

WILLETTON SENIOR HIGH SCHOOL
Semester One Examination, 2022
Question/Answer booklet

MATHEMATICS
APPLICATIONS
UNIT 1

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	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.

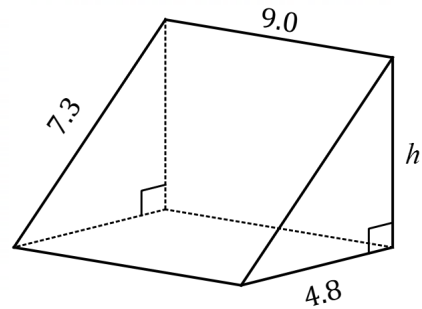
Working time: 100 minutes.

Question 8

(6 marks)

The diagram, not to scale, shows a right triangular prism with a length of 9.0 cm.

The lengths of some of the edges are shown on the diagram in centimetres.



(a) Determine the height h of the right triangle.

(2 marks)

(b) Determine the total surface area of the prism.

(4 marks)

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Question 9

(9 marks)

Ash lives at home with her parents. Her take-home income and all the expenses used in her personal budget from the previous year are shown below, together with how often the amounts are incurred and updates that Ash needs to make for the current year.

Budget item	Previous amount (\$)	Frequency	Update
Take-home income	2100.00	Fortnightly	Increase by 3.5%
Gym membership	22.00	Weekly	Increase by \$3.50
Household contribution	140.00	Weekly	Increase by \$30
Mobile phone	45.25	Monthly	No change
Car running costs	150.00	Weekly	Decrease by 10%
Car loan repayment	506.75	Monthly	No change
Entertainment & eating out	150.00	Weekly	Increase by 5%
Other	450.00	Monthly	Decrease by 5%

- (a) Determine the amount of her fortnightly take-home income for the current year, after the change indicated in the update column. (2 marks)

- (b) Use the information in the update column to complete the missing entries in the table below for Ash's budget for the current year. (3 marks)

Budget item	Amount this year (\$)	Frequency
Take-home income		Fortnightly
Gym membership		Weekly
Household contribution		Weekly
Mobile phone	45.25	Monthly
Car running costs		Weekly
Car loan repayment	506.75	Monthly
Entertainment & eating out		Weekly
Other	427.50	Monthly

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After subtracting her expenses from her take-home income, Ash calculated (assuming that there are exactly 52 weeks in a year and 26 fortnights in a year) that at the end of last year she was left with a surplus of \$18 552 to use for a holiday or deposit in a savings account.

- (c) Ash hopes that her budget updates for the current year will lead to an increase in her annual surplus. Determine, with justification, whether this is the case. (4 marks)

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Question 10**(8 marks)**

At the start of this year, an art supplies wholesaler in Australia needed to buy 4800 flat brushes and collected the following price information from overseas manufacturers:

Country of manufacturer	Poland	Singapore	Mexico
Number of flat brushes per pack	320	400	300
Cost per pack (in local currency, includes shipping)	1870 zloty	\$850	9300 pesos

At the time, the relevant exchange rates for one Australian dollar were 2.855 Polish zloty, 0.948 Singapore dollars and 14.42 Mexican pesos.

- (a) Determine the cost per brush from the Polish manufacturer in Australian dollars. (2 marks)
- (b) Determine the total cost in Australian dollars of buying 4800 brushes from the Mexican manufacturer. (3 marks)
- (c) Determine, with justification, which of the three countries the wholesaler should use in order to minimise the unit cost per brush. (3 marks)

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Question 11

(8 marks)

Information about the shares of three companies listed on the Australian Securities Exchange (ASX) towards the end of last year is shown in the table below.

ASX Share Code	Market value of share (\$)	Earnings per share (\$)	Dividend per share (\$)	Percentage dividend
HVN	5.07	0.674	0.35	6.90%
MPL	3.42	0.160	A	3.80%
DMP	120.83	2.119	1.74	B

(a) Determine the value of **A** and the value of **B** in the table. (2 marks)

(b) Calculate the price-to-earnings ratio for each share and hence rank the stocks in order from highest to lowest price relative to earnings. (3 marks)

(c) Calculate, to the nearest dollar, the total dividend paid to an investor who owned 684 shares in HVN, 1240 shares in MPL and 215 shares in DMP. (3 marks)

