

Semester One Examination, 2023

Question/Answer booklet

MATHEMATICS APPLICATIONS UNIT 3

Section One: Calculator-free

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

WA student number: In figures

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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):

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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

- 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.
- Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
- 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.
- 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.
- It is recommended that you do not use pencil, except in diagrams.
- 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.
- The Formula sheet is not to be handed in with your Question/Answer booklet.

Markers use only		
Question	Maximum	Mark
1	7	
2	6	
3	7	
4	7	
5	10	
6	9	
7	6	
S1 Total	52	
S1 Wt ($\times 0.6731$)	35%	
S2 Wt	65%	
Total	100%	

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Section One: Calculator-free

35% (52 Marks)

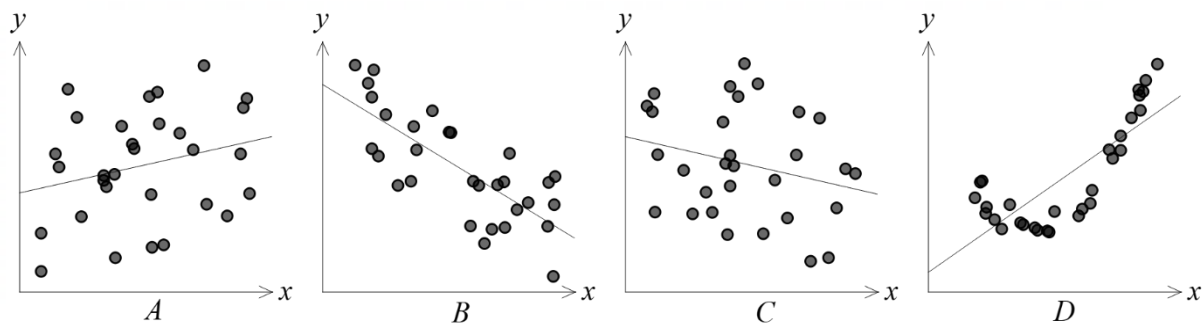
This section has **seven** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

Question 1

(7 marks)

Scatterplots for datasets A , B , C and D are shown below, together with the least-squares line for each dataset.



(a) Which dataset best illustrates the existence of a weak positive relationship between the variables? Justify your choice by referring to two key features of its scatterplot. (3 marks)

(b) Which dataset best illustrates the existence of a non-linear relationship between the variables. Justify your choice by referring to at least one key feature of its scatterplot. (2 marks)

Let r_A, r_B, r_C and r_D be the values of the correlation coefficient between the variables for datasets A, B, C and D respectively.

(c) Use estimates for the coefficients to arrange r_A, r_B, r_C and r_D in ascending numerical order. (2 marks)

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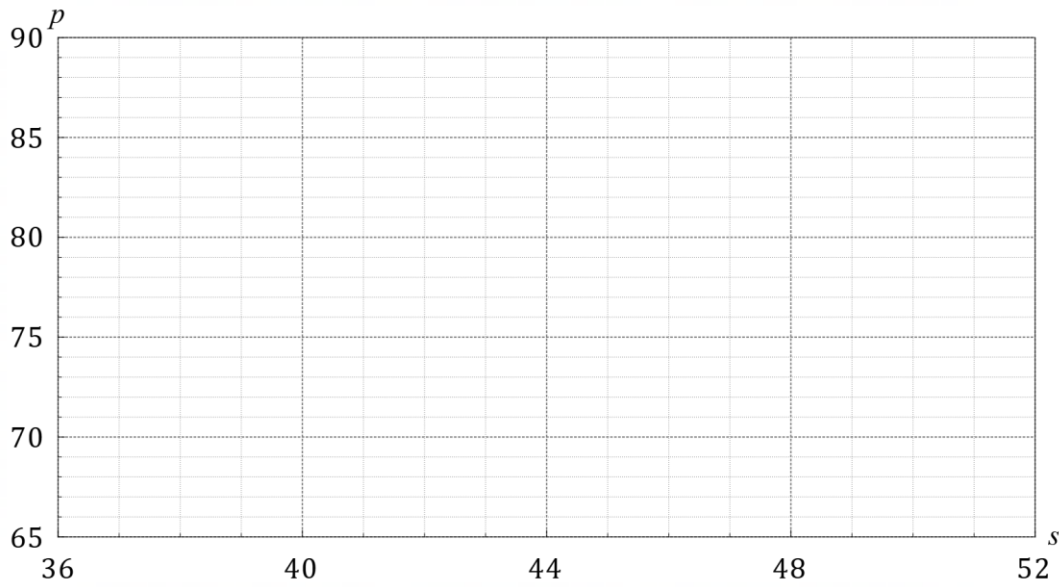
Question 2

