Semester Two Examination, 2022

Question/Answer booklet

MATHEMATICS APPLICATIONS UNITS 1&2

Section Two:
Calculator-assumed

Your name _____

Teacher's name _____

Time allowed for this section
Reading time before commencing work: ten minutes
Working time: one hundred minutes

Number of additional answer booklets used (if applicable): ☐

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	51	35
Section Two: Calculator-assumed	12	12	100	99	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.

See next page

Section Two: Calculator-assumed **65% (99 Marks)**

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

Working time: 100 minutes.

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Question 8 **(7 marks)**

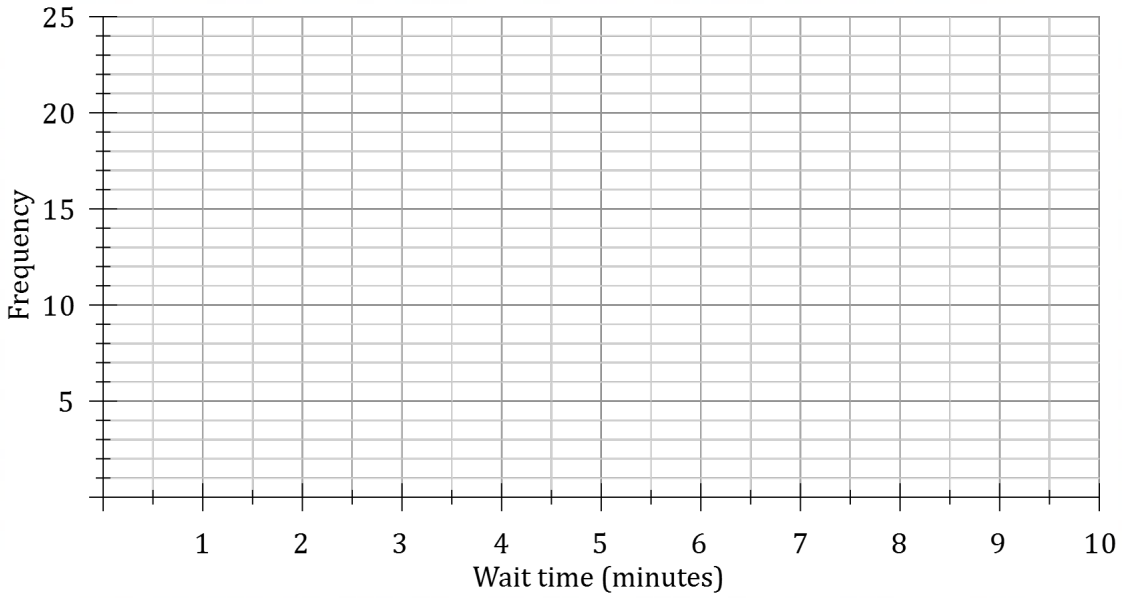
The time in minutes that callers had to wait before their calls were answered at a business are summarised in the following table.

Wait time t	$0 \leq t < 2$	$2 \leq t < 4$	$4 \leq t < 6$	$6 \leq t < 8$	$8 \leq t < 10$
Frequency	4	9	19	22	7

(a) Explain whether the wait times are a discrete or continuous variable. (1 mark)

(b) Determine the mean and standard deviation of the wait times. (2 marks)

(c) Construct a histogram of the wait times on the axes below. (2 marks)



(d) State, with justification, whether the shape of the distribution is symmetric, positively skewed or negatively skewed. (2 marks)

See next page

Question 9 **(8 marks)**

As a casual waiter at a local restaurant, Kay is paid $\$24.91$ per hour on weekdays, with time-and-a-half paid on weekends and double-time on public holidays. Her hours worked during the last pay period, when Friday was a public holiday, are shown below.

Day	Thu	Fri	Sat	Sun
Hours worked	6.5	3.5	4	3

(a) Determine the gross wage that Kay earned for her work during this pay period. (3 marks)

The restaurant displays works by local artists and wait staff earn a 5.5% commission on the price of any artwork they sell to customers. On the Sunday of this pay period, Kay sold an acrylic painting priced at $\$780$.

