Semester One Examination, 2021

Question/Answer booklet

MATHEMATICS APPLICATIONS UNIT 1

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

Section One: Calculator-free

WA student number: In figures | | | | | | | | | |

In words _____

_____

Your 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	8	8	50	52	35
Section Two: Calculator-assumed	13	13	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.

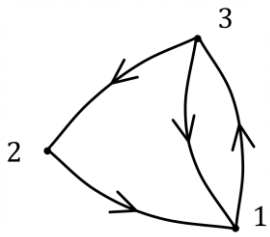
Section One: Calculator-free **35% (52 Marks)**

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

Working time: 50 minutes.

Question 1 **(5 marks)**

Three people who share a computer network have each forgotten their own password but can remember at least one other person's password. In the following diagram, the directed lines indicate that the person at the start of the line remembers the password of the person at the end of the line. For example, person 2 remembers the password of person 1.



(a) Create a square matrix M where the entry $M_{i,j}$ is 0 if person i does not remember the password of person j, and is 1 if they do. (3 marks)

(b) Determine M^2. (2 marks)

See next page

Question 2 **(5 marks)**

(a) Describe the type (using row, column, square, zero or identity) of each of the following matrices:

(i) $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$. (1 mark)

(ii) $\begin{bmatrix} 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$. (1 mark)

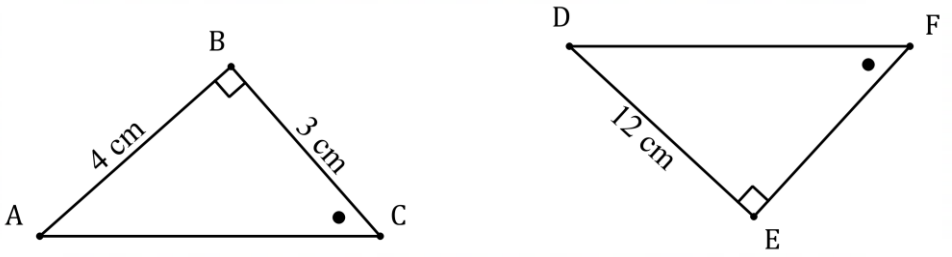
(iii) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$. (1 mark)

(b) The size of matrix $\begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 1 & 0 \end{bmatrix}$ is $m \times n$. State the value of m. (1 mark)

(c) Write the 4×2 zero matrix O. (1 mark)

Question 3 **(5 marks)**

The diagram below, not drawn to scale, shows two similar right triangles.



(a) Calculate the scale factor for the larger triangle relative to the smaller. (1 mark)

(b) Determine the length of side AC, the length of side DF and the length of side EF. (3 marks)

(c) Calculate how many times greater the area of the large triangle is compared to the area of the small triangle. (1 mark)

See next page

Question 4 **(7 marks)**

A young person has drawn up a budget for their weekly income of $800. Some of their income is allocated to rent, living expenses, loan repayments, phone, and the rest to savings.

	A	B
1	Weekly budget	
2	Rent	$235.00
3	Debt repayments	
4	Living expenses	$290.00
5	Phone	$65.00
6	Savings	
7	**Total**	**$800.00**

The young person allocates 15% of their weekly income to debt repayments.

(a) Determine the budget allocation for debt repayments. (2 marks)

(b) The young person has been saving for a holiday and needs to save another $720 to make the booking. If the above budget is maintained, determine the number of weeks will it take them to save this amount. (3 marks)

(c) If the budget allocations for rent and phone increase by $7 and $3 respectively, what effect will this have on your answer to part (b)? (2 marks)

Question 5 **(5 marks)**

(a) Calculate the value of $a + b \times c$ when $a = 5, b = 5$ and $c = 6$. (1 mark)

(b) Use the formula $y = (x - 1)(x + 4)$ to calculate y when $x = 0.5$. (2 marks)

(c) Use the formula $s = ut + \frac{1}{2}at^2$ to calculate s when $u = 4.5, t = 10$ and $a = 3.8$. (2 marks)

See next page

Question 6 **(8 marks)**

Consider the following matrices:

$$A = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 5 \\ 5 & -3 \end{bmatrix} \quad C = \begin{bmatrix} -2 & 1 \\ 0 & 2 \end{bmatrix} \quad D = \begin{bmatrix} -1 \\ 1 \end{bmatrix} \quad E = [0 \quad 2] \quad F = [2 \quad -1].$$

(a) Calculate, where possible, the following. If not possible, give a reason why.

(i) $A + C$. (1 mark)

(ii) $D \times B$. (1 mark)

(iii) $9F - 7E$. (2 marks)

(iv) $B \times C$. (2 marks)

(b) Calculate A^6. (2 marks)

Question 7 **(10 marks)**

One weekend, a company operated three boats to run harbour trips.

On Saturday, boats D, E and F carried $48, 65$ and 42 adults, and $24, 44$ and 25 children, respectively.

(a) Represent this information in the 2×3 matrix X, with adults in the top row, and boats in alphabetical order. (1 mark)

On Sunday, a total of 120 adults and 87 children took trips. Boats D and E carried an equal number of children and boat E carried 25 adults. Compared to Saturday, boat F took 1 more adult and 10 more children.

(b) Represent the Sunday passenger numbers in matrix Y, using the same row and column labels as matrix X. (3 marks)

See next page

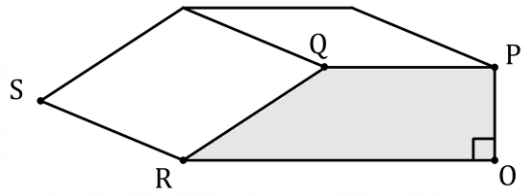
(c) Calculate matrix T, where $T = X + Y$ and explain what information it represents. (2 marks)

The price per trip was $\$10$ per adult and $\$5$ per child.

(d) Represent the price information in matrix P that can be meaningfully multiplied by matrix T, calculate PT and explain what information it represents. (4 marks)

Question 8 **(7 marks)**

The diagram below, not drawn to scale, shows a prism with trapezoidal cross-section $OPQR$, where $OP = 8$ cm, $PQ = 15$ cm, $QR = 17$ cm, $OR = 30$ cm and $RS = 10$ cm.



(a) Calculate the area of the cross-section $OPQR$. (2 marks)

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

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

End of questions

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

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