(6 marks)

A research institute placed healthy coral in eight reef tanks for a three-week period. For each tank, the average salinity of the water over that time, s in parts per thousand, and the percentage p of coral that remained healthy at the end of the three weeks was recorded in the table below.

s	45	38	40	48	44	41	37	50
p	74	85	84	71	76	80	88	66

- (a) Construct a scatterplot of the data on the axes below. (2 marks)



- (b) Comment on the validity of each of the following statements:
- (i) Average salinity is a good predictor for the percentage of coral that will remain healthy after three weeks in a reef tank. (2 marks)

 - (ii) Increasing the average salinity causes the percentage of coral that will remain healthy after three weeks in a reef tank to decrease. (2 marks)

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Question 3**(7 marks)**

The first term of a sequence is 1220 and the next three terms, in order, are 1300, 1380 and 1460.

(a) Is this sequence arithmetic, geometric or neither? (1 mark)

(b) Determine a recurrence relation that defines this sequence. (2 marks)

(c) Deduce a rule for the n^{th} term of this sequence. (1 mark)

The terms of this sequence model the monthly balance of a savings account. This balance was \$1220 during the first month.

(d) During which month will this balance first reach \$2100 or more? (3 marks)

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Question 4

(7 marks)

Amit has drawn connected graph G in the plane to help solve a map colouring problem. Its edges are not directed, it has 4 faces and its adjacency matrix C is

$$C = \begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \end{bmatrix}$$

(a) Use one or more elements of C to explain why G

(i) is **not** a complete graph.

(2 marks)

(ii) contains a bridge.

(2 marks)

(b) Show that G satisfies Euler's formula.

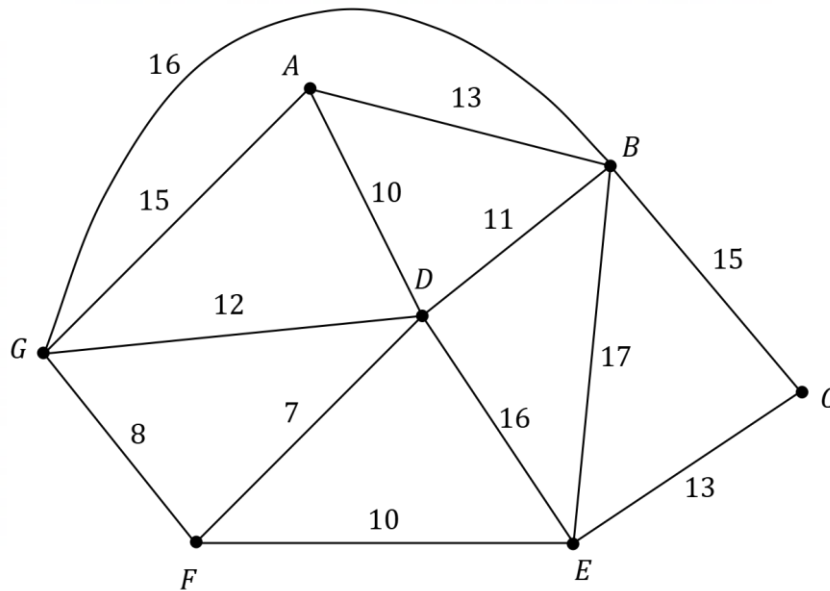
(3 marks)

Question 5

(10 marks)

Bart delivers bread from his depot at D to all 6 grocery stores located at A, B, C, E, F and G daily.

In the graph below the vertices represent the depot and shops, the edges represent direct roads between shops and the edge weights are the travel times along these roads in minutes.



