Western Australian Certificate of Education
Examination, 2014

Question/Answer Booklet

MATHEMATICS
3C/3D

Section One:
Calculator-free

Place one of your candidate identification labels in this box.

Ensure the label is straight and within the lines of this box.

Student Number:	In figures						
	In words						

Time allowed for this section

Reading time before commencing work: five minutes
Working time for section: 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 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.

Ref: 14-084

MAT3CD-S1

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	9	9	50	50	33⅓
Section Two: Calculator-assumed	13	13	100	100	66⅔
				Total	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2014*. 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. 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.

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.

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Additional working space

Question number: _____

Section One: Calculator-free   **(50 Marks)**

This section has **nine (9)** 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 that you are continuing to answer at the top of the page.

Working time: 50 minutes.

Question 1   **(9 marks)**

Evaluate the following:

(a) $\displaystyle\int_0^3 \left(6x^2 + 2x + 1\right)\, dx$ (3 marks)

(b) $\displaystyle\int_1^2 \frac{d}{dx}\left(\frac{x^5}{x^2 + 1}\right) dx$ (3 marks)

(c) $\displaystyle\frac{d}{dx} \int_{x^2}^{x^2} \frac{2}{3t^2 - 1}\, dt$ (3 marks)

Additional working space

Question number: _____

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Question 2 (7 marks)

(a) Simplify the expression $2 - \dfrac{1}{2 - \dfrac{1}{x}}$. (3 marks)

(b) Solve the inequality $\dfrac{2x^3}{(x-2)(x+4)} > 0$. (4 marks)

See next page

Additional working space

Question number: _____

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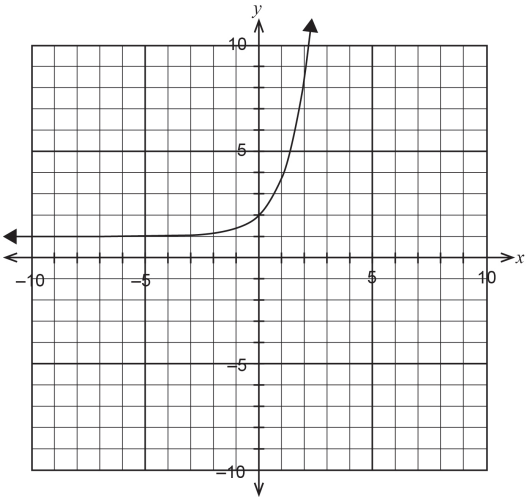DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 3 (4 marks)

When two fair six-sided dice are rolled, event A occurs when the sum of the uppermost faces is odd. Event B occurs when the sum of the uppermost faces is two, three, eight or nine.

Explain whether events A and B are mutually exclusive, independent or neither. Justify your answer.

See next page

Additional working space

Question number: _____

Question 4   (8 marks)

The function $f(x) = e^x + 1$ is graphed on the axes below.

(a)   On the same axes, sketch the following functions, showing all relevant features. Label each graph.

(i) $f(x-3)$ (2 marks)

(ii) $f(-2x)$ (3 marks)

Question 9   (3 marks)

The derivatives of the sequence $1, x, x^2, x^3, \ldots, x^{n-1}$ are $0, 1, 2x, 3x^2, \ldots, (n-1)x^{n-2}$. If the sum of the power series $1 + x + x^2 + x^3 + \ldots + x^{n-1} = \dfrac{1-x^n}{1-x}$, show that the sum of the series of
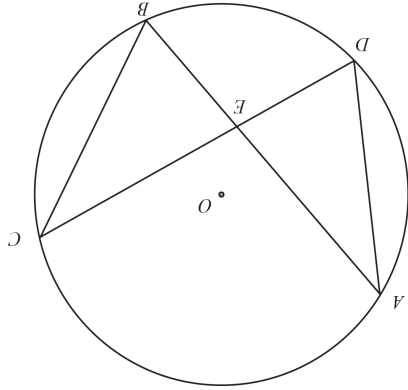
derivatives $1 + 2x + 3x^2 + \ldots + (n-1)\,x^{n-2} = \dfrac{x^n\,(n-1) - nx^{n-1} + 1}{(1-x)^2}$.

End of questions

(b) The graph $y = g(x)$ is drawn below. Given that $g(x) = f(ax - 6)$ where a is a constant, determine the value of a.

(3 marks)

See next page

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Question 8 (5 marks)

Points A, B, C and D lie on the circle with centre O, as shown below, with $\overline{AB}$, $\overline{CD}$, $\overline{AD}$ and $\overline{CB}$ chords of the same circle. Point E is the point of intersection of chords $\overline{AB}$ and $\overline{CD}$.
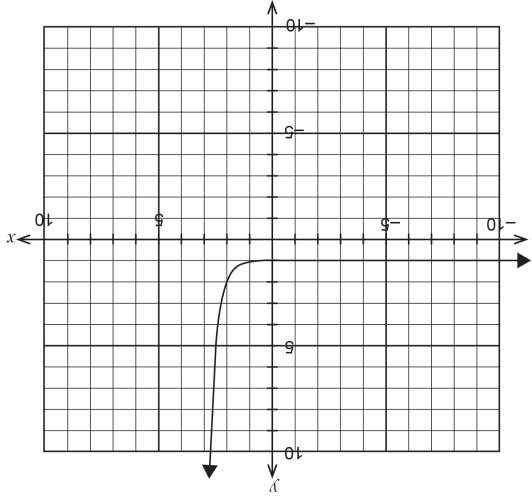

Prove $\dfrac{AE}{AD} = \dfrac{CE}{CB}$.

See next page

Question 5   **(4 marks)**

Given that $y = x^{\frac{1}{3}}$, use $x = 1000$ and the increments formula $\delta y \approx \dfrac{dy}{dx}\, \delta x$ to determine an approximate value for $\sqrt[3]{1006}$.

Question 6   **(6 marks)**

Let $f(x) = x - 7$ and $g(x) = \dfrac{1}{x}$.

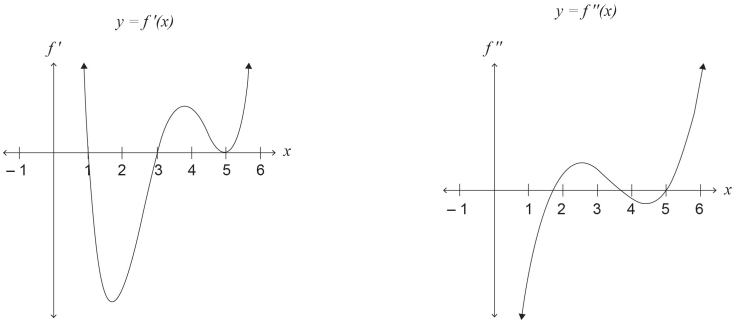(a)   State $g \circ f(x)$ with its domain and range.   (3 marks)

(b)   Determine $h(x)$ if $h \circ f(x) = 10x - 49$.   (3 marks)

Question 7   **(4 marks)**

The graphs of $y = f'(x)$ and $y = f''(x)$ of a function $y = f(x)$ are shown below. The function $y = f(x)$ passes through points $(1, 4)$, $(3, -2)$ and $(5, 1)$.

(a)   Determine the coordinates of the maximum and minimum points of $y = f(x)$.   (2 marks)

(b)   Determine whether there exists a horizontal point of inflection. Give reasons.   (2 marks)