

Semester One Examination, 2022

Question/Answer booklet

MATHEMATICS
METHODS
UNIT 1

If required by your examination administrator, please place your student identification label in this box

Section Two:
Calculator-assumed

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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: 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 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 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.

Question 8 (8 marks)

(a) The variables and are linearly related so that when and when
. State, with reasoning, whether the relationship between and is an example of direct proportion. (2 marks)

(b) Four points have coordinates and .

(i) If is the midpoint of and , determine the value of the constant and the value of the constant . (2 marks)

(ii) Determine the equation of the line that is perpendicular to and that passes through in the form , where and are integers and .

 (4 marks)

Question 9 (9 marks)

The time of sunrise, hours after midnight, on the day of the year in Esperance is closely modelled by

(a) Use the model to calculate, in hours and minutes, the time of sunrise on February.

 (2 marks)

(b) Graph as a function of on the axes below for . (4 marks)



(c) Jill lives in Esperance and is woken by her alarm clock at am every day. How many days will she be awake before sunrise in a year of days? (3 marks)

Question 10 (8 marks)

Triangle has sides cm, cm and an area of cm2.

(a) Determine all possible values for the size of angle . (3 marks)

(b) Determine, showing use of trigonometry, the largest possible perimeter of triangle .

 (3 marks)

(c) Determine, showing use of trigonometry, the size of angle when triangle has the largest possible perimeter. (2 marks)

Question 11 (8 marks)

A calculator is used to randomly generate a whole number between and inclusive.

Event occurs when the number is a multiple of , event occurs when the number is odd and event occurs when the number is a square number.

(a) Determine the ordered set of all possible outcomes for the event

(i) . (2 marks)

(ii) . (2 marks)

(b) Determine

(i) . (2 marks)

(ii) . (2 marks)

Question 12 (7 marks)

In a random sample of cats, it was found that of the cats were males with green-coloured eyes, and of the females had green-coloured eyes.

(a) Determine the probability that a randomly selected cat from the sample

(i) is female. (1 mark)

(ii) is female or does not have green-coloured eyes. (2 marks)

(iii) is female given that it has green-coloured eyes. (2 marks)

(b) Does the sample indicate possible independence of sex and eye colour for cats? Explain your answer. (2 marks)

Question 13 (9 marks)

The shaded regions shown in the diagram form
a logo that is to be cut from a plastic sheet.

The boundaries of the shaded regions are
parts of triangle , where ,
and arcs of two concentric circles with
centre and radii of cm and cm.

(a) Express exactly in radians. (1 mark)

(b) Determine the total length of the two curved and three straight cuts that must be made by the cutting machine, giving your answer to the nearest centimetre. (4 marks)

(c) Determine the area of logo, giving your answer to the nearest square centimetre.

 (4 marks)

Question 14 (9 marks)

A function defined by , where and are constants, passes through the points and .

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

(b) Draw the graph of on the axes below, clearly indicating the coordinates of all axes intercepts and equations of any asymptotes. (4 marks)



(c) State the equations of all asymptotes of the graph of . (2 marks)

Question 15 (7 marks)

Events and are such that and .

(a) When and are mutually exclusive, determine . (1 mark)

(b) When , determine . (2 marks)

(c) When , determine . (2 marks)

(d) When and are independent, determine . (2 marks)

Question 16 (8 marks)

A group of students is needed to assist in the school office. The group is to be selected from a class of , in which are day students and the remainder boarders.

(a) Determine the number of different groups that can be selected. (2 marks)

(b) Determine the number of different groups that can be selected containing no day students. (2 marks)

(c) A group is randomly selected from the class. Determine the probability that the group

(i) contains only day students. (2 marks)

(ii) contains at least one boarder and at least one day student. (2 marks)

Question 17 (8 marks)

(a) The graph of the quadratic function has roots at and and the range of is . Use an algebraic method to determine . (4 marks)

(b) The area of square is cm2 more than six times the area of square , and the difference in the perimeters of the two squares is cm. Determine the least possible area of square , the smaller of the squares. (4 marks)

Question 18 (8 marks)

As part of a statistics project a student accessed data from a sample of people about their age and whether they were a smoker. of the people were aged under , and of this age group were smokers. Altogether, there were smokers in the sample.

(a) Use the above information to complete the relative frequency table below, rounding entries to three decimal places. (3 marks)

|  |  |
| --- | --- |
| Age | Tobacco Use |
| Non-smoker | Smoker |
| Under  |  |  |
|  or older |  |  |

(b) A person is randomly selected from the sample. Determine the probability that

(i) they are a non-smoker. (1 mark)

(ii) they are a smoker or aged or older. (1 mark)

(c) If two selections are made at random from the sample (with replacement), determine the probability that one person is a smoker, and the other is not. (3 marks)

Question 19 (9 marks)

The graph of the cubic polynomial passes through the points , and has a local maximum at .

(a) Use the above information to sketch the graph of on the axes below. (3 marks)



Let , where and are constants.

(b) Determine the value of each of the constants and . (3 marks)

(c) Another cubic polynomial is defined by . Determine the value(s) of the constant so that the graphs of and do not intersect. (3 marks)

Supplementary page

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

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