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

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education Examination, 2014

Question/Answer Booklet

MATHEMATICS: SPECIALIST 3A/3B

Section One: Calculator-free

Please place your student identification label in this box

Student Number: In figures | | | | | | | | |

In words _____

_____

Time allowed for this section

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

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer Booklet
Formula Sheet

Number of additional answer booklets used (if applicable): ☐

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.

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	50	33⅓
Section Two: Calculator-assumed	12	12	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 responses to the specific questions asked and to follow any instructions that are specific 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.

See next page

Section One: Calculator-free **(50 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 that you are continuing to answer at the top of the page.

Working time: 50 minutes.

Question 1 **(4 marks)**

(a) Convert the Cartesian coordinates $(3, -3)$ into polar coordinates $[r; \theta]$ where $-\pi < \theta \leq \pi$. (2 marks)

(b) Convert the polar coordinates $\left[6, \frac{2\pi}{3}\right]$ into Cartesian coordinates. (2 marks)

Question 2 **(6 marks)**

Six transformations, A–F, are defined in the table below.

Transformation	Description
A	Translate by 2 units to the right
B	Translate by 2 units to the left
C	Dilate horizontally about $x = 0$ with factor 2
D	Dilate vertically about $y = 0$ with factor 2
E	Reflect vertically about $y = 0$
F	Reflect horizontally about $x = 0$

(a) Write the defining rule for the resultant function when the following transformations are performed on $f(x) = e^x$.

(i) A (1 mark)

(ii) C (1 mark)

(iii) B then F (2 marks)

(b) A different pair of transformations will yield the same result as that of (a) part (iii). Which pair of transformations will also produce the result of 'B then F'? (2 marks)

See next page

Question 3 **(8 marks)**

Points P and Q are defined by their respective position vectors $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$.

Determine

(a) the exact value for the distance PQ. (2 marks)

(b) a vector equation for the line containing points P and Q. (3 marks)

(c) the position vector of the point M that divides the line segment PQ in the ratio $2:1$. (3 marks)

Question 4 **(9 marks)**

(a) Differentiate the following expressions with respect to x.

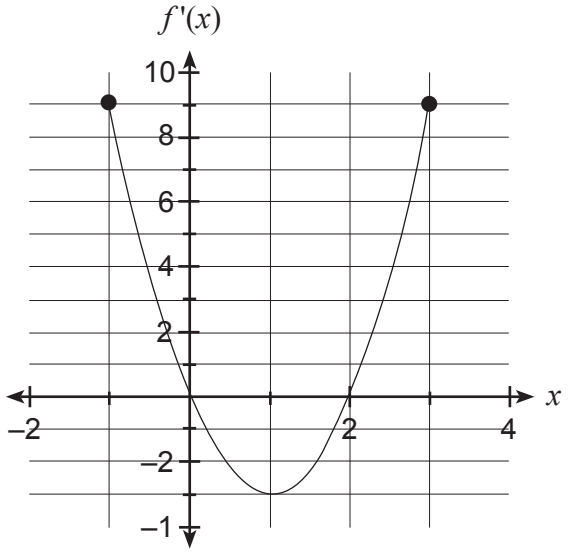
(i) $e^{2x}(1-x)$ (2 marks)

(ii) $\sqrt{25-9x^2}$ (2 marks)

(b) Given that $g(x) = \dfrac{\ln x}{x}$, evaluate $g'(1)$. (3 marks)

See next page

The graph of a function $y = f'(x)$ is shown below for $-1 \leq x \leq 3$.



(c) Describe the behaviour of the graph of $y = f(x)$ at $x = 2$. (2 marks)

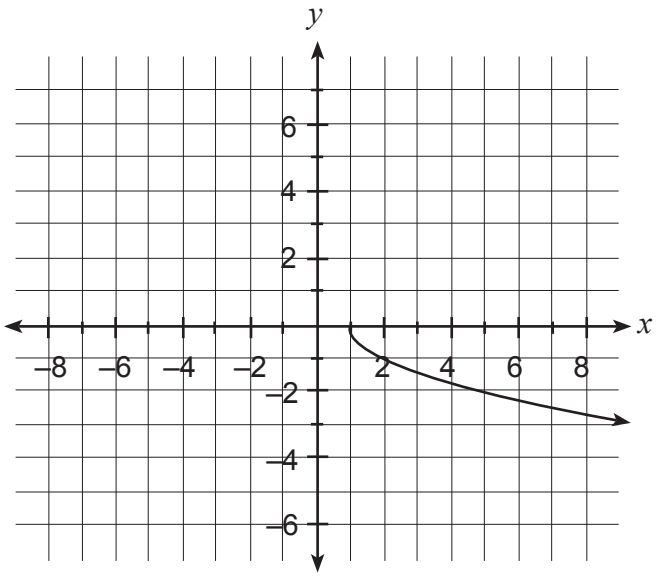
Question 5 **(11 marks)**

Two functions f and g are defined by the rules $f(x) = -\sqrt{x-1}$ and $g(x) = x^2$.

(a) State the domain and range for function f. (2 marks)

(b) Determine the defining rule for $y = f^{-1}(x)$. (2 marks)

The graph of $y = f(x)$ is shown below.



(c) Sketch, on the axes provided, the graph for $y = f^{-1}(x)$. (3 marks)

(d) Evaluate

(i) $g(f(2))$. (1 mark)

(ii) $f\left(g\left(\sqrt{5}\right)\right)$. (1 mark)

(e) What is the domain for the function $f(g(x))$? (2 marks)

Question 6 **(4 marks)**

Solve exactly the equations below, finding all solutions within the domain $0 \leq x \leq 2\pi$.

(a) $\cos(2x) = -\frac{1}{2}$ (2 marks)

(b) $\sin\left(x - \frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$ (2 marks)

See next page

Question 7 **(4 marks)**

By using the substitution $y = 2^x$, or otherwise, find all solutions of the equation

$$4^x - 9(2^x) + 8 = 0.$$

See next page

Question 8 **(4 marks)**

Given that $\tan 2\theta = \frac{1}{2}$ and $0 < \theta < \frac{\pi}{2}$ determine the exact value for $\tan \theta$.

End of questions

Additional working space

Question number: _____

Additional working space

Question number: _____

Additional working space

Question number: _____

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