

Papers written by  
Australian Maths  
Software

**SEMESTER ONE**

**YEAR 12, Unit 3**

**MATHEMATICS APPLICATIONS  
REVISION 1  
2016**

**Section One  
(Calculator-free)**

Name: \_\_\_\_\_

Teacher: \_\_\_\_\_

**TIME ALLOWED FOR THIS SECTION**

Reading time before commencing work:

5 minutes

Working time for section:

50 minutes

**MATERIAL REQUIRED / RECOMMENDED FOR THIS SECTION**

**To be provided by the candidate**

Standard items: pens, pencils, pencil sharpener, highlighter, eraser, ruler.

**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.

**To be provided by the supervisor**

Question/answer booklet for Section One.

A formula sheet which may also be used for Section Two.

**Structure of this examination**

	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
<b>Section One Calculator—free</b>	<b>7</b>	<b>7</b>	<b>50</b>	<b>52</b>	<b>35</b>
Section Two Calculator—assumed	10	10	100	98	65
Total marks				150	

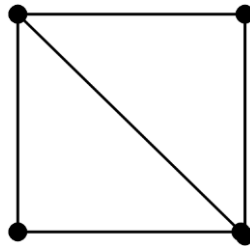
**Instructions to candidates**

1. The rules for the conduct of this examination are detailed in the Information Handbook. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in the Question/Answer booklet.
3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Spare pages are provided at the end of this booklet. If you need to use them, indicate in the original answer space where the answer is continued i.e. give the page number.
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 an answer to 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.

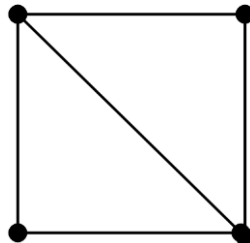
1. (5 marks)

(a) Define and sketch a simple graph. (2)

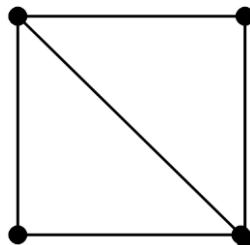
(b) (i) Explain why the following graph is not a complete graph. (1)



(ii) Convert the graph in (i) to a complete graph on the diagram below. (1)



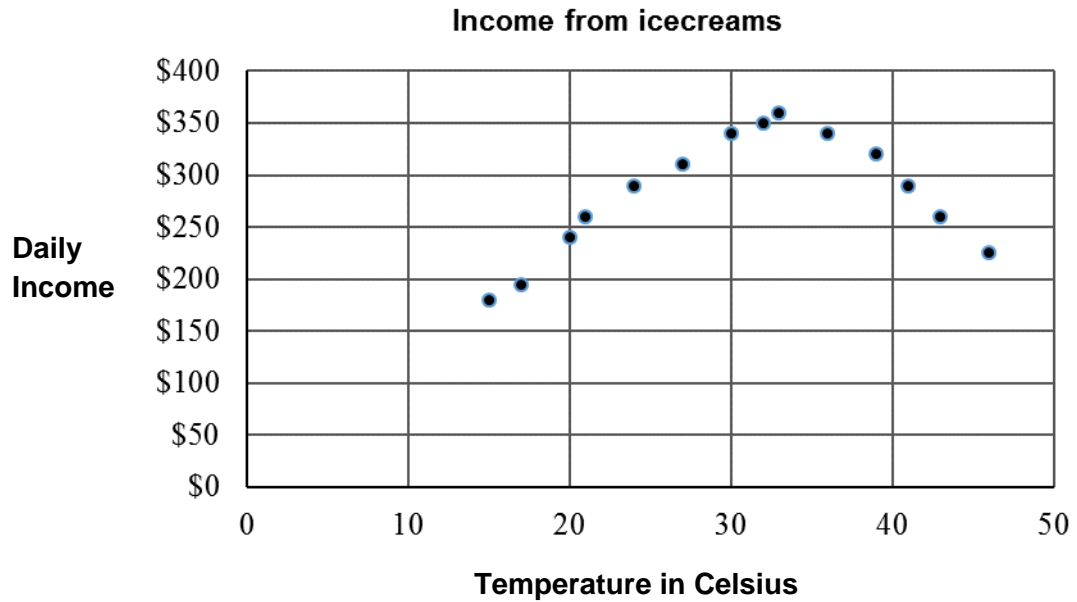
(c) Highlight a subgraph on the graph below. (1)



2. (7 marks)

(a) The graph below shows the income from the sale of ice creams against the temperature of the day.

