

Semester One Examination, 2022

Question/Answer booklet

MATHEMATICS
METHODS
UNIT 1

**SOLUTIONS**

Section One:
Calculator-free

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

 In words

 Your name

|  |  |
| --- | --- |
| Number of additionalanswer 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 ofquestionsavailable | Number ofquestions tobe answered | Workingtime(minutes) | Marksavailable | Percentageofexamination |
| Section One:Calculator-free | 7 | 7 | 50 | 52 | 35 |
| Section Two:Calculator-assumed | 12 | 12 | 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**seven** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

Question 1 (6 marks)

Solve each of the following equations.

(a) . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ simplifies equationü obtains correct solution |

(b) . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ factorisesü both correct solutions |

(c) . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ arranges equation into form ü both correct solutions |

Question 2 (6 marks)

(a) Solve the equation . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ equates to zero and factorisesü correct solutions |

(b) Sketch the graphs of and on the axis below, showing the coordinates of all axes intercepts of the parabola and any points of intersection of the graphs. (4 marks)

 

|  |
| --- |
| Solution |
| See graph |
| Specific behaviours |
| ✓ symmetrical parabola, correct turning pointü labels roots of parabolaü correct straight lineü labels both points of intersection |

Question 3 (7 marks)

(a) The graph of is shown. State the value of the constant and the value of the constant . (2 marks)

 

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

(b) Point lies on the unit circle with centre so that the anticlockwise angle measured from the positive -axis to the line is , . Determine the size of when has coordinates . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ indicates method (reasoning or sketch of unit circle)ü correct angle |

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

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ indicates ü one correct solutionü both correct solutions |

Question 4 (8 marks)

The graphs of the function and two relations are shown below.



(a) Explain how the vertical line test can be used to distinguish a function from a relation.

 (2 marks)

|  |
| --- |
| Solution |
| The test concludes that a relation is a function if and only if no vertical line intersects the relation more than once. Otherwise, graph is simply a relation. |
| Specific behaviours |
| ✓ includes reference to all possible vertical lines (if and only if...)ü includes reference to no more than one intersection for function |

(b) State the equation of the parabolic relationship. (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correct equation |

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

(c) Determine . (1 mark)

(d) Solve . (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ü all correct solutions |

(e) The equation of the circle is , where and are constants. Determine the value of each constant. (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correct factored form of circleü expands and simplifiesü uses expanded form to state each value |

Question 5 (6 marks)

(a) Expand . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ expands any pair of binomialsü correct expansion |

(b) Let .

(i) Calculate . (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correct difference |

(ii) Solve . (3 marks)

|  |
| --- |
| Solution |
| Since then is a factor of .By inspection,Hence when . |
| Specific behaviours |
| ✓ obtains factor using (i) ü expresses as linear and quadratic factorsü factors quadratic and states solutions |

Question 6 (11 marks)

In the diagram, is a right
triangle, and points and lie on
sides and respectively to
form right triangles and .

The length of is unit,
 and ,
from which it can be shown
that ,
and .

(a) Use triangle to explain why . (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correctly uses properties of in explanation |

(b) Given that and , show that

 (2 marks)

|  |
| --- |
| Solution |
| From diagram:Hence |
| Specific behaviours |
| ✓ uses diagram to obtain expressions for ü uses quotients to obtain equation |

(c) Use the equation from part (b) to derive the identity .

 (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ cross multipliesü shows step to simplify into required form |

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

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ expands using sum formulaü substitutes exact valuesü simplifies |

(e) Solve for . (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ expands using difference formulaü substitutes exact values and simplifiesü correct solution |

Question 7 (8 marks)

The binomial coefficients in the ninth row of Pascal's triangle are and so on.

(a) Deduce the value of

|  |
| --- |
| Solution |
| Using symmetry property then . |
| Specific behaviours |
| ✓ correct coefficient |

(i) . (1 mark)

(ii) . (2 marks)

|  |
| --- |
| Solution |
| Using next row property or |
| Specific behaviours |
| ✓ indicates use of property or formulaü correct coefficient |

(b) The sum of all but one of the binomial coefficients in the ninth row of Pascal's triangle
is . Determine, with justification, the value of the missing coefficient. (2 marks)

|  |
| --- |
| Solution |
| Sum of row is Hence missing coefficient is . |
| Specific behaviours |
| ✓ indicates sum of rowü correct coefficient |

(c) Determine the coefficient of the term in the expansion of . (3 marks)

|  |
| --- |
| Solution |
| Using the binomial expansion, required term will beHence coefficient will be |
| Specific behaviours |
| ✓ indicates how to obtain term of expansionü simplifies the three components of coefficientü correct coefficient |

Supplementary page

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

© 2022 WA Exam Papers. Hale School has a non-exclusive licence to copy and communicate this document for non-commercial, educational use within the school. No other copying, communication or use is permitted without the express written permission of WA Exam Papers. SN035-192-3.