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### Semester Two Examination, 2020

### Question/Answer booklet

# MATHEMATICS

**SOLUTIONS**

**METHODS**

**UNITS 1&2**

## Section One:

## Calculator-free

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

In words

Your name

## 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 | 12 | 12 | 100 | 90 | 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 (7 marks)

(a) Evaluate . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ eliminates square root  ü correct fraction |

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

(2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ obtains equivalent expression of form  ü correct value using scientific notation |

(c) Determine the value of given that . (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ expresses LHS in form  ü expresses RHS in form  ü correct value of |

Question 2 (7 marks)

Solve the following equations.

(a) , . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ one correct solution  ✓ all correct solutions |

(b) . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ equates to and factorises  ü both correct solutions |

(c) . (3 marks)

|  |
| --- |
| **Solution** |
| When |
| **Specific behaviours** |
| ✓ indicates that is a factor  ü determines quadratic factor  ü all three solutions |

Question 3 (6 marks)

(a) The turning point of a quadratic is at and the curve passes through . Determine the equation of the quadratic in the form . (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ writes in completed square  form using constant  ü uses -intercept to evaluate  constant  ü correct equation in required  form |

|  |
| --- |
| **Alternative Solution** |
| when , so  Solving & simultaneously,  Hence |
| **Specific behaviours** |
| ✓ any **two** correct substitutions  ü differentiates correctly to determine 2nd  simultaneous equation  ü solves for , and states correct equation in  required form |

(b) Functions and are defined by and .

State the

(i) domain of . (1 mark)

|  |
| --- |
| **Solution** |
| Require : |
| **Specific behaviours** |
| ✓ states restriction on |

(ii) range of . (1 mark)

|  |
| --- |
| **Solution** |
| Range of is range of : |
| **Specific behaviours** |
| ✓ states restriction on |

(iii) domain of . (1 mark)

|  |
| --- |
| **Solution** |
| is translated units right. |
| **Specific behaviours** |
| ✓ states restriction on |

Question 4 (6 marks)

(a) The point lies on the curve with equation . Determine the equation of the tangent to the curve at . (3 marks)

|  |
| --- |
| **Solution** |
| When  Equation of tangent:  Or |
| **Specific behaviours** |
| ✓ derivative  ü gradient of tangent  ü equation of tangent |

(b) Determine given that and . (3 marks)

|  |
| --- |
| **Solution** |
| Using : |
| **Specific behaviours** |
| ✓ antiderivative  ü determines constant  ü correct value |

Question 5 (7 marks)

(a) A sequence is defined by . Determine:

(i) (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates use of general term formula  ü correct term |

(ii) the sum of the first terms of the sequence. (2 marks)

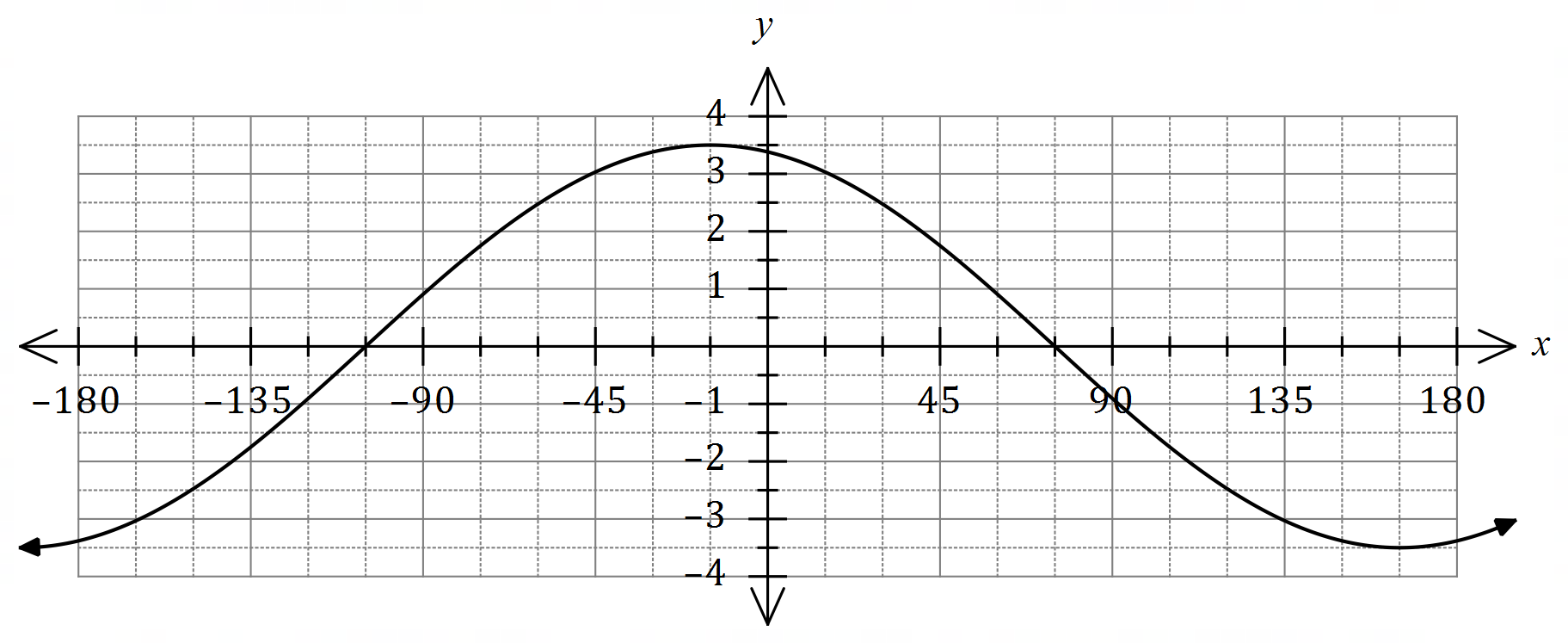
|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates correct use of sum formula  ü correct sum |

(b) The sum to infinity of the series is . Determine the sum of the first three terms of the series. (3 marks)

|  |
| --- |
| **Solution** |
| Series is geometric with and .  NB |
| **Specific behaviours** |
| ✓ equation using sum to infinity  ü value of  ü correct sum |

Question 6 (7 marks)

Part of the graph of is shown below.



(a) State the value of the constant and the value of the constant , .

(2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct amplitude  ü correct phase angle |

(b) Show that and state the value of the constant .

(2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ uses sum and difference identities correctly  ü states correct value of |

(c) Determine an exact value for . (3 marks)

|  |
| --- |
| **Solution** |
| If and then and . Hence |
| **Specific behaviours** |
| ✓ indicates suitable values for and  ü uses result from (b) and correct exact values  ü exact value |

Question 7 (7 marks)

The line is a tangent to the curve . Determine the value(s) of the constant .

|  |
| --- |
| **Solution** |
| Gradient of cubic:  Gradient of line is so:  At :  At :  Hence . |
| **Specific behaviours** |
| ✓ gradient function for cubic  ü equates  ü simplifies and factors quadratic  ü both solutions to quadratic  ü -coordinate of both possible points of tangency  ü one value of  ü repeats for second value of |

Question 8 (5 marks)

Consider the function defined by .

(a) Show that when , the expression simplifies to . (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ü substitutes and into function  ü clearly and correctly expands quadratic term  ü substitutes for and simplifies |

(b) Show use of the result in (a) and the formula to determine the value of . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ uses result as numerator in limit  ü correctly eliminates from denominator and simplifies limit |

Supplementary page

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

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