



## Western Australian Certificate of Education Examination, 2012

### Question/Answer Booklet

# MATHEMATICS: SPECIALIST 3A/3B

## Section One: Calculator-free

Please place your student identification label in this box

Student Number:    In figures

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In words

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### 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 tape/fluid, 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 total exam
Section One: Calculator-free	8	8	50	50	33 $\frac{1}{3}$
Section Two: Calculator-assumed	11	11	100	100	66 $\frac{2}{3}$
<b>Total</b>				150	100

## Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2012*. Sitting this examination implies that you agree to abide by these rules.
- Answer the questions according to the following instructions.

Section One: Write answers in this Question/Answer Booklet. Answer all questions.

**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.

- 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.
- 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.
- The Formula Sheet is **not** handed in with your Question/Answer Booklet.

## 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(s) that you are continuing to answer at the top of the page.

Working time: 50 minutes.

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**Question 1****(4 marks)**

If  $z = 1 + \sqrt{2}i$  then determine each of the following in the form  $a + ib$ .

(a)  $1 - \bar{z}$

**(2 marks)**

(b)  $(1 + z) \div (\overline{1 + z})$

**(2 marks)**

**Question 2****(7 marks)**

Differentiate the following with respect to  $x$ . Simplify your answers as far as possible.

(a)  $f(x) = x \ln x$

**(2 marks)**

(b)  $y = \frac{x+1}{x^2+1}$

**(3 marks)**

(c)  $g(x) = e^{\sqrt{x}}$

**(2 marks)**

**Question 3****(7 marks)**

Let  $h(x) = x^2 - 3$  and  $g(x) = 1 + \sqrt{x}$ .

(a) Determine  $(h \circ g)(9)$ . (1 mark)

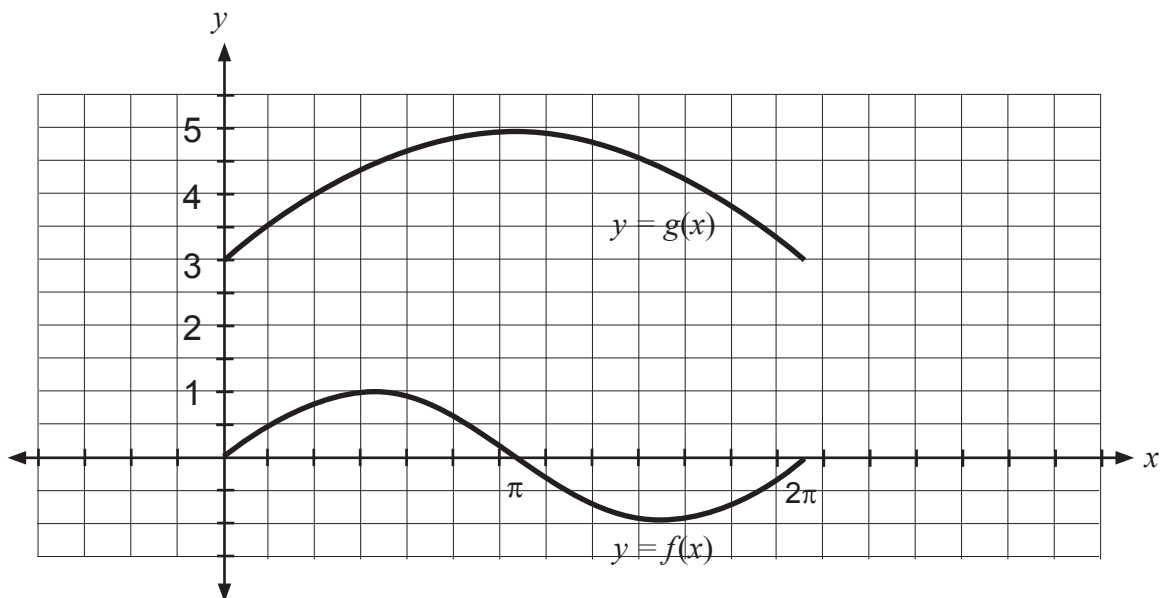
(b) Derive an expression for the composite function  $(h \circ g)(x)$ . (2 marks)