Explain precisely how you could illustrate that a linear fit to the data below is not the best fit for a function approximation for the data below. (3)



- (b) The headmaster of a school is democratic and wants to know if his students prefer a roof over their lunch area or an extension to their lunch area but with no roof. The school cannot afford both.

How should the headmaster obtain the information and how could he present the information to the school board who are to fund the changes? (4)

3. (7 marks)

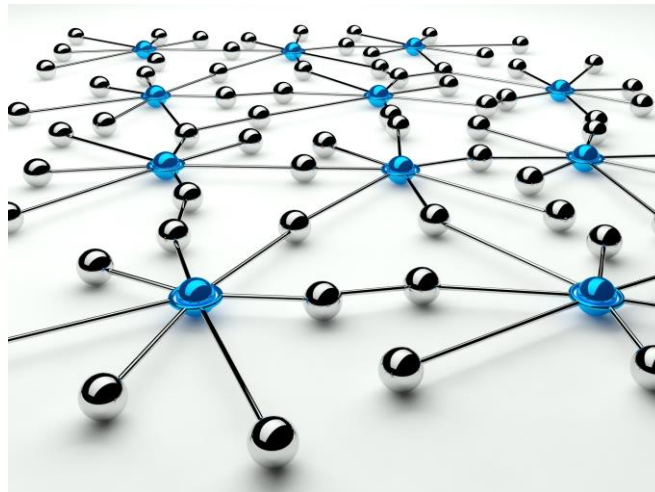
(a) Consider the following diagram of a worldwide network.



Give two examples of what the network may represent.

(2)

(b) Consider the following diagram of a network between people.



Give two examples of what the network may represent.

(2)

- (c) Barry, Jenny, Andre, Pam and Joan were friends in the same class.

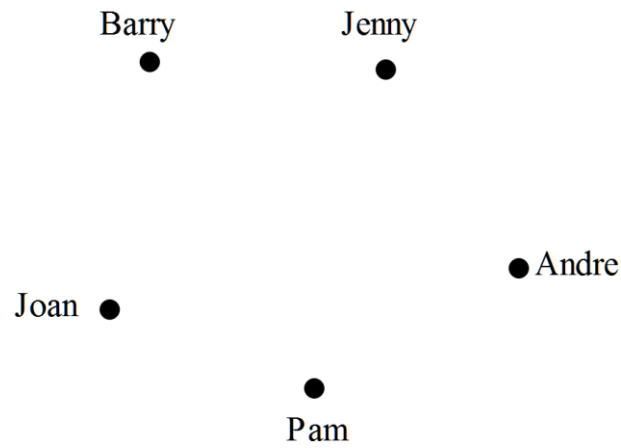
On one particular day, Barry emailed Jenny, Pam and Joan.

Joan emailed Barry back as did Pam.

Andre texted Pam, Joan and Barry.

Joan rang Jenny and Barry (i.e. it was a two way communication).