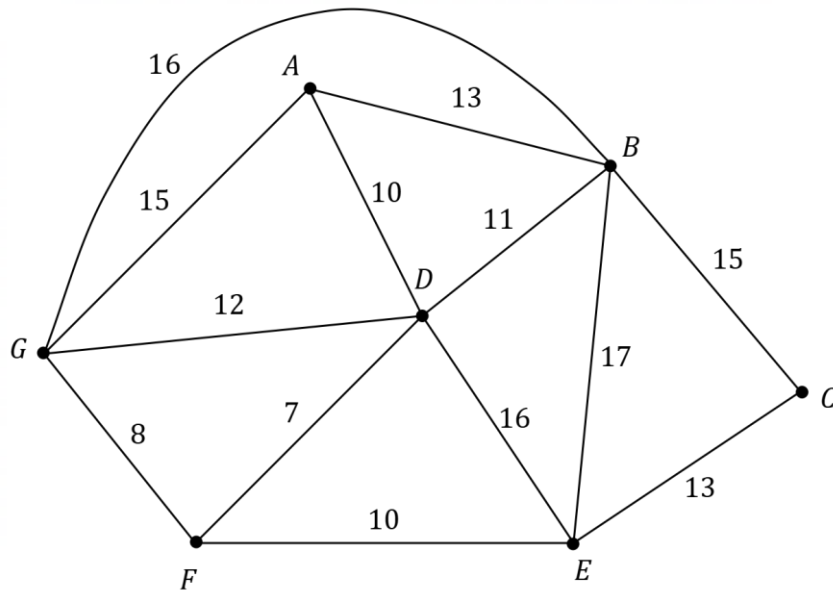
- (a) Explain why the graph shown above is Hamiltonian. (2 marks)

Bart always starts and finishes a daily delivery from his depot, and never visits a store or travels along the same road more than once. He always spends 6 minutes at each store to complete the delivery.

- (b) One day, Bart left the depot at 6:45 am and started his delivery round by travelling to shop E , as it had requested an urgent delivery. List the order that the shops received their deliveries and determine the time that Bart returned to the depot on this day. (4 marks)

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- (c) Determine the order in which Bart should visit the stores so that he returns to the depot in the least possible time, and state what this time is. Justify your answer. A copy of the graph has been provided below. (4 marks)

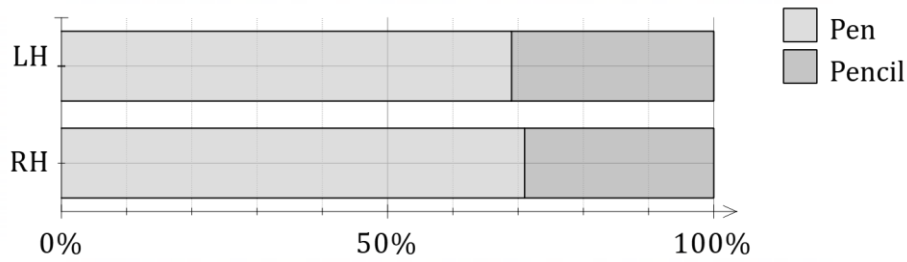


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Question 6

(9 marks)

- (a) The following divided bar graph shows the writing preferences (pen or pencil) for a sample of left and right-handed students.



Explain whether the data indicates the presence of a clear association between dominant hand and writing preference. (2 marks)

- (b) The table below shows the responses of people who house share in either Perth or Melbourne to a survey about their financial position pre-COVID to now.

	Financial position pre-COVID to now		
	Better	Same	Worse
Melbourne	34	100	66
Perth	10	30	10

- (i) Calculate how many more people responded to the survey in Melbourne compared to Perth. (2 marks)

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- (ii) Construct a row percentaged table for the data. (3 marks)

- (iii) State, with reasons, whether the data suggests an association is present between the two variables. (2 marks)

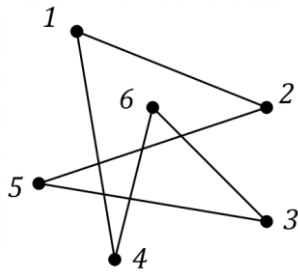
Question 7

(6 marks)

For each of the following questions, answer yes or no and then justify your answer. Responses given without justification will not be awarded any marks.

(a) Is the graph shown below bipartite?

(2 marks)

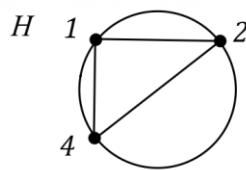
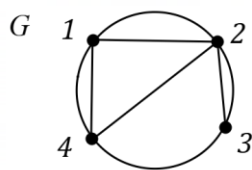


(b) Is a connected planar graph with 3 vertices and 5 edges a simple graph?

(2 marks)

(c) Is graph H a subgraph of graph G ?

(2 marks)



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Supplementary page

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