(b) Determine the commission Kay earned by selling the acrylic painting. (1 mark)

(c) Determine the statutory superannuation contribution that Kay's employer must make at a contribution rate of 10.5% for Kay's total earnings this pay period. (2 marks)

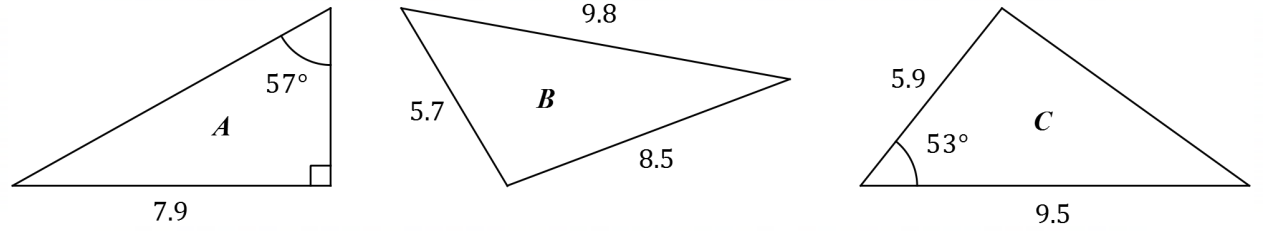
(d) Before a recent pay rise, Kay was only paid $\$23.50$ per hour on weekdays. Determine the percentage pay rise that Kay received. (2 marks)

See next page

Question 10 **(8 marks)**

A jeweller has designed three triangular pendants A, B and C as shown below, where the dimensions are in centimetres. The pendants are to be cut from a thin sheet of metal.

Determine, with justification, the area of metal required for each.



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Question 11 **(8 marks)**

A supermarket sells tuna in spring water in three sizes of can, as shown in the table below.

Can size	Small	Medium	Large
Net weight (g)	95	185	425
Price per can ($)	1.10	2.10	4.65

(a) Calculate the cost in cents per gram for each size of can and hence explain why the large can represents the best value for money. (3 marks)

The net weight is the sum of the weight of the tuna and the spring water in the can. The information labels on the small, medium and large cans state that $75\%, 70\%$ and 65% of the net weights respectively are tuna.

(b) Show that the medium size can contains 129.5 g of tuna. (1 mark)

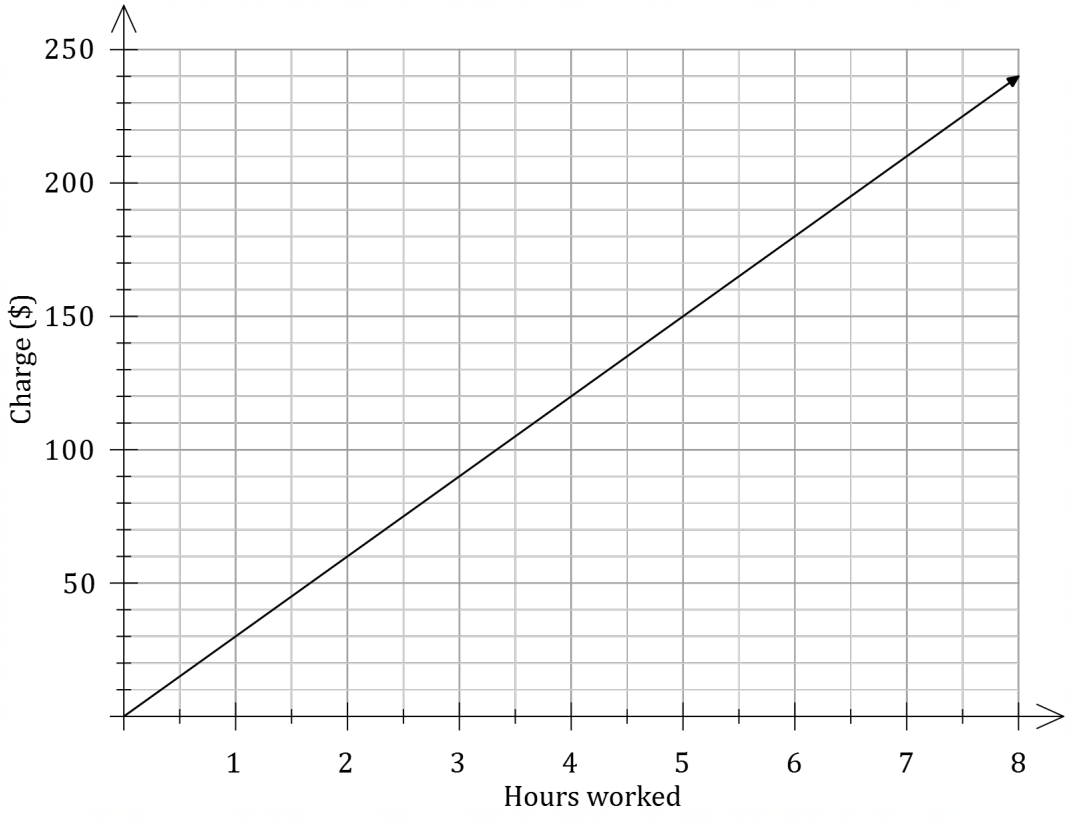
(c) Determine the cost in cents per gram of tuna for each size of can. (3 marks)

(d) Comment on whether the large can really represents the best value for money. (1 mark)

See next page

Question 12 **(9 marks)**

A new business complex is comparing the costs charged by Dee and Faye to carry out general maintenance once per week. Dee will charge an attendance fee of $35 plus $23 per hour. The cost of using Faye is shown on the graph below.