Sketch the directed network that illustrates the communication between the five friends on that day. (3)



4. (8 marks)

(a) Define the sequence 100, 95, 90, 85, .... recursively. (2)

(b) Generate the first three terms of the sequences defined recursively below

(i)  $T_{n+1} = 1.10T_n$ ,  $T_1 = 10\ 000$  (3)

(ii)  $P_{n+1} = 2P_n - 10$ ,  $P_1 = 20$  (3)

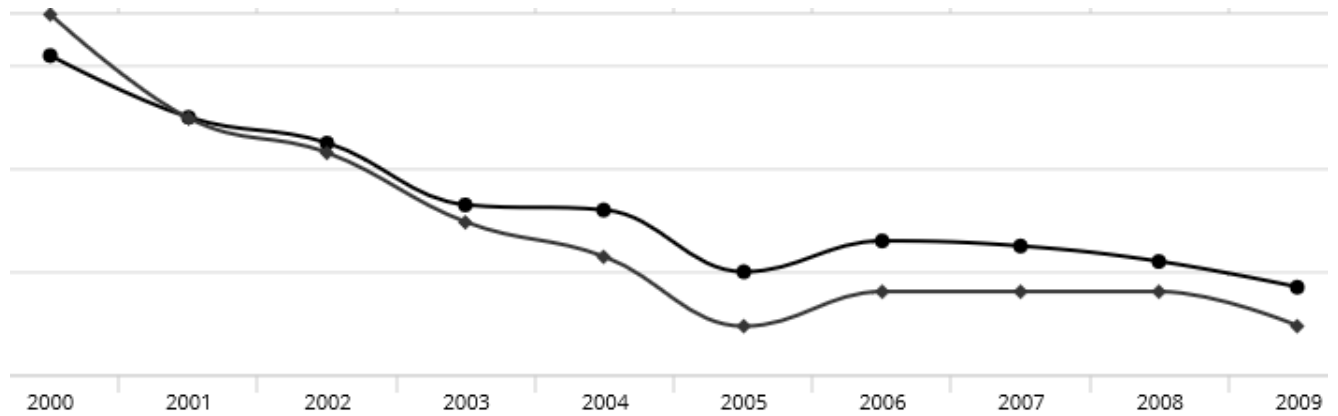


5. (3 marks)

The divorce rate in Maine per 1000 correlates with the per capita consumption of margarine.

The correlation coefficient is 0.95.

The graph of the relationship is shown below.



Data sources: [National Vital Statistics Reports](#) and [U.S. Department of Agriculture](#)

Therefore the higher the divorce rate, the higher the consumption of margarine.  
and the lower the divorce rate, the lower the consumption of margarine.

It has been conjectured that

*“When the divorce rate is high, it causes people to eat more comfort food.”*

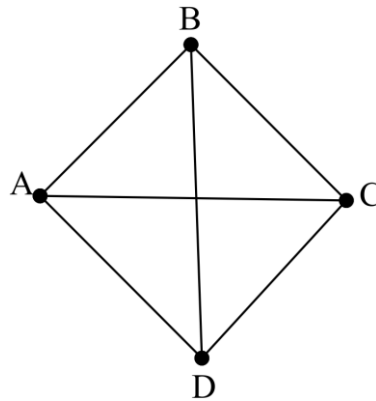
Discuss.

(3)

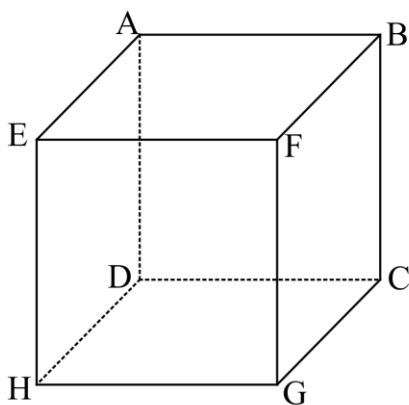
6. (11 marks)

(a) (i) Define planar. (1)

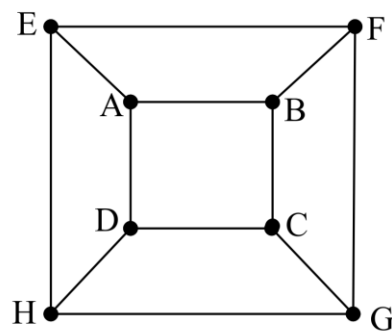
(ii) Redraw the following graph to show that the graph is planar. (2)



(b) (i) Write down the number of vertices (V), faces (F) and edges (E) for hexahedron and the graph.



