

# Perth Modern School

## WA Exams Practice Paper C, 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	7	7	50	52	35
Section Two: Calculator-assumed	12	12	100	100	65
Total				152	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% (52 Marks)**

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 50 minutes.

**Question 1**

**(5 marks)**

- (a) The ticks in the table below indicate which facilities are available in each of four classrooms (A, B, C and D).

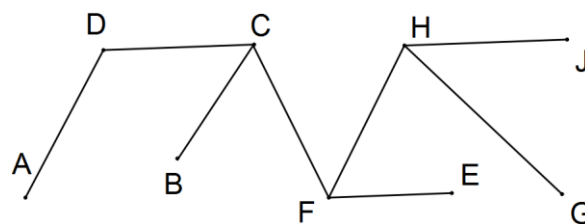
	A	B	C	D
Computer	✓		✓	✓
Projector	✓	✓	✓	
Smartboard			✓	✓

Show this information as a bipartite graph.

**(3 marks)**

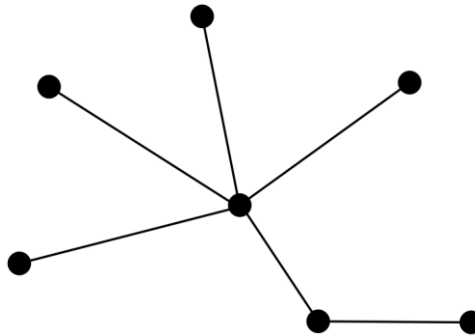
- (b) State, with justification, whether or not the graph shown below is bipartite.

**(2 marks)**

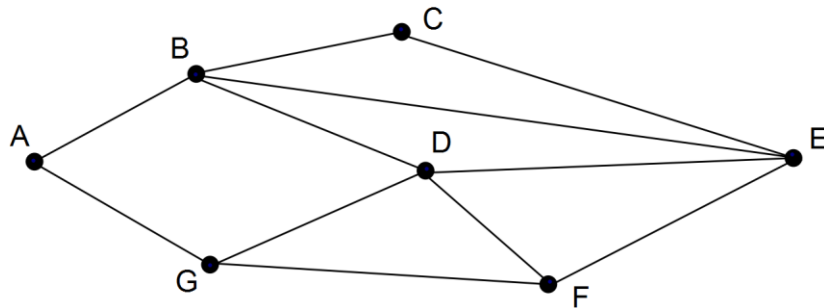


**Question 2****(8 marks)**

- (a) The connected simple graph shown has 7 vertices.



- (i) Explain why this graph is a tree. (1 mark)
- (ii) Without adding any vertices, add the minimum number of edges to the above graph so that it contains a Hamiltonian path. Clearly indicate the start and end of the path. (3 marks)
- (b) The graph shown below