



## Trinity College

WA Exams Practice Paper A, 2016

Question/Answer Booklet

### MATHEMATICS APPLICATIONS UNITS 3 AND 4

Section One:  
Calculator-free

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

Student Number: In figures

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In words

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Your name

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#### Time allowed for this section

Reading time before commencing work: five minutes

Working time for section: fifty minutes

#### 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 notes or other items of a non-personal nature in the examination room. 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 exam
Section One: Calculator-free	8	8	50	51	35
Section Two: Calculator-assumed	12	12	100	100	65
<b>Total</b>				151	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.
3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.
4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
  - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
  - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.
5. **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.
6. It is recommended that you **do not use pencil**, except in diagrams.
7. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

**Section One: Calculator-free**

**35% (51 Marks)**

This section has **eight (8)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 50 minutes.

**Question 1**

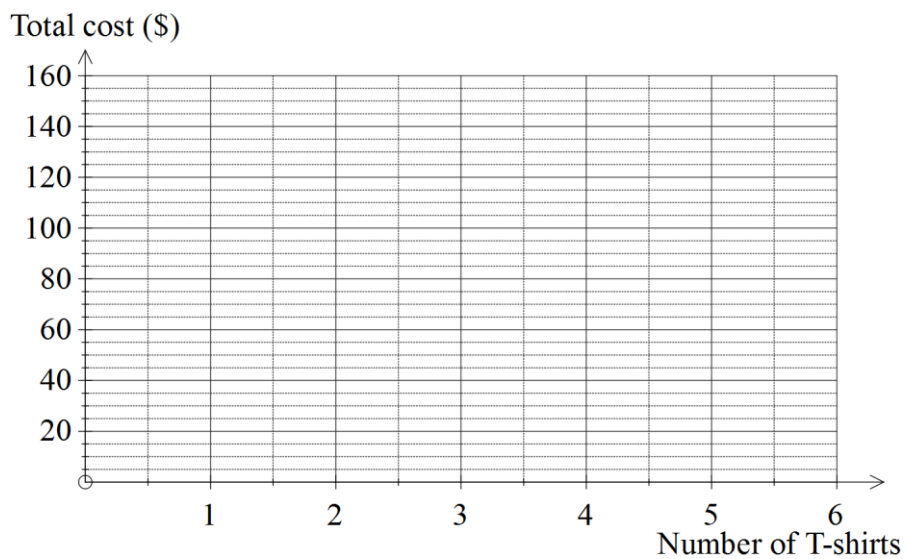
**(7 marks)**

An online company sell T-shirts for \$25 each plus a single \$15 shipping fee.

- (a) Complete the table below to show the total cost of purchasing up to five T-shirts. (2 marks)

Number of T-shirts	1	2	3	4	5
Total cost (\$)	40				

- (b) Display the information in the table in graphical form on the axes below. (2 marks)



- (c) State a rule for the total cost  $C$  of purchasing  $n$  T-shirts. (1 mark)

- (d) Determine how many T-shirts can be purchased for \$265. (2 marks)

**Question 2****(7 marks)**

The distances, in metres, along direct tracks between six campsites, A, B, C, D, E and F, are shown in the table below. Not all of the campsites have direct tracks between them.

	A	B	C	D	E	F
A		50				
B	50		90	155	80	
C		90		75		
D		155	75		60	115
E		80		60		180
F				115	180	

- (a) Use the fact that there are eight edges between the six vertices to determine the number of faces that a planar graph of the above information will have. (2 marks)
- (b) Draw a weighted planar graph to represent the information in the table. (3 marks)
- (c) Is the graph above Eulerian, semi-Eulerian or neither? Explain your answer. (2 marks)

## Question 3

(7 marks)

The seasonal indices for the first three quarters of a year for the turnover in a restaurant are shown in the table below.

Quarter	One	Two	Three	Four
Seasonal index	0.85	1.02	1.17	-

- (a) In the first and second quarters of this year, the restaurant had turnovers of \$248 700 and \$249 600. In which of these first two quarters will the deseasonalised value of the turnover be greatest? Explain your answer. (3 marks)

- (b) Determine the seasonal index for the fourth quarter. (1 mark)

- (c) The equation of the trend line fitted to the deseasonalised turnover  $T$  for each quarter  $Q$  is

$$T = 285\,000 - 9\,500 \times Q.$$

- (i) Explain, in the context of the question, the meaning of the figure 9 500 in this equation. (1 mark)
- (ii) Use the equation to write down an expression to predict the actual turnover in the fourth quarter of the first year, but **do not** evaluate it. (2 marks)

**Question 4****(6 marks)**

A complete graph with  $n$  vertices will have  $\frac{n(n-1)}{2}$  edges.

(a) Determine the number of edges a complete graph with 10 vertices will have. (1 mark)

(b) A complete graph has 4 vertices.

(i) Draw the graph, and explain why it is planar. (2 marks)

(ii) Represent the graph with an adjacency matrix. (1 mark)

(c) Are all complete graphs also planar? Justify your answer. (2 marks)

**Question 5****(4 marks)**

- (a) A couple are saving the same amount of money each week towards buying a home. State which of the following three investment options would grow their savings at the fastest rate, and explain why. (2 marks)

A: An account offering 5% interest per annum, compounded monthly.

