

# PERTH MODERN SCHOOL



PERTH MODERN SCHOOL

Exceptional schooling. Exceptional students.

Independent Public School

Trial WACE Examination, 2012

Question/Answer Booklet

## MATHEMATICS SPECIALIST 3C/3D

### Section One: Calculator-free

Student Number: In figures

--	--	--	--	--	--	--	--

In words

Your name

Teacher

### 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

#### *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 used in this section of the examination. 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	7	7	50	50	33
Section Two: Calculator-assumed	13	13	100	100	67
<b>Total</b>				150	100

## Instructions to candidates

1. 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.
2. 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.
3. **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.
4. It is recommended that you **do not use pencil**, except in diagrams.

**Section One: Calculator-free**

**(50 Marks)**

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

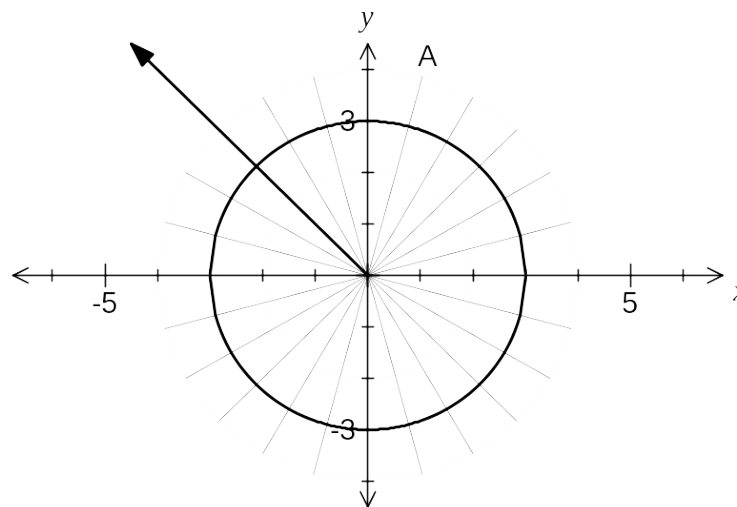
Working time for this section is 50 minutes.

**Question 1**

**(5 marks)**

- (a) Sketch the polar graphs of  $r = 3$  and  $\theta = \frac{3\pi}{4}$  on the axes below.

**(2 marks)**



- (b)  $A$  is the point with polar coordinates  $\left(4, \frac{5\pi}{12}\right)$ . Find the exact distance between  $A$  and the point of intersection of the graphs of  $r = 3$  and  $\theta = \frac{3\pi}{4}$ .

**(3 marks)**

## Question 2

(6 marks)

(a) Determine  $\int 12xe^{x^2} (e^{x^2} + 1)^2 dx$ .

(2 marks)

(b) Evaluate  $\int_{0.2}^1 \frac{9}{x^2} \sqrt{1 + \frac{3}{x}} dx$ , using the substitution  $u = 1 + \frac{3}{x}$  or otherwise.

(4 marks)

**Question 3****(5 marks)**

Determine a unit vector perpendicular to the plane containing the lines  $\mathbf{a} = \mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$  and  $\mathbf{b} = \mathbf{i} + \mathbf{j} - \mathbf{k}$ .

**Question 4****(11 marks)**

(a) Find  $\frac{dy}{dx}$  for the following and simplify:

(i)  $y = \log_{16}(x^2)$ . (3 marks)

(ii)  $y = \cos^3(e^{(1-x^2)})$ . (3 marks)

(b) Find the equation of the tangent to the curve  $y = \sqrt{x+y}$  when  $y=6$ . (5 marks)

Question 5

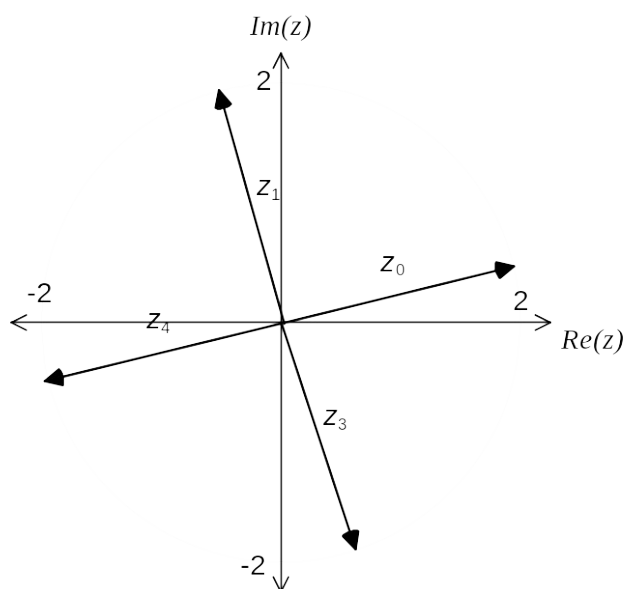
(7 marks)

(a) Find all complex solutions of the equation  $z^4 = 8 + 8\sqrt{3}i$ .

(5 marks)

(b) Sketch the solutions from (a) on the complex plane.

(2 marks)



## Question 6

(9 marks)

- (a) Find the value(s) of  $a$  for which the matrix  $\begin{bmatrix} a & 3 \\ 1 & a+2 \end{bmatrix}$  is singular. (2 marks)

- (b) A system of linear equations is given by

$$a + 4b + 2c = 9$$

$$2a + 3b = 13 + c$$

$$3c + 3a + 9 = 2b$$

The system can be solved using the matrix equation  $Q = P^{-1}R$ . Write down suitable matrices for  $P$ ,  $Q$  and  $R$ , but **do not solve** the system. (3 marks)

- (c) Find matrix  $A$  if  $AB + 2B = 4I$ , where  $I$  is the identity matrix and  $B = \begin{bmatrix} 2 & -1 \\ -2 & 3 \end{bmatrix}$ . (4 marks)



## Question 7

(7 marks)

- (a) Show that  $\frac{1+e^a}{1+e^{-a}} = e^a$ , where  $a$  is a constant.

(2 marks)

- (b) Show that  $\int_{-3}^3 \frac{e^{kx}}{1+e^{kx}} dx = 3$ , where  $k$  is a constant.

(5 marks)

**Additional working space**

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

**Additional working space**

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

This examination paper may be freely copied, or communicated on an intranet, for non-commercial purposes within educational institutes that have purchased the paper from WA Examination Papers provided that WA Examination Papers is acknowledged as the copyright owner. Teachers within purchasing schools may change the paper provided that WA Examination Paper's moral rights are not infringed.

Copying or communication for any other purposes can only be done within the terms of the Copyright Act or with prior written permission of WA Examination papers.

*Published by WA Examination Papers  
PO Box 445 Claremont WA 6910*