(c) State the domain and range of  $(h \circ g)(x)$ . (2 marks)

(d) Determine  $g^{-1}(x)$ . (2 marks)

Question 4

(6 marks)



The diagram above shows the graph of  $f(x) = \sin x$  over the domain  $0 \leq x \leq 2\pi$  together with the graph of a second function  $g(x) = a \sin bx + c$  for some constants  $a$ ,  $b$  and  $c$ .

(a) Determine  $a$ ,  $b$  and  $c$ . (3 marks)

(b) On the diagram above, sketch the graph of the function  $h(x) = 2\sin(\pi x) + 3$  over the same domain. (3 marks)

## Question 5

(6 marks)

- (a) Determine all the roots (including any complex-valued roots) of the equation  $x^3 + 4x = 0$ .  
(3 marks)

- (b) Solve for  $x$ :

$$9^x = 4(3^x) - 3$$

(3 marks)

## Question 6

(6 marks)

(a) If  $\log_a y = 1 + 2 \log_a x$ , express  $y$  in terms of  $x$ .

(2 marks)

(b) If  $x = \frac{1}{\sqrt{3}}$  show that  $\log(1 - x^4) - \log(1 - x) - \log(1 + x) = 2 \log 2 - \log 3$ .

(4 marks)



## Question 7

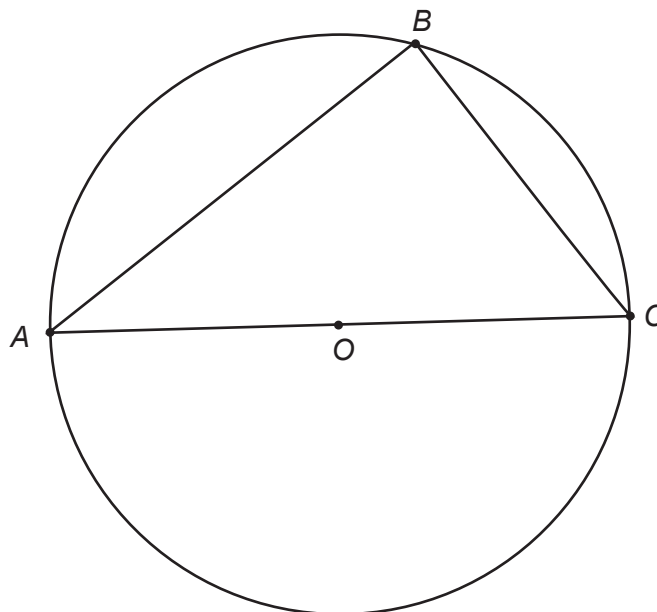
(7 marks)

(a) Rewrite  $\cos 4x + 6 \sin x \cos x = 2$  as a quadratic equation in terms of  $\sin 2x$ . (3 marks)

(b) Hence, or otherwise, solve the equation for  $x$  in the interval  $-\pi < x \leq \pi$ . (4 marks)

Question 8

(7 marks)



The above diagram shows a triangle inscribed in a circle with centre  $O$ .

- (a) Use vector methods to show that  $\vec{OA} \cdot \vec{OB} = -\vec{OC} \cdot \vec{OB}$ . (1 mark)

- (b) Express  $\vec{AB}$  in terms of  $\vec{OA}$  and  $\vec{OB}$  and express  $\vec{BC}$  in terms of  $\vec{OB}$  and  $\vec{OC}$ . (2 marks)

- (c) Use the results of Parts (a) and (b) to deduce that the angle  $\angle ABC = 90^\circ$ . (4 marks)

**Additional working space**

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

**Additional working space**

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

**Additional working space**

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

**Additional working space**

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

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OSBORNE PARK WA 6017