

Semester Two Examination, 2022

Question/Answer booklet

MATHEMATICS  
METHODS  
UNITS 1&2

**SOLUTIONS**

Section One:  
Calculator-free

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| WA student number: In figures |  |  |  |  |  |  |  |  |  |  |

In words

Your name

|  |  |
| --- | --- |
| Number of additional answer booklets used (if applicable): |  |

## Time allowed for this section

Reading time before commencing work: five minutes

Working time: 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 material. 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 examination |
| Section One: Calculator-free | 7 | 7 | 50 | 53 | 35 |
| Section Two: Calculator-assumed | 12 | 12 | 100 | 96 | 65 |
|  | | |  | **Total** | 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 preferably using a blue/black pen.  
Do not use erasable or gel pens.

3. You must be careful to confine your answers to the specific question asked and to follow any instructions that are specific to a particular question.

4. 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.

5. It is recommended that you do not use pencil, except in diagrams.

6. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Section One: Calculator-free 35% (53 Marks)

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

Working time: 50 minutes.

Question 1 (6 marks)

(a) Determine . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ expands expression  ü correctly differentiates |

(b) Determine when . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correctly differentiates  ü correct value |

(c) Determine the instantaneous rate of change of area when if the area of a region at time seconds is given by cm2. (2 marks)

|  |
| --- |
| Solution |
| When |
| Specific behaviours |
| ✓ obtains  ü correct rate of change |

Question 2 (7 marks)

(a) Expand . (2 marks)

|  |
| --- |
| Solution |
| Alternative: |
| Specific behaviours |
| ✓ indicates reasonable attempt to use appropriate method  ü correct expansion |

(b) Solve the equation . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ cross multiplies and simplifies (incorrect method scores zero mark)  ü correct value of |

(c) Determine the centre and radius of the circle with equation . (3 marks)

|  |
| --- |
| Solution |
| Hence centre is at and radius is . |
| Specific behaviours |
| ✓ completes square  ü states centre  ü states radius |

Question 3 (7 marks)

(a) Determine in simplified form when . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ simplifies to correct power of  ü correct value |

(b) Determine the value of in scientific notation when and .

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correct value of  ü correct value in scientific notation |

(2 marks)

(c) Solve the equation . (3 marks)

|  |
| --- |
| Alternative Solution |
|  |
| Specific behaviours |
| ✓ squares both sides  ü expresses both sides as powers of  ü correct value of |

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ expresses LHS as power of  ü expresses RHS as power of  ü correct value of |

Question 4 (7 marks)

<EFOFEX>
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FXData:
</EFOFEX>(a) Given and when , determine the value of when .

(3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correctly antidifferentiates  ü evaluates constant  ü calculates value of |

(b) The height metres above the ground  
of a small body seconds after it is  
projected vertically upwards is shown  
in the position-time graph.

Given that , where and   
are constants, determine the speed of  
the body when .

(4 marks)

|  |
| --- |
| Solution |
| Using roots:  Using point:  Velocity:  Speed: |
| Specific behaviours |
| ✓ uses roots or turning point to obtain expression for in terms of and  ü obtains expression for in terms of   (Only 1 mark if students use just 1 point to show the values of and )  ü correctly differentiates  ü correct speed |

Question 5 (9 marks)

(a) Solve the equation for . (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ obtains expression for (  ü obtains one correct half-angle  ü both correct solutions |

(b) The periodic function is defined as .

(i) State the amplitude and period of . (2 marks)

|  |
| --- |
| Solution |
| Amplitude is and period is . |
| Specific behaviours |
| ✓ correct amplitude  ü correct period |

(ii) Sketch the graph of on the axes below over the domain .

(3 marks)

|  |
| --- |
| Solution |
| See graph |
| Specific behaviours |
| ✓ adds scale to -axis, endpoints  ü thru  ü smooth curve |

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(iii) State the range of . (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correct restriction for |

Question 6 (8 marks)

Let .

(a) Determine the equation of the tangent to the curve when . (4 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ expands polynomial  ü obtains derivative  ü calculates slope of tangent and -coordinate  ü correct equation of tangent |

(b) The tangent to the curve at is perpendicular to the tangent to the same curve at point .

(i) Determine the gradient of the tangent at P. (1 mark)

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

(ii) Determine the equation of the tangent at . (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ states correct perpendicular gradient  ✓ finds correct y-coordinate of  ✓ correct solution |

Question 7 (9 marks)

Let .

(a) Show that and hence factorise . (3 marks)

|  |
| --- |
| Solution |
| Using terms, . |
| Specific behaviours |
| ✓ shows sum of three terms is zero  ü expresses as product of linear and quadratic factor  ü determines all linear factors |

(b) Determine the location of the stationary points of the curve . (3 marks)

|  |
| --- |
| Solution |
| Stationary points at and . |
| Specific behaviours |
| ✓ correct derivative of  ü indicates that  ü correct -coordinates of stationary points |

(c) Sketch the graph of . (3 marks)

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|  |
| --- |
| Solution |
| See graph |
| Specific behaviours |
| ✓ correct and axes intercepts  ü correctly shows stationary points  ü smooth cubic curve |

Supplementary page

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

Supplementary page

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

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