

Semester Two Examination, 2022

Question/Answer booklet

MATHEMATICS  
METHODS  
UNITS 1&2

Section Two:  
Calculator-assumed

**Student Name**

**Teacher Name**

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

## Time allowed for this section

Reading time before commencing work: ten minutes

Working time: one hundred minutes

## Materials required/recommended for this section

***To be provided by the supervisor***

This Question/Answer booklet

Formula sheet (retained from Section One)

***To be provided by the candidate***

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,  
correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators, which can include scientific, graphic and Computer Algebra System (CAS) calculators, are permitted in this ATAR course examination

## 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 | 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 Two: Calculator-assumed 65% (98 Marks)

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

Working time: 100 minutes.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

Question 8 (8 marks)

In an industrial process to create hydrogen, an engineer observed that the higher the power density W/cm2, the shorter the cathode lifetime in hours, so that when and when .

The relationship between the variables is of the form , where and are constants.

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

(b) If the process is only possible for , state the corresponding range of .

(2 marks)

(c) Graph the relationship on the axes below over the domain . (3 marks)

<EFOFEX>
id:fxd{ba5bb47e-e12d-44aa-8263-e51209ff4306}

FXData:

</EFOFEX>

Question 9 (8 marks)

An online store offers different art prints, of which are abstract, are modern and the remainder impressionist.

(a) Determine the number of different selections that can be made

(i) when different prints are bought from the store.

(2 marks)

(ii) when different impressionist prints are bought from the store. (2 marks)

(b) A random selection of different prints sold by the store is made. Determine the probability that

(i) none of the prints in the selection are abstract. (3 marks)

(ii) at least one of the prints in the selection is abstract. (1 mark)

Question 10 (8 marks)

A function is defined by and the graph of is shown below.

<EFOFEX>
id:fxd{5cd892d9-523d-48c6-9471-2fef2cd589a6}

FXData:

</EFOFEX>

(a) Draw the chord between the points and on the curve that have  
-coordinates and respectively and determine the slope of this chord as an exact value. (3 marks)

The point with -coordinate lies on the curve between and , where .

(b) Use to calculate the slope of chord when

(i) . (2 marks)

(ii) . (1 mark)

(c) Show use of to determine the slope of tangent to the curve at that is correct to decimal places. (2 marks)

Question 11 (9 marks)

Clinical records for sports injuries classified the type of sport involved as either individual or team. The records show that of injuries were the result of team sport, and that after initial treatment, of team sport and of individual sport related injuries required no further treatment.

Determine the probability that a randomly chosen sports injury

(a) was sustained through individual sport and required no further treatment. (2 marks)

(b) required further treatment. (3 marks)

(c) was sustained through individual sport or required no further treatment. (2 marks)

(d) was sustained through team sport, given that the patient was known to have required no further treatment. (2 marks)

Question 12 (8 marks)

(a) A large outdoor amphitheatre has seats in the first row, in the second row and so on, where each row has four more seats than the previous row. There are rows of seats in the amphitheatre.

(i) Determine the number of seats in the last row of the amphitheatre. (2 marks)

(ii) Determine the total number of seats in the last rows of the amphitheatre.

(3 marks)

(b) The sum of the first and second terms of a geometric series is , and the sum of the second and third terms of the series is . Determine the sum of the first three terms of the series. (3 marks)

Question 13 (9 marks)

Let be the sum of the first terms of an arithmetic sequence with first term and common difference .

The sum of the first terms of the sequence is .

(a) Show that . (2 marks)

The sum of the first terms of the sequence is .

(b) Determine the sum of the first terms of the sequence. (3 marks)

The sum can be expressed in the form , where and are constants.

(c) Determine the value of , the value of and then use a method involving differentiation to show that is the maximum sum of the sequence. (4 marks)

Question 14 (9 marks)

(a) Express as an exact radian measure and hence determine the length of an arc of a circle that subtends an angle of at the centre of a circle of radius cm. (2 marks)

(b) Determine the area of a segment of a circle that subtends an angle of at the centre of a circle of radius cm. (2 marks)

(c) The lengths of the sides of a triangle with an area of cm2 are in the ratio . Determine the length of the shortest side of the triangle. (5 marks)

Question 15 (7 marks)

The graph of is shown below, where is a positive constant.

<EFOFEX>
id:fxd{89341804-5551-4edb-88d5-353bf4ac1dff}

FXData:

</EFOFEX>

(a) On the axes above sketch and label the graphs of

(i) . (2 marks)

(ii) . (2 marks)

(b) Given that the curve passes through the point , solve for .

(3 marks)

Question 16 (9 marks)

(a) Determine the global minimum and maximum values of the function when the domain of is restricted to . (2 marks)

(b) Determine the discriminant of and use it to explain how many roots the function has. (2 marks)

(c) The graph of is symmetrical about the line and passes through the points and . Determine the roots of the graph. (5 marks)

Question 17 (8 marks)

The length of a rectangular prism is three times its width, and the sum of its height, width and length is cm. Let the width of the rectangular prism be cm.

(a) Show that the volume of the rectangular prism is cm3. (2 marks)

(b) Use a method involving differentiation to determine the height of the rectangular prism that maximises its volume. (3 marks)

(c) Determine the maximum possible total surface area of the rectangular prism. (3 marks)

Question 18 (8 marks)

For two events and , and . Determine the value of the constant in each of the following cases:

(a) and are mutually exclusive. (1 mark)

(b) . (2 marks)

(c) . (2 marks)

(d) . (3 marks)

Question 19 (7 marks)

On the first day of the year 1912 an industrialist established a fund with a deposit of so that years later it could be used to award research grants. The funds were to be invested at an interest rate of per annum compounded yearly, with interest added to the fund on the last day of each year. Let be the balance of the fund in dollars after years, so that .

(a) Show that form a geometric sequence and hence determine , the balance of the fund after years to the nearest cent. (3 marks)

Suppose instead that was deposited into the fund on the first day of each year, starting in 1912, and let be the balance of this modified fund in dollars after years so that .

(b) Show that the balance of the modified fund after one year is . (1 mark)

(c) Express as the sum of the terms of a geometric sequence and hence determine , the balance of the modified fund after years to the nearest cent. (3 marks)

Supplementary page

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

Supplementary page

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

|  |  |  |  |
| --- | --- | --- | --- |
| Markers | Markers use only | | |
| Question | Maximum | Mark |
| Gatland  (24 marks) | 8 | 8 |  |
| 9 | 8 |  |
| 10 | 8 |  |
| Smirke  (17 marks) | 11 | 9 |  |
| 12 | 8 |  |
| Mack  (18 marks) | 13 | 9 |  |
| 14 | 9 |  |
| Riemer  (16 marks) | 15 | 7 |  |
| 16 | 9 |  |
| Thompson  (23 marks) | 17 | 8 |  |
| 18 | 8 |  |
| 19 | 7 |  |
|  | S2 Total | 98 |  |

© 2022 WA Exam Papers. Willetton Senior High 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. SN115-202-2.