

Semester Two Examination, 2021

Question/Answer booklet

MATHEMATICS  
METHODS  
UNITS 1&2

**SOLUTIONS**

Section One:  
Calculator-free

Student’s name

Teacher’s 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 | 8 | 8 | 50 | 52 | 35 |
| Section Two: Calculator-assumed | 13 | 13 | 100 | 98 | 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% (52 Marks)

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

Working time: 50 minutes.

Question 1 (6 marks)

(a) Solve . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ indicates appropriate method  ü obtains correct solutions |

Let .

(b) Evaluate . (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ obtains zero |

(c) Factorise . (3 marks)

|  |
| --- |
| Solution |
| By inspection: |
| Specific behaviours |
| ✓ uses result from (b) to obtain one factor  ü obtains quadratic factor  ü completes factorisation |

Question 2 (6 marks)

(a) Evaluate when . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ obtains  ü correct value |

(b) Determine . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ expands into polynomial  ü obtains derivative |

(c) The volume of water in a tank at time seconds is given by cm3. Determine the instantaneous rate of change of volume when . (2 marks)

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

Question 3 (5 marks)

The quadratic function has roots at and .

(a) Determine the value of the constant and the value of the constant . (3 marks)

|  |
| --- |
| Solution |
| Roots factors:  Using last term: |
| Specific behaviours |
| ✓ uses factors to expand  ü value of  ü value of |

(b) State the range of the function . (2 marks)

|  |
| --- |
| Solution |
| Minimum turning point midway between roots:  Hence range is |
| Specific behaviours |
| ✓ locates turning point  ü obtains range as |

Question 4 (7 marks)

(a) Determine the function given that and . (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ obtains antiderivative  ü evaluates constant  ü clearly states function |

(b) Determine the equation of the tangent to the curve at the point where . (4 marks)

|  |
| --- |
| Solution |
| Gradient function:  Gradient of tangent:  -coordinate of point of tangency:  Hence tangent: |
| Specific behaviours |
| ✓ obtains gradient function  ü calculates gradient of tangent  ü obtains -coordinate  ü obtains equation of tangent |

Question 5 (7 marks)

(a) The first term of an arithmetic sequence is and the term is three times the term. Determine the sum of the first terms of this sequence. (4 marks)

|  |
| --- |
| Solution |
| OR |
| Specific behaviours |
| ✓ formulates equation  ü solves for  ü correct use of sum formula  ü calculates sum |

(b) Determine for the following geometric sequence:

(3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ indicates and  ü correct use of formula  ü correct sum to infinity |

Question 6 (7 marks)

Let .

(a) Draw the graph of on the axes below. (3 marks)

Chart, line chart

Description automatically generated

|  |
| --- |
| Solution |
| See graph |
| Specific behaviours |
| ✓ accurately plots (2,1) and (3,3)  ü for  ü smooth exponential curve with arrows |

(b) Solve for . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ forms equation with fractional index on RHS  ü correct solution |

(c) Evaluate , giving your answer in simplest exact form. (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ eliminates fractional or negative index  ü correct value as required |

Question 7 (7 marks)

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

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ indicates reference angle  ü one correct solution  ü second correct solution |

(b) In triangle , the length of side is cm, and . Determine the length of side . (2 marks)

|  |
| --- |
| Solution |
| Using sin rule: |
| Specific behaviours |
| ✓ indicates correct use of sin rule  ü correct length |

(c) Triangle has sides of length and cm. Given that is the longest side in the triangle, determine the value of . (2 marks)

|  |
| --- |
| Solution |
| Using cosine rule: |
| Specific behaviours |
| ✓ indicates correct use of cosine rule  ü correct value |

Question 8 (7 marks)

Determine the coordinates of the point(s) where the line intersects the circle with centre and radius .

|  |
| --- |
| Solution |
| Equation of circle:  Use line to substitute :  Expand:  Simplify:  Solve quadratic:  Or  Intersect at the points and . |
| Specific behaviours |
| ✓ writes equation of circle  ü substitutes line to eliminate or  ü expands  ü simplifies  ü solves quadratic  ü one correct point  ü second correct point |

Supplementary page

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

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