(a) Use the graph to state how much Faye charges per hour. (1 mark)

(b) Show that for 4 hours work, Dee will cost $7 more than Faye. (2 marks)

See next page

(c) Complete the table below to show how much Dee will charge. (2 marks)

Hours worked	2	4	6	8
Dee's charge ($)				

(d) Add a line to the graph on the previous page to represent the cost of using Dee for the maintenance. (2 marks)

The business complex has a budget of $\$180$ per week for the maintenance.

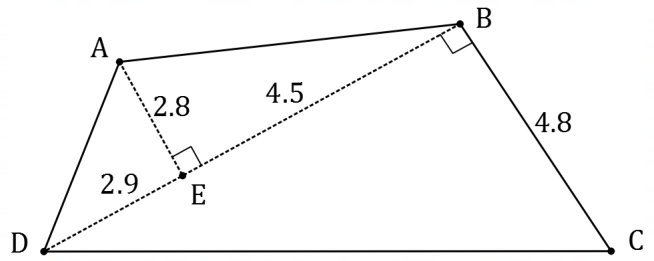
(e) State, with reasoning, which person you would recommend is given the work. (2 marks)

See next page

Question 13 **(9 marks)**

The plan at right, not drawn to scale, shows garden bed $ABCD$, with all measurements in metres.

Point E lies on the diagonal from from B to D so that $DE = 2.9$ m, $AE = 2.8$ m and $BE = 4.5$ m.



(a) Determine the area of the garden bed. (3 marks)

A budget of $\$420$ is allocated by the owner to buy mulch for the garden bed, and mulch is available in 0.035 m^3 bags that cost $\$12$ each.

(b) Determine the volume of mulch that can be bought using the budgeted amount. (2 marks)

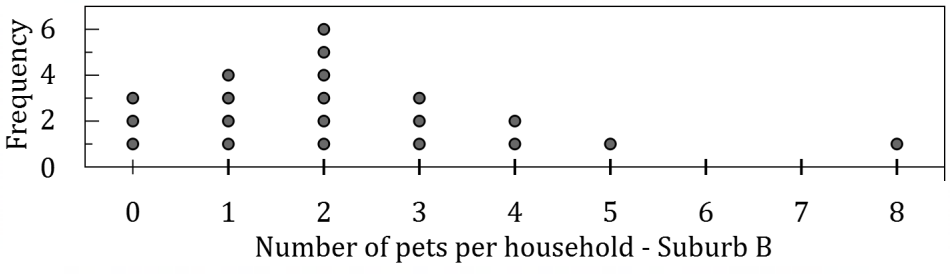
(c) Determine the depth of the mulch once it has been spread uniformly over the garden bed, giving your answer to the nearest millimetre. (2 marks)

(d) A fence between corners A and B of the garden bed is to be replaced. Determine the length of this fence. (2 marks)

See next page

Question 14 **(7 marks)**

Following a survey of pet ownership in 20 randomly chosen households in city Suburb A, the mean and standard deviation was found to be 2.55 and 1.56 pets per household respectively. The dot plot below shows the results of a similar survey from households in city Suburb B.



(a) Calculate the mean and standard deviation of the data for Suburb B. (2 marks)

(b) State, with justification, in which of the two suburbs pet ownership is highest. (1 mark)

(c) Use the $Q3 + 1.5 \times IQR$ criteria to show that Suburb B contains a possible outlier. (2 marks)

(d) Due to the likelihood of an outlier in one of the data sets, it can be argued that there are better statistics than the mean and standard deviation to compare the location and spread of the two groups. Name these two statistics and briefly explain why they are better. (2 marks)

Question 15 **(11 marks)**

Ron won a lottery prize of $\$21\,879$ and decided to invest the whole amount for eight months. He deposited one-third of the prize into a savings account, another third into a term deposit and bought shares in a logistics company with the remainder.

(a) Determine the interest that Ron earned from the savings account, given that it paid simple interest of 1.8% per annum. (3 marks)

(b) Determine the interest that Ron earned from the term deposit, given that it paid interest of 3.1% per annum compounded monthly. (3 marks)

See next page

(c) Shares in the logistics company cost Ron $\$5.10$ each and the company paid a special dividend of 12 cents per share to shareholders whilst Ron owned them.

