx$

(2 marks)

(b) Determine $\int x^2(x^3 + 4)^9 dx$

(2 marks)