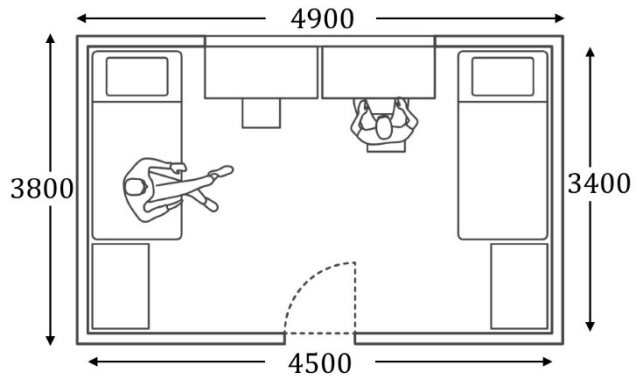
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Question 12

(8 marks)

A sketch plan of a twin bedroom is shown, not drawn to scale.

The internal and external dimensions of the room are shown on the sketch in millimetres.



- (a) State the internal length and width of the room in metres. (2 marks)

The floor of the interior of the room is to be carpeted using a 10 m long roll of carpet that is 1.8 m wide. No more than four cuts can be made to the carpet.

- (b) Sketch a diagram to show how the carpet could be laid on the floor, showing the dimensions of each piece of carpet cut from the roll. (3 marks)

- (c) After the floor has been carpeted, some of the roll is left over. Determine what percentage of the area of the roll is left over. (3 marks)

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Question 13**(8 marks)**

The image shows some recently harvested grain stored in a conical pile on level ground.



The top of the pile is 12 m above the ground and the radius of the base is 35 m.

- (a) Determine the volume of grain contained in the pile. (2 marks)
- (b) Trucks that can each carry a load of 28 tonnes will be used to transport the grain to the local port. If one cubic metre of grain weighs 630 kg, determine the number of truck loads of grain required to move the entire pile of grain to the port. Note that there are 1000 kg in one tonne. (2 marks)
- (c) Determine the slant height of the conical pile. (2 marks)
- (d) When rain is forecast, the sloping surface of the grain can be covered with tarpaulins. Calculate the area of grain that needs to be covered. (2 marks)

Question 14

(7 marks)

The table below and matrix \mathbf{T} show the number of trips (in thousands) made in 2005 by visitors to three Australian cities categorised by reason (holiday or visiting friends / relatives).

(000's)	Holiday	VFR
Sydney	1952	2718
Adelaide	576	790
Perth	854	1107

$$\mathbf{T} = \begin{bmatrix} 1952 & 2718 \\ 576 & 790 \\ 854 & 1107 \end{bmatrix}, \quad \mathbf{R} = \begin{bmatrix} 1.035 & 0 & 0 \\ 0 & 1.02 & 0 \\ 0 & 0 & 1.03 \end{bmatrix}$$

Visitor numbers in both categories to Sydney, Adelaide and Perth increased by 3.5%, 2% and 3% per year respectively over the following years and this information is shown in matrix \mathbf{R} .

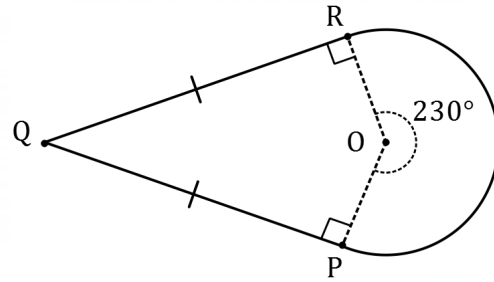
- (a) Determine matrix $\mathbf{R} \times \mathbf{T}$, rounding entries to the nearest whole number. (2 marks)
- (b) How many more trips for a holiday were made to Perth in 2006 (the following year) compared to the same type of trip to Adelaide in 2006? (2 marks)
- (c) The matrix $\mathbf{R}^n \times \mathbf{T}$ will show the number of trips (in thousands) by category in the n^{th} year after 2005. Determine, with justification, the year in which the number of VFR trips to Adelaide first exceeded 900 000. (3 marks)

Question 15

(8 marks)

The diagram (not to scale) shows a fabric panel used in the construction of a kite.

The panel consists of a 230° sector of a circle with centre O and radius 50 cm, and quadrilateral $OPQR$ in which $QR = QP = 108$ cm.



(a) Calculate the area of the sector.

