Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

**Western Australian Certificate of Education
Examination, 2013**

Question/Answer Booklet

MATHEMATICS
3C/3D

Section One:
Calculator-free

Please place your student identification label in this box

Student Number: In figures

In words

Number of additional
answer booklets used
(if applicable):

Time allowed for this section

Reading time before commencing work: five minutes
Working time for section: 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 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: 13-089

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	7	7	50	50	33⅓
Section Two: Calculator-assumed	11	11	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 2013*. 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** handed in with your Question/Answer Booklet.

Additional working space

Question number: _____

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

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

Section One: Calculator-free (50 Marks)

This section has **seven (7)** 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 need to 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 **(5 marks)**

Solve the equation $\dfrac{x+2}{2x-1} = \dfrac{2x+1}{x+4}$.

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Additional working space

Question number: _____

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Question 2 **(7 marks)**

An airline owns three small aircraft: P, Q and R. One day, a total of 80 passengers travelled on the three aircraft. The total number of passengers who travelled on aircraft P and Q was four times the number who travelled on aircraft R.

Each passenger who travelled on aircraft P paid $200. Those who travelled on aircraft Q paid $300 each, and those who travelled on aircraft R paid $100 each. The 80 passengers paid $19 400 in total.

Let p = number of passengers who flew on aircraft P,
q = number of passengers who flew on aircraft Q, and
r = number of passengers who flew on aircraft R.

(a) Write three equations relating p, q and r that will allow a solution for all three variables.

(3 marks)

(b) How many passengers flew on each aircraft? (4 marks)

Additional working space

Question number: _____

Question 3   **(4 marks)**

Let $f(x) = \dfrac{1}{x^2} + \dfrac{e^{2x}}{2}$.

Determine the second derivative $f''(x)$.

Additional working space

Question number: _____

Question 4 **(10 marks)**

Let $f(x) = (x-1)(x^2-16)$.

(a) Show that $f'(x) = (3x-8)(x+2)$. (3 marks)

(b) Determine the equation of the tangent to the graph of $f(x)$ at the point where $x = 3$.
(3 marks)

(c) the value of $\int_0^3 f(-x)\,dx$. (2 marks)

(d) the value of $\int_0^2 (x - f(x))\,dx$. (3 marks)

(e) the value of $\int_{-1}^1 f'(x)\,dx$. (2 marks)

End of questions

Question 7 (11 marks)

The graph of the function $f(x)$ is shown below for $-3 \leq x \leq 3$.

The areas enclosed between the graph, the x-axis and the lines $x = -3$ and $x = 3$ are marked in the appropriate regions.
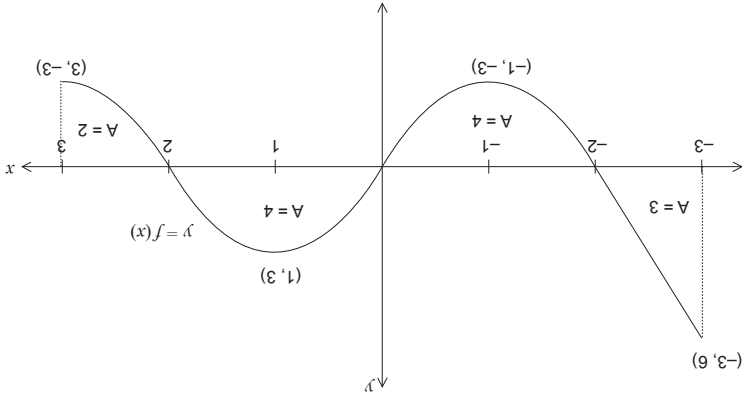
Determine:

(a) the value of $\int_{-2}^{3} f(x)\, dx$. (2 marks)

(b) the area enclosed between the graph of $f(x)$ and the x-axis, from $x = -2$ to $x = 3$. (2 marks)

See next page

(c) What is the maximum value of the function over the domain $-4 \leq x \leq 4$? (4 marks)

See next page

Question 5   **(6 marks)**

A cubic function $f(x) = ax^3 + bx^2 + cx + d$ has these features:

- $f'(x) \geq 0$ only for $-2 \leq x \leq 6$
- $f''(x) \geq 0$ only for $x \leq 2$
- There are exactly two points at which the graph of $f(x)$ meets the x-axis
- $d < 0$.

(a)   (i)   State the x-coordinate of the point of inflection.   (1 mark)

      (ii)   Is the graph of $f(x)$ horizontal at the point of inflection? Explain your answer.

                                                       (1 mark)

(b)   Is a positive or negative? Explain your answer.   (2 marks)

(c)   Determine the coordinates of the local maximum.   (2 marks)

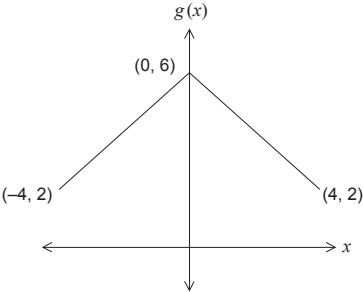**See next page**

Question 6   **(7 marks)**

A function is defined as $f(x) = x(10 - x)$, over the domain $0 \leq x \leq 10$.

(a)   Determine the range of $f(x)$.   (2 marks)

The graph of a second function $g(x)$ is shown below for the domain $-4 \leq x \leq 4$. The coordinates of the endpoints and vertex of the graph are labelled.

(b)   Determine:

      (i) $f(g(2))$.   (2 marks)

      (ii)   the domain and range of $f(g(x))$.   (3 marks)

See next page