V =    F =    E =

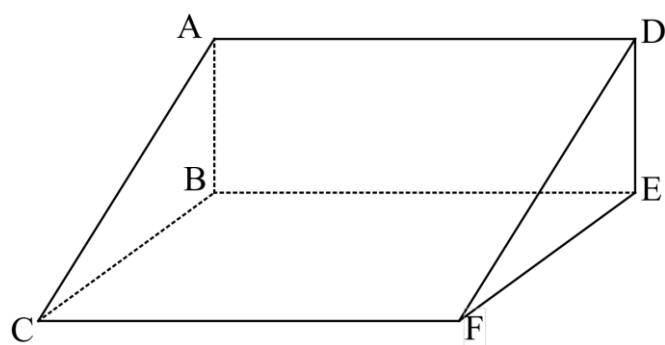


V =    F =    E =

(3)

- (ii) Use Euler's formula to illustrate that the hexahedron in (i) can be drawn as an equivalent planar graph. (3)

- (c) Sketch the corresponding planar graph for the three dimensional figure shown below, labelling all vertices. (2)



7. (11 marks)

(a) A yacht (Y) sends location messages to nearby towns (A, B, and C) on a daily basis.

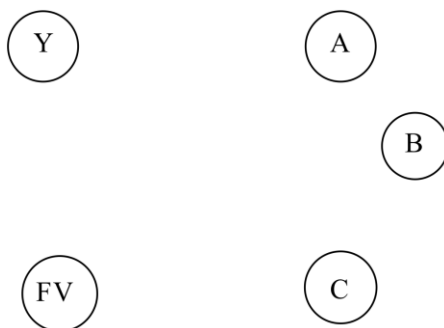
A fishing vessel (FV) communicates with the nearby towns but does not communicate with the yacht.

The communications are shown on the matrices below:

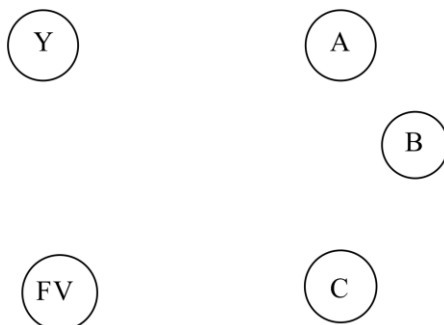
$$\begin{array}{c} \text{TO} \\ \text{A B C} \\ \text{FROM Y} \begin{pmatrix} 1 & 1 & 0 \end{pmatrix} \\ \text{FV} \begin{pmatrix} 1 & 0 & 2 \end{pmatrix} \end{array}$$

$$\begin{array}{c} \text{TO} \\ \text{Y FV} \\ \text{FROM A} \begin{pmatrix} 1 & 2 \end{pmatrix} \\ \text{B} \begin{pmatrix} 1 & 0 \end{pmatrix} \\ \text{C} \begin{pmatrix} 0 & 3 \end{pmatrix} \end{array}$$

(i) Draw a directed graph representing the messages from the yacht and fishing vessel to the three nearby towns. (3)

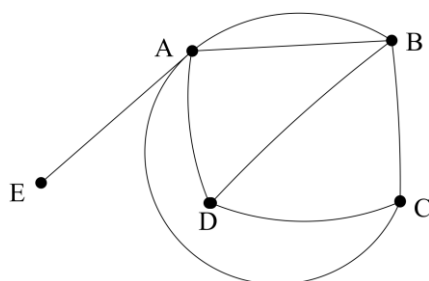


(ii) Draw a directed graph representing the messages from the yacht and fishing vessel to and from the three nearby towns. (2)



- (iii) Explain why the graph in (ii) is an example of a bipartite graph. (2)

- (b) Draw the communication matrix that represents the data shown on the graph below. (4)



**END OF SECTION ONE**