(2 marks)

(b) Hence determine the total area of the fabric panel.

(3 marks)

(c) The panel is to be edged with tape. Calculate the length of tape required.

(3 marks)

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Question 16**(8 marks)**

A single person aged 18 to 21, living away from their parents and looking for work can qualify for a youth allowance from the government of \$512.50 per fortnight, provided their fortnightly income is no more than \$150.

In any fortnight that a person earns more than \$150, the youth allowance is reduced by 50 cents for each dollar of income they have between \$150 and \$250. If their income is over \$250, the payment will further reduce by 60 cents for each dollar of income over \$250.

Emily qualifies for the allowance. She has a casual job that pays \$19.50 per hour, working for three-and-a-half hours every Wednesday and Friday at a bakery and she also receives 100 Euros each week for work she does for an online business in Europe.

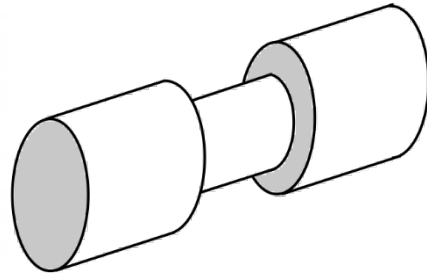
- (a) Calculate Emily's fortnightly earnings from her bakery job. (2 marks)
- (b) The government use an exchange rate of one Australian dollar to 0.6734 Euros for foreign earnings. Calculate the fortnightly amount that Emily earns from the European business. (2 marks)
- (c) Determine Emily's total fortnightly income from her bakery job, European business and government allowance. (4 marks)

Question 17**(10 marks)**

- (a) Kelly takes a short-term loan of \$2400 at 9.6% per annum simple interest for 50 days. Determine the sum of the principal and interest that Kelly must repay at the end of the loan period. (3 marks)
- (b) An amount of \$15 000 is invested at 4.5% per annum compounded annually for 3 years. Determine the total interest earned on this investment over the 3 years. (3 marks)
- (c) At the start of last year, Syed was employed as a manager with a salary of \$86 000. During the year, Syed was awarded a 6.5% pay rise followed by another rise of 7.7% at the start of this year.
- (i) Determine Syed's salary at the start of this year. (2 marks)
- (ii) Determine the percentage increase in Syed's salary from the start of last year to the start of this year. (2 marks)

Question 18**(9 marks)**

A woodturner takes a solid cylindrical wooden pole of length 66 cm and radius 8 cm and uses a machine to reduce the radius of the middle third of the pole by 30%, as shown in the diagram (not to scale).



- (a) Explaining your method, calculate the volume of wood removed by the machine.

(4 marks)

- (b) Explaining your method, determine the total surface area of the remaining object.
(5 marks)

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Question 19**(9 marks)**

When a person needs to save an amount of A dollars by making N monthly deposits into an account with an interest at a rate of $R\%$ p.a. compounded monthly, then the deposit that they must make each month, D dollars, is given by the formula

$$D = \frac{Ai}{k}, \text{ where } i = \frac{R}{1200} \text{ and } k = (1 + i)^N - 1.$$

- (a) Lydia will make monthly deposits into a savings account with an interest rate of 6.96% p.a. compounded monthly and wants to save \$18 000 to buy a used car in two years' time.
- (i) How many monthly deposits will she make in two years? (1 mark)
- (ii) Determine the amount that she must deposit each month. *Hint: Do not round the value of k in your calculations.* (4 marks)

- (b) Josh has no savings but has just started a job and can afford to deposit \$500 per month in a savings account with an interest rate of 7.8% p.a. compounded monthly. After working for six years, he hopes to have saved \$45 000 so that he can take a year off work and travel around the world. Comment on how feasible his savings plan is to achieve this aim. (4 marks)

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Supplementary page

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Markers use only			
Question	Marker	Maximum	Mark
8	Mr Appleby	6	
9	Mr Appleby	9	
10	Mr Appleby	8	
11	Dr Duan	8	
12	Dr Duan	8	
13	Dr Duan	8	
14	Mr Stillitano	7	
15	Mr Stillitano	8	
16	Mr Stillitano	8	
17	Miss Colquhoun	10	
18	Miss Colquhoun	9	
19	Miss Colquhoun	9	
Rounding deduction		-1	
Unit deduction		-1	
Section 2 Total		98	