B: An account offering 5% simple interest per annum.

C: An account offering 5% interest per annum, compounded annually.

- (b) A student wishes to have the smallest possible monthly repayment on a loan to purchase a car costing \$20 000. The loan attracts interest of 0.75% per month. State which of the following four options would achieve this aim, and explain why. (2 marks)

P: Take a loan for 80% of the cost over the shortest possible period of time.

Q: Take a loan for 90% of the cost over the shortest possible period of time.

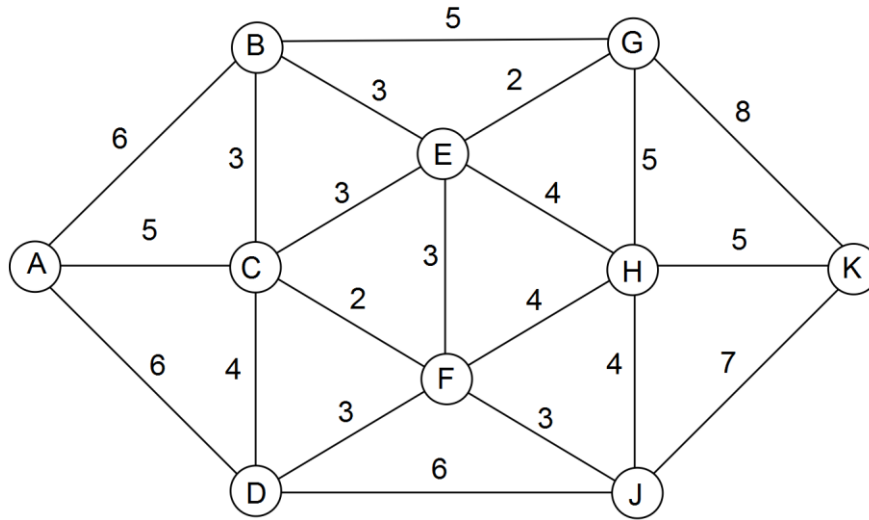
R: Take a loan for 80% of the cost over the longest possible period of time.

S: Take a loan for 90% of the cost over the longest possible period of time.

**Question 6**

**(7 marks)**

The time taken, in minutes, to walk on footpaths between various buildings on a school campus is shown on the weighted graph below.



- (a) Determine the minimum time needed to walk from
  - (i) B to K. (1 mark)
  - (ii) G to D. (1 mark)
  
- (b) Determine the minimum time needed to walk from A to K, stating the route and the time. (3 marks)
  
- (c) A student wanted to walk along every footpath on the campus, without using the same footpath more than once. If this is possible, explain where they should start. If it is not possible, explain why not. (2 marks)



Question 7

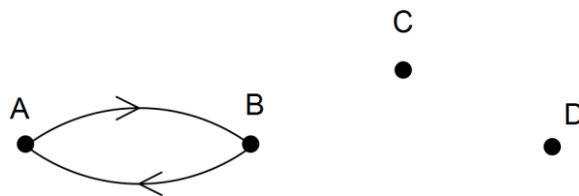
(7 marks)

The adjacency matrix for a digraph with four vertices is

$$\begin{matrix}
 & A & B & C & D \\
 A & \begin{bmatrix} 0 & 1 & 0 & 0 \end{bmatrix} \\
 B & \begin{bmatrix} 1 & 0 & 1 & 0 \end{bmatrix} \\
 C & \begin{bmatrix} 0 & 0 & 0 & 1 \end{bmatrix} \\
 D & \begin{bmatrix} 0 & 1 & 0 & 1 \end{bmatrix}
 \end{matrix}$$

(a) Complete the digraph below.

(2 marks)



(b) List, in order visited, the vertices on a Hamilton path for the digraph starting at vertex C.

(1 mark)

(c) State the vertices, if any, from which a Hamilton path for the digraph cannot start. Explain your answer.

(2 marks)

(d) A Hamilton cycle will exist if one directed edge is added to the digraph. State a suitable edge to add and list, in order, the vertices that will lie on the cycle.

(2 marks)

**Question 8**

**(6 marks)**

(a) The athletics events that four students are proficient in are shown in the table below.

<i>Student</i>	<i>Proficient in these events</i>
Branden	High Jump, Long Jump
Joyce	Long Jump
Marti	High Jump, Triple Jump
Sol	Long Jump, Triple Jump

Represent this information using a bipartite graph.

**(2 marks)**

(b) Another three students plan to enter as a team for a triathlon. Their best times (in minutes) for each leg of the triathlon are shown in the table below.

	Swim	Cycle	Run
Gene	26	35	29
Rhea	34	22	35
Tandra	21	19	25

Each student must complete just one of the three legs. Show use of the Hungarian algorithm to determine which student should be allocated to each leg in order to minimise their total time for the triathlon, and state what this time is. **(4 marks)**

**Additional working space**

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

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