# Rossmoyne Senior High School

### Year 12 Trial WACE Examination, 2015

### Question/Answer Booklet

**SOLUTIONS**

# MATHEMATICS

# SPECIALIST 3CD

## Section One:

## Calculator-free

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

In words

Your name

## 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 (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 | 7 | 7 | 50 | 50 | 33⅓ |
| Section Two:  Calculator-assumed | 13 | 13 | 100 | 100 | 66⅔ |
|  | | | **Total** | 150 | 100 |

## Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. 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 response to the specific question asked and to follow any instructions that are specified 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.

1. **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.
2. It is recommended that you **do not use pencil**, except in diagrams.
3. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

Section One: Calculator-free (50 Marks)

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

Working time: 50 minutes.

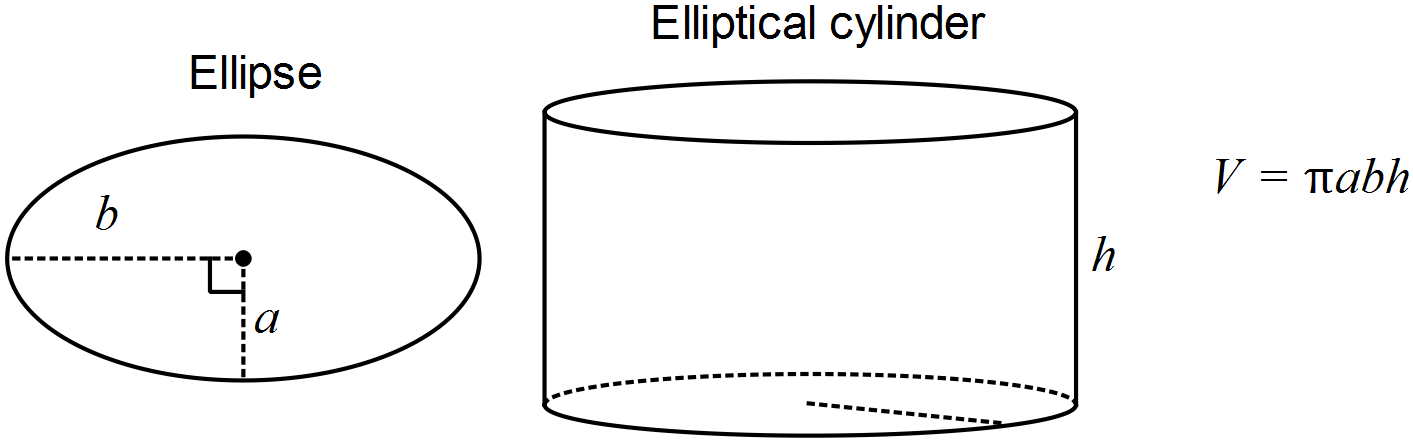
Question 1 (5 marks)

Determine the matrix A, given that .



Question 2 (6 marks)

An elliptical cylinder is such that the sum of the height, , and the length of the minor semi-axis, , is 30 cm. The length of the major semi-axis, , is twice the length of the minor semi-axis.



Use calculus to determine the dimensions of the elliptical cylinder that maximise its volume and state the maximum volume.



Question 3 (5 marks)

Using the substitution  or otherwise, determine .



Question 4 (11 marks)

(a) Express the following in the form a+bi :

(i) . (4 marks)



(ii) . (3 marks)



