



**Hale School**  
**Semester 1, 2011**

**Question/Answer Booklet**

**MATHEMATICS**

Circle your teacher's initials

MRC      MAV

**SPECIALIST 3CD**

**Section One**  
**(Calculator Free)**

Your name \_\_\_\_\_

**Time allowed for this section**

Reading time before commencing work: 5 minutes  
Working time for paper: 50 minutes

**Material required/recommended for this section**

**To be provided by the supervisor**

Question/answer booklet for Section One.  
Formula sheet.

**To be provided by the candidate**

Standard items: pens, pencils, pencil sharpener, highlighter, eraser, ruler.

**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 examination

	Number of questions	Working time (minutes)	Marks available
<b>This Section (Section 1) Calculator Free</b>	<b>7</b>	<b>50</b>	<b>40</b>
Section Two Calculator Assumed	13	100	80
Total marks			120

## Instructions to candidates

1. The rules for the conduct of WACE external examinations are detailed in the booklet *WACE Examinations Handbook*. Sitting this examination implies that you agree to abide by these rules.
2. Answer the questions in the spaces provided.
3. Spare answer pages are provided at the end of this booklet. If you need to use them, indicate in the original answer space where the answer is continued i.e. give the page number.
4. **Show all 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. Any question, or part question, worth more than 2 marks requires valid working or justification 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.

**1. [3 marks]**

Use an inverse matrix method to solve the matrix equation

$$\begin{bmatrix} 2 & 4 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} m \\ n \end{bmatrix} = \begin{bmatrix} 18 \\ 2 \end{bmatrix}$$

**2. [7 marks]**

Determine:

(a)  $\operatorname{Im} \left[ \operatorname{cis} \left( \frac{5\pi}{6} \right) \right]$

[2]

(b)  $\operatorname{Arg} \left[ 4 \operatorname{cis} \left( \frac{-2\pi}{3} \right) \right]^5$

[2]

(c) Describe the locus of points  $z$  on the Argand plane defined by the rule:

$$(z + \bar{z})^2 - (z - \bar{z})^2 = 16$$

[3]

**3. [6 marks]**

For each of the following functions, find  $\frac{dy}{dx}$  in terms of  $x$ .

(a)  $y = 2 \cos(e^{x^2})$

[2]

(b)  $(3x^2 + 4) \ln y = 5x$

[4]

**4. [7 marks]**

- (a) Write  $\frac{1 + i\sqrt{3}}{1 + i}$  in cis form.

[2]

- (b) Hence, determine the exact value of  $\cos\left(\frac{\pi}{12}\right)$ .

[3]

- (c) By using the result from (a), or otherwise, calculate  $\left(\frac{1 + i\sqrt{3}}{1 + i}\right)^{12}$ .

[2]

**5. [5 marks]**

(a) Prove that  $\tan^2 \theta = \frac{1 - \cos 2\theta}{1 + \cos 2\theta}$

[2]

(b) Hence determine the exact value of  $\tan\left(\frac{\pi}{8}\right)$

[3]

**6. [6 marks]**

Evaluate the following limits, showing full reasoning.

(a)  $\lim_{x \rightarrow 0} \left( \frac{\sin |x|}{x} \right)$

[3]

(b)  $\lim_{\theta \rightarrow 0} \frac{\tan(3\theta)}{\tan(5\theta)}$

[3]



**7. [6 marks]**

Relative to an origin  $O$ , point  $A$  has cartesian coordinates  $(1, 2, 2)$  and point  $B$  has cartesian coordinates  $(-1, 3, 4)$ .

- (a) Find an expression for the vector  $\vec{AB}$ .

[1]

- (b) Show that the cosine of the angle between the vectors  $\vec{OA}$  and  $\vec{AB}$  is  $\frac{4}{9}$ .

[2]

- (c) Hence determine the exact area of the triangle  $OAB$ .

[3]

**SPARE PAGE FOR WORKING**

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