Determine the profit that Ron made from his logistics shares if he sold them for $\$5.36$ at the end of the eight-month period, ignoring all transaction costs and brokerage fees.

(3 marks)

(d) Determine the percentage gain that Ron made on his lottery prize through these three investments at the end of the eight-month period. (2 marks)

Question 16 **(7 marks)**

The marks of 1600 students who sat a math exam were normally distributed with a mean of 63.5 and standard deviation of 8.8.

(a) What percentage of the students are expected to have an exam mark within two standard deviations of the mean? (1 mark)

(b) Determine the probability that a randomly chosen student who sat the exam

(i) had a mark that was no more than 66. (1 mark)

(ii) had a mark that was at least one-and-a-half standard deviations above the mean. (1 mark)

(c) Determine the standard score for Sue, who had an exam mark of 69. (2 marks)

(d) In Sue's previous math exam that had a mean of 62.7 and a standard deviation of 7.0, Sue also had a mark of 69. However, her teacher said her performance had worsened in this latest exam despite her achieving the same mark. Explain, with mathematical justification, the reasoning behind her teacher's statement. (2 marks)

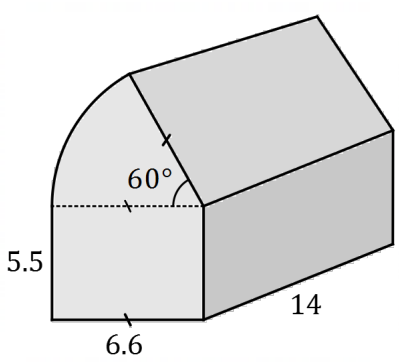
See next page

Question 17 **(8 marks)**

The cross section of the prism shown in the diagram consists of a $60°$ sector of a circle of radius 6.6 cm sitting atop a rectangle of width 6.6 cm and height 5.5 cm.

The length of the prism is 14 cm.

The diagram is not drawn to scale.



(a) Determine the area of the sector. (2 marks)

(b) Determine the volume of the prism. (2 marks)

(c) Determine the total surface area of the prism to the nearest square centimetre. (4 marks)

See next page

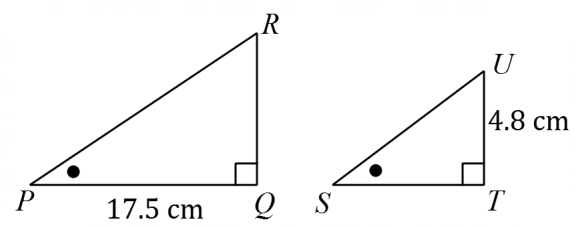
Question 18 **(9 marks)**

(a) A scale model of a prism has a triangular cross-section with an area of 28 cm^2 and a height of 16 cm.

(i) Determine the volume of the scale model. (1 mark)

(ii) The height of the actual prism is 120 cm. Determine the area of the cross-section of the actual prism. (3 marks)

(b) Two similar triangles are shown at right, not drawn to scale.



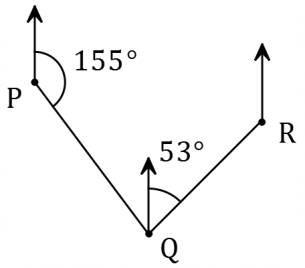
The length of side PQ is 17.5 cm, the length of side UT is 4.8 cm, and the area of triangle PQR is 52.5 cm^2.

Determine the length of side SU. (5 marks)

See next page

Question 19 **(8 marks)**

A small robot moves at a speed of 0.8 metres per second and is currently at point P on level ground. The robot moves for 12 seconds on a bearing of $155°$ to point Q and then turns and moves for a further 9 seconds on a bearing of $053°$ to point R, as shown below.



(a) Show that the size of $\angle PQR = 78°$. (1 mark)

(b) Show use of trigonometry to determine the distance of P from R. (3 marks)

(c) Show use of trigonometry to determine the size of angle $\angle QPR$ to the nearest degree. (2 marks)

(d) The robot must return directly to P from R. Determine the bearing it should move in and the time it will take. (2 marks)

End of questions

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Markers use only			
Question	Marker	Maximum	Mark
8	Mr Galbraith	7	
9	Mr Galbraith	8	
10	Mr Galbraith	8	
11	Ms Regi	8	
12	Ms Regi	9	
13	Ms Regi	9	
14	Miss Colquhoun	7	
15	Miss Colquhoun	11	
16	Miss Colquhoun	7	
17	Dr Duan	8	
18	Dr Duan	9	
19	Dr Duan	8	
Rounding deduction		-1	
Unit deduction		-1	
Section 2 Total		99	