

**Semester One Examination 2018**

**Question/Answer Booklet**

**MATHEMATICS SPECIALIST**

**UNIT 3**

**Section One:**

**Calculator-free**

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| Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Teacher‘s Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
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**Time allowed for this section**

Reading time before commencing work: five minutes

Working time for paper: fifty minutes

**Material 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 tape/fluid, erasers, 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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Number of questions available | Number of questions to be attempted | Suggested working time (minutes) | Marks available | Weighting |
| **Section One****Calculator—free** | **7** | **7** | **50 minutes** | **50** | **35%** |
| Section TwoCalculator—assumed | 11 | 11 | 100 minutes | 100 | 65% |
|  | 150 | 100% |

**Instructions to candidates**

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2018.* Sitting this examination implies that you agree to abide by these rules.
2. 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.

1. 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.
2. 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. The Formula Sheet is **not** handed in with your Question/Answer Booklet.

# Section One: Calculator–free 50 marks

This section has **seven (7)** questions. Attempt **all** questions.

Write your answers in the spaces provided.

Working time: 50 minutes

**Question 1 (5 marks)**

The polynomial function has the real solutions

for .

Determine all real and complex solutions of and then fully factorise . (5 marks)

**Question 2 (7 marks)**

The solutions to the equation are of the form , where and . One of the solutions is .

(a) Determine the complex number in polar form. (2 marks)

(b) Sketch all solutions on the polar grid provided below. (2 marks)



(c) The solutions form the outline of a regular shape.

 Determine the exact perimeter of this regular shape. (3 marks)

**Question 3 (6 marks)**

Consider the planes given by the equations below, where .

When a matrix is used, a simplified format of their coefficients is given below.

State the value(s) of so that the three planes

(a) do not intersect at a single point. (2 marks)

(b) intersect at a unique solution, and hence determine the coordinates of the point

 of intersection in terms of . (4 marks)

**Question 4 (10 marks)**

The function is defined at and its graph is shown below.



(a) Sketch the graph of on the same grid above. (2 marks)

(b) Determine the equation of and state its domain. (3 marks)

**Question 4 – Continued**

The function is defined as .

(c) Determine an expression for . (1 mark)

(d) Does the domain of need to be adjusted for to exist? Justify your answer,

 and determine the corresponding range of the composition.

 (4 marks)

**Question 5 (12 marks)**

A right rectangular prism, with square base OGEF, is shown below.

Point O is the origin and points F, G, C have respective position vectors and .



(a) Determine the vector equation of the line that passes through F and D. (2 marks)

(b) Determine the Cartesian equation of the plane perpendicular to FD that passes through A.

 (3 marks)

**Question 5 – Continued**

(c) Determine the point of intersection between the line in (a) and the plane in (b). (3 marks)

(d) The sphere given by has FD as its diameter.

 Determine the value of the real constants and . (4 marks)

**Question 6 (5 marks)**

Sketch the function on the grid below, clearly stating its main graphical features.



 (5 marks)

 **Question 7 (5 marks)**

The complex number is defined for .

(a) Find a simplified expression for the modulus of in terms of . (1 mark)

(b) Determine the value of the argument of . [Hint: consider and ] (2 marks)

(c) The argument of . [Hint: consider and ] (2 marks)

**Additional working space**

**End of Section One**

Question number(s): ……………………

**Additional working space**

Question number(s): ……………………

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Question number(s): ……………………

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