

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

MATHEMATICS
APPLICATIONS
UNIT 1

Section One:
Calculator-free

Your name _____

Teacher's name _____

Time allowed for this section

Reading time before commencing work: five minutes
Working time: fifty 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

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 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 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**(5 marks)**

(a) Evaluate $30 - 20 \div 2 + 3$.

(1 mark)

(b) Determine the value of v when $t = 3$, $a = 2.5$ and $v = 2at^2 - (t + 5)(a - 2)$. (2 marks)

(c) Evaluate the expression $\frac{a + 16}{\sqrt{5a - b}}$ when $a = 8$ and $b = 4$. (2 marks)

Question 2**(5 marks)**

Aaron works part-time as a porter at a hotel. His timesheet for three shifts he worked in January this year is shown below.

Day	Start time	Finish time
Wednesday (Australia Day holiday)	6:30 am	1:00 pm
Thursday	11:45 am	7:45 pm
Friday	10:15 am	7:15 pm

The hotel pays porters \$20 per hour, except for (i) hours worked after 5 pm when time-and-a-half is paid; and (ii) all hours worked on a public holiday when double time is paid.

Determine Aaron's pay for the three shifts he worked.

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Question 3

(8 marks)

(a) State the size of the following matrices in the form $a \times b$.

(i)
$$\begin{bmatrix} 1 & 0 & -2 & 1 \\ -2 & 1 & 0 & 3 \end{bmatrix}$$
 (1 mark)

(ii) The identity matrix with 5 columns. (1 mark)

(b) The row matrix \mathbf{Z} has 3 elements. Write a suitable matrix \mathbf{Z} , given that its 3 elements are all whole numbers and have a sum of 7. (2 marks)

(c) Write as a single matrix

(i)
$$\begin{bmatrix} 0 & -2 \\ 5 & 3 \end{bmatrix} + 3 \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$$
 (2 marks)

(ii)
$$\begin{bmatrix} 4 & -2 \\ -1 & 3 \end{bmatrix} \begin{bmatrix} 2 \\ -3 \end{bmatrix}$$
 (2 marks)

Question 4

(9 marks)

Consider the sequences 7, 9, 11, 13, ... and 7, 17, 27, 37, They both start at 7 but the numbers in the first sequence go up in 2's and the numbers in the second go up in 10's.

- (a) Calculate $7 + 10 + 13 + 16 + 19$. (1 mark)

The formula $S = \frac{1}{2}(n(d(n - 1) + 14))$ can be used to determine the sum S of the first n numbers in sequences that start at 7 and go up by d each time.

- (b) Show use of the formula to determine the value of S when $n = 5$ and $d = 3$, and explain why this value is the same as your answer to part (a). (3 marks)

This spreadsheet uses the above formula to calculate the value of S for some values of n and d .

		n										
		20	21	22	23	24	25	26	27	28	29	30
d	3	710	777	847	920	996	1075	1157	1242	1330	1421	1515
	4	900	987	1078	1173	1272	1375	1482	1593	1708	1827	1950
	5	1090	1197	1309	1426	1548	1675	1807	1944	2086	2233	2385
	6	1280	1407	1540	1679	1824	1975	2132	2295	2464	2639	2820
	7	1470	1617	1771	1932	2100	2275	2457	2646	2842	3045	3255
	8	1660	1827	2002	2185	2376	2575	2782	2997	3220	3451	3690

- (c) State the value of S when $n = 29$ and $d = 5$. (1 mark)

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- (d) Determine the sum of the first 27 numbers in the sequence that starts 7, 14, 21, 28,
(2 marks)

Consider another formula $T = \frac{n^2d}{2} - \frac{nd}{2} + 7n$.

A claim was made that S and T will always be equal for any given value of d and value of n .

