

**Penrhos College**

**Semester 2 Examination, 2011**

**Question/Answer Booklet**

MATHEMATICS SPECIALIST:

3C/3DMAS

**Section One:**

**Calculator-free**

**Student Name:\_\_\_SOLUTIONS\_\_\_\_**

#### Time allowed for this section

Reading time before commencing work: 5 minutes

Working time for this section: 50 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, 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.

***Instructions to candidates***

1. **All** questions should be attempted.

2. Write your answers in the spaces provided in this Question/Answer Booklet. Spare answer pages may be found 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).

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. 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.

***Structure of this paper***

|  |  |  |
| --- | --- | --- |
| Questions | Marks available | Your score |
| 1 | 2 |  |
| 2 | 6 |  |
| 3 | 5 |  |
| 4 | 6 |  |
| 5 | 4 |  |
| 6 | 7 |  |
| 7 | 5 |  |
| 8 | 5 |  |
| **Total:** | **40** |  |
| 9 | 4 |  |
| 10 | 9 |  |
| 11 | 6 |  |
| 12 | 8 |  |
| 13 | 6 |  |
| 14 | 5 |  |
| 15 | 5 |  |
| 16 | 6 |  |
| 17 | 6 |  |
| 18 | 10 |  |
| 19 | 5 |  |
| 20 | 10 |  |
| **Total:** | **80** |  |
| ***Total marks = 120*** | |  |
|  | | **%** |

**Section One: Calculator-free (40 Marks)**

This section has **eight (8)** questions. Answer **all** questions. Write your answers in the space provided.

Suggested working time for this section is 50 minutes.

**Question 1 (2 marks)**

Given the matrix  find all values of *x* such that the matrix is singular.

|  |
| --- |
| **Solution** |
| For ***A***-1 to exist it cannot be singular.  Hence |
| **Specific behaviours** |
| ✓ determines an expression for the determinant equal to 0  ✓solves correctly x |

**Question 2 (6 marks)**

If  and , determine in simplest form:

(a) 

[1]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓correct value for |

(b) 

[1]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct value for |

(c) 

[2]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ convert *z*1 to polar form  ✓correct value for *z*1*z*2 |

(d) 

[2]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ convert *z*2 to Cartesian form  ✓ correct value of *z*1 + *z*2 |

**Question 3 (5 marks)**

(a) Prove the identity 

[3]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓uses compound angle identity  ✓uses  identity  ✓uses identity |

(b) Hence or otherwise determine the indefinite integral 

[2]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓rewrite  to the form  ✓integrates expression correctly |

**Question 4 (6 marks)**

Determine the following integrals, writing your answers in simplified form.

(a) 

[2]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ applies the chain rule  ✓ correct solution including the constant |

(b) 

[2]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ recognizes  ✓ correct solution |

(c) 

[2]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct antiderivative  ✓ correct answer |

**Question 5 (4 marks)**

Prove  where *n* = 1, 2, 3, …

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓expresses complex numbers on LHS in polar form  ✓applies de Moivre’s theorem  ✓uses sin θ = -sin θ and cos θ = cos (-θ)  ✓establish correct conclusion |

**Question 6 (7 marks)**

Given the curve find:

(a) 

[3]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correctly differentiates implicitly  ✓ correctly applies product rule  ✓correctly rearranges equation for |

(b) the value of *x* when *y* = 0.

[1]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct value of *x* |

(c) using the incremental formula, find the approximate change in *x* when *y* changes from 0 to 0.1. Give your answer in exact form.

[3]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ chooses increment formula in correct form   correct substitutions for *x*, *y* and *y*  ✓ correct value of *x* |

**Question 7 (5 marks)**

A particle in simple harmonic motion has acceleration  such that  where is the displacement from the origin O.

The particle is instantaneously at rest at time  seconds and at position.

(a) Find the displacement of *x* as a function of *t*.

[3]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓correct period  ✓correct amplitude  ✓correctly states displacement of *x* as a function of *t* |

(b) Find the maximum velocity of the particle as an exact value.

[2]

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓correctly differentiates  ✓correct maximum velocity as an exact value |

**Question 8 (5 marks)**

Determine  Let 

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ Substitutes for *x*  ✓ Substitutes for *dx*  ✓ Changes upper and lower limits  ✓ Simplifies and finds antiderivative  ✓ Evaluates |

**Additional working space**

Question number(s):

**Additional working space**

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