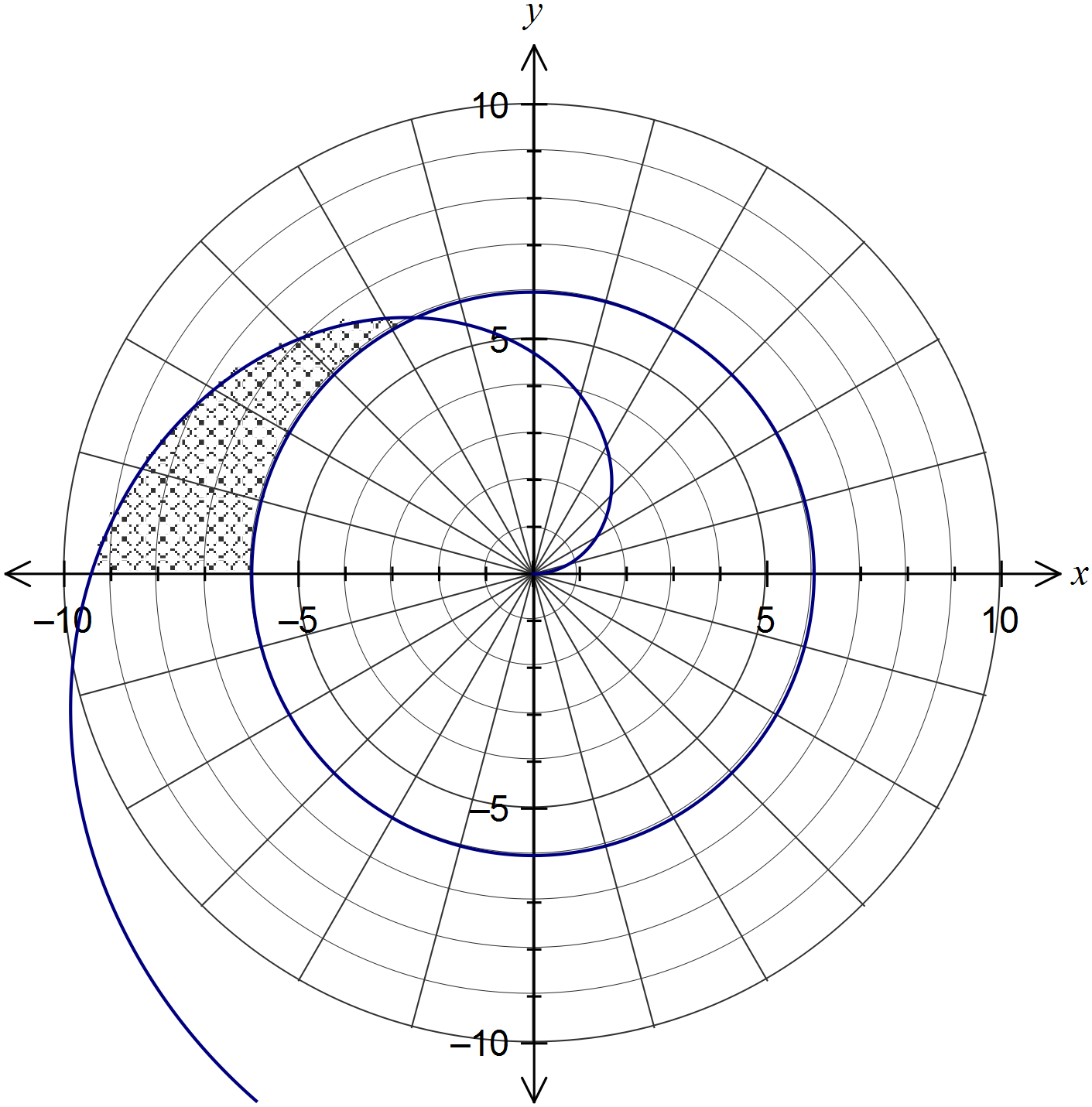
(b) Determine all solutions to the equation , giving your answers in the form .

(4 marks)



Question 5 (8 marks)

(a) On the axes below shade the region satisfied by ,  and . (3 marks)



For any curve , the area bounded by the curve and the rays  is given by .

(b) Determine the area of the shaded region in (a). (5 marks)

Circle and spiral intersect when .

Hence .



Question 6 (9 marks)

The rate of change of the distance, x centimetres, between two particles t seconds after an experiment began, is given by the equation , where  and .

(a) Using the substitution , or otherwise, determine . (3 marks)



(b) Determine an expression for x in terms of t, if the distance between the two particles after 1 second is 0.5 cm. (4 marks)



(c) Show that when , . (2 marks)



Question 7 (6 marks)

Prove by induction that  is always an integer when n is a positive integer.



Additional working space

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

Additional working space

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

Additional working space

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

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