Semester 1 (Unit 3) Examination, 2019

Question/Answer Booklet

MATHEMATICS APPLICATIONS

Section One: Calculator-free

Student Name/Number: _____

Teacher Name: _____

Time allowed for this section
Reading time before commencing work: five minutes
Working time for this 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	6	6	50	50	35
Section Two: Calculator-assumed	12	12	100	100	65
					100

Instructions to candidates

1. The rules for the conduct of School exams are detailed in the _____*School/College assessment policy*. 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 answer to the specific question asked and to follow any instructions that are specified 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.

see next page

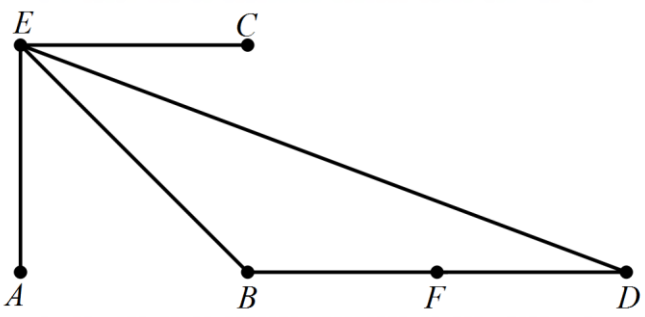
Section One: Calculator-free **35% (50 Marks)**

This section has **6** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for the use of planning/continuing your answer to a question have been 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.

Suggested working time: 50 minutes.

Question 1 **(7 marks)**



(a) What is the sum of the degrees of the vertices? (1 mark)

(b) State which edge/s form a bridge (1 marks)

(c) Describe a walk which contains five edges and a cycle (2 marks)

(d) Re-draw this network as a bipartite graph, clearly showing the two separate groups.

(3 marks)

see next page

Question 2 **(9 marks)**

Company ABC commissioned four opinion surveys by two different firms over a period of 7 months following the launch of its new website. The firms were asked to repeat the survey on separate samples. Firm X was commissioned to do surveys one month and 3 months after the launch, while Firm Y commissioned to do the surveys after 5 months and 7 months respectively.

The survey results are provided below. Note: Both firms used a 5-point scale to measure how well liked the website was.

The key used was:

VWL: very well liked, WL: well liked, S: satisfactory, UL: un-liked, VUL: very un-liked

	Survey Results						
		VWL	WL	S	UL	VUL	Total
Firm X	Sample 1X	7	31	26	16	10	90
	Sample 2X	22	15	35	10	18	100
Firm Y	Sample 1Y	12	20	17	**A**	4	60
	Sample 2Y	32	52	46	13	7	150
	Total	73	118	124	46	39	400
	Percentage	18.25%	29.50%	**B**	11.50%	9.75%	**C**