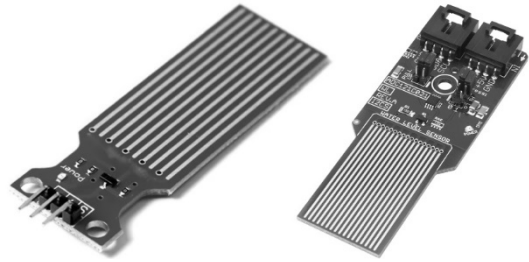
- (e) Show that when $n = 30$ and $d = 6$ the claim is true. (2 marks)

Question 5

(10 marks)

A company manufactures Standard and Premium liquid level sensors (shown at right), with each model requiring different numbers of capacitors, diodes, resistors and transistors as shown in matrix **M**:

$$\mathbf{M} = \begin{bmatrix} 2 & 3 & 7 & 1 \\ 1 & 5 & 6 & 3 \end{bmatrix}$$



The numbers in the first row of **M** are the components required for the Standard model, and the numbers in the second row are the components for the Premium model. The first, second, third and fourth columns of matrix **M**, show the number of capacitors, diodes, resistors and transistors respectively.

- (a) Write down the element $m_{1,2}$ of **M** and describe what this number represents. (2 marks)

The cost in cents, of capacitors, diodes, resistors and transistors from Supplier A is 20, 20, 10 and 50 respectively, whilst from Supplier B is 15, 30, 10 and 40 respectively.

- (b) Arrange this information into cost matrix **C** and hence determine matrix **R**, where $\mathbf{R} = \mathbf{M} \times \mathbf{C}$. (3 marks)

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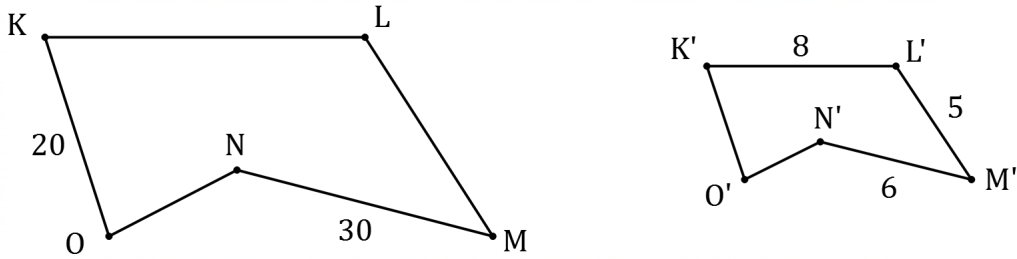
- (c) Explain what the element $r_{2,1}$ of matrix \mathbf{R} represents. (2 marks)
- (d) The company have an order for 200 Standard and 100 Premium models. Show use of matrix multiplication to calculate a 1×1 matrix that represents the total cost, in dollars, of the components required for this order from Supplier A. (3 marks)

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Question 6

(7 marks)

The diagram below, not drawn to scale, shows two similar pentagons $KLMNO$ and $K'L'M'N'O'$. The lengths of some of the sides are shown in centimetres.



- (a) Show use of a scale factor to determine the length of side LM and the length of side $O'K'$. (3 marks)

The perimeter of $KLMNO$ is 130 cm.

- (b) Determine the length of side $O'N'$. (2 marks)

The area of $K'L'M'N'O'$ is 30 cm^2 .

- (c) Determine the area of $KLMNO$. (2 marks)

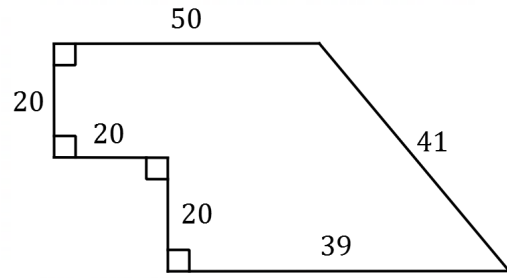
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Question 7

(8 marks)

The sketch diagram (not drawn to scale) shows a plot of land bounded by six straight sides.

The length of each side is shown in metres.



- (a) A fence that costs \$30 per metre is to be erected around the perimeter of plot. Determine the total cost of fencing. (3 marks)

- (b) Once the fence is in place, the plot is to be treated with weedkiller at a rate of 10 mL per square metre. The weedkiller is sold in 3 litre containers. Determine, with justification, the number of containers of weedkiller required. (5 marks)

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Supplementary page

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Markers use only			
Question	Marker	Maximum	Mark
1	Mr Riemer	5	
2	Mr Riemer	5	
3	Mr Riemer	8	
4	Mr Galbraith	9	
5	Mr Galbraith	10	
6	Mr Galbraith	7	
7	Mr Galbraith	8	
Section 1 Total		52	
Section 2 Total		98	
Exam Total		150	
Total		100%	