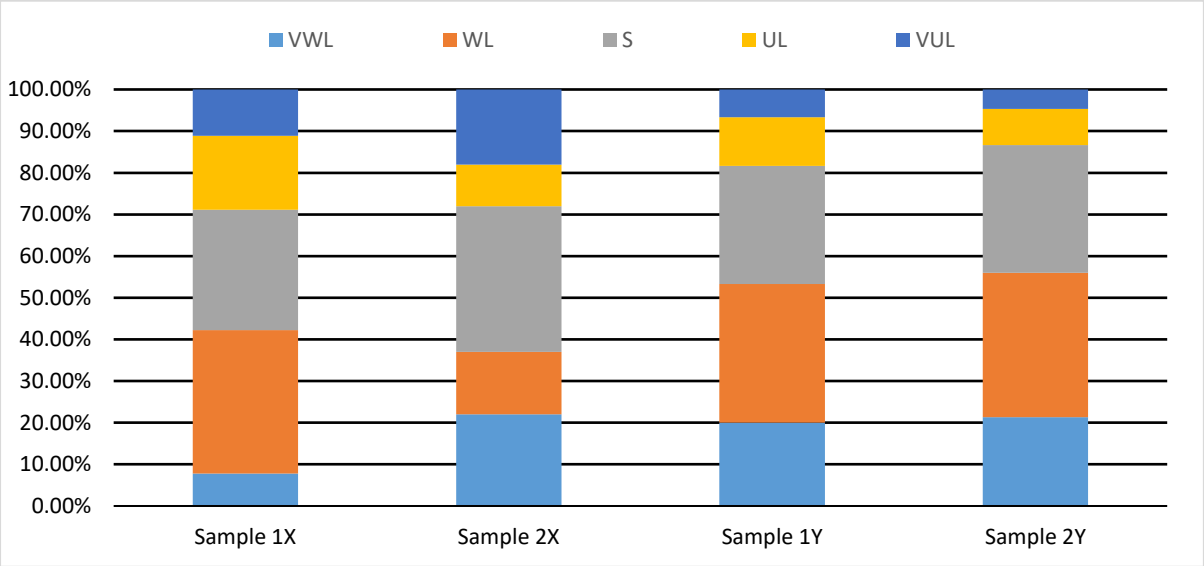
(a) State an appropriate question which could have been used to collect such data.

(1 mark)

(b) Complete the table by stating the three missing numbers, A, B and C. (3 marks)

see next page

The data in the table has been displayed as a divided column graph below.



(c) Using the graph above or another method, comment on:

(i) the association between the 'Samples' and the rating 'Satisfactory'. (1 marks)

(ii) the association between 'Samples' and the ratings 'VWL, WL and S combined'

(2 marks)

The marketing and promotions manager at Company ABC decided that the survey results provided by Firm Y were more reliable than those provided by Firm X.

(d) Do you agree with this decision? Justify your decision. (2 marks)

see next page

Question 3

(9 marks)

$$\text{Graph 1}: \begin{array}{c} \\ A \\ B \\ C \end{array}\!\!\begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix} \end{array} \qquad \text{Graph 2}: \begin{array}{c} \\ D \\ E \\ F \end{array}\!\!\begin{array}{c} \begin{array}{ccc} D & E & F \end{array} \\ \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 2 & 1 & 0 \end{bmatrix} \end{array} \qquad \text{Graph 3}: \begin{array}{c} \\ G \\ H \\ I \end{array}\!\!\begin{array}{c} \begin{array}{ccc} G & H & I \end{array} \\ \begin{bmatrix} 0 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \end{array}$$

(a) Use the three adjacency matrices above to answer the following:

(i) Which graph/s contain a loop? (1 mark)

(ii) State which graph has an isolated vertex? (1 mark)

(iii) Which graph is a digraph and what feature of the matrix identifies whether a graph is directed or not?

(2 marks)

(b) (i) Draw a connected graph with one vertex of order 2, two vertices of order 3 and two vertices of order 4. (3 marks)

ii) Is this network traversable? Justify your answer. (2 marks)

see next page

Question 4 **(6 marks)**

(a) Show that 1 is a term of the sequence defined by $T_n = \dfrac{38-5n}{3}$ and determine the term that it equates to? (3 marks)

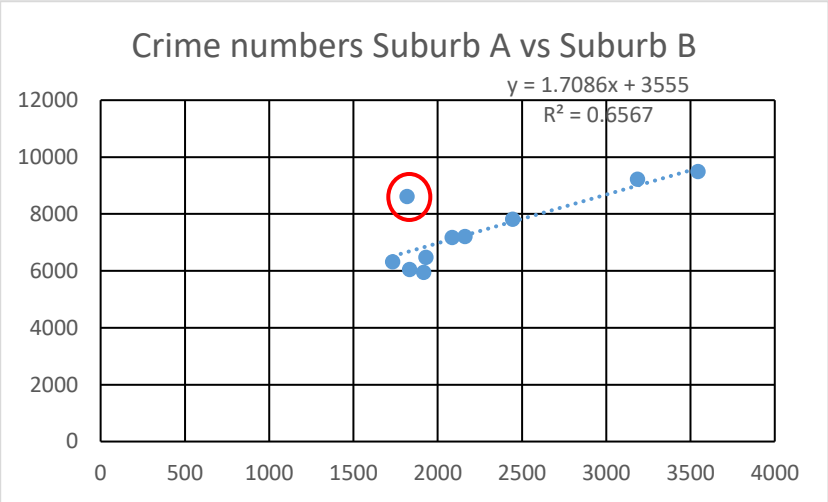
(b) Find the n^{th} term of the Arithmetic sequence given $T_4 = 11,\ T_{16} = 35$. (3 marks)

see next page

Question 5 **(11 marks)**

The data provided below was sourced from the website of the The Western Australian Police force and provides the number of crimes committed in two Perth localities over the decade 2007-08 to 2016-2017. A scatter plott of the data is provided next to the numerical data.

Year	Suburb A	Suburb B
2007-08	3546	9489
2008-09	3187	9215
2009-10	2087	7176
2010-11	1918	5941
2011-12	1834	6043
2012-13	1733	6311
2013-14	1819	8616
2014-15	1932	6473
2015-16	2162	7200
2016-17	2445	7808



(a) Describe the strength of the linear relationship between the number of crimes in the two suburbs for the specified decade. Interpret what this means. (3 marks)

One of the data points in the graph has been circled.

(b) Which year does the circled data point represent? Interpret the information conveyed by this data point relative to the rest of the data. (2 marks)

see next page

(c) Three estimates are given for the correlation coefficient: 0.4 0.6 0.8

Which of these three values is the best estimate? Justify your selection. (2 marks)

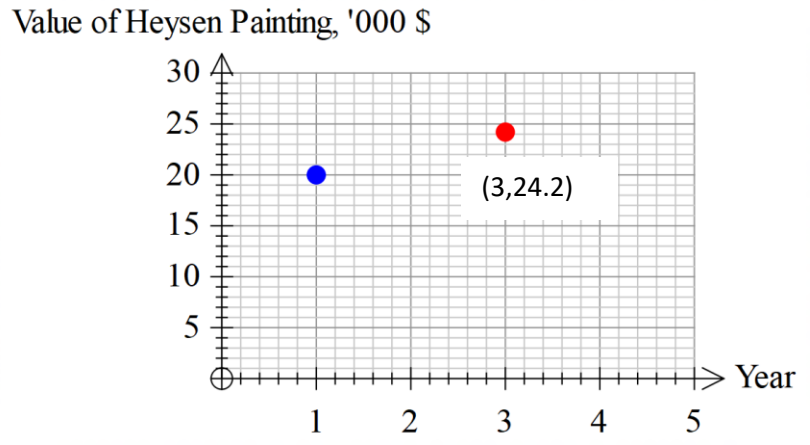
(d) It is known that the number of crimes committed in Suburb A during the 2017-18 year is 3010. Use the graph (or model) to predict the number of crimes likely to have been committed in Suburb B during the same year. (2 marks)

(e) Describe the reliability of the prediction that you made in part (d) and justify your conclusion. (2 marks)

see next page

Question 6 **(8 marks)**

The value of Matt's famous Heysen painting, on any given year since it was purchased, follows the Geometric sequence, $V_n = 20000 \times 1.1^{n-1}$, where V_n is the value in the n^{th} year. The values in the first and third year are displayed graphically below.



(a) Show how the common ratio of the geometric sequence is calculated. (2 marks)

(b) Describe the change in the value of Matt's painting during the first four years. (2 marks)

(c) Add the missing data points for the 2nd and 4th year. (2 marks)

(d) Write the geometric sequence rule $V_n = 20000 \times 1.1^{n-1}$ as a recursive equation. (2 marks)

End of Questions

 see next page

Additional working space

Question number: _____

see next page

Additional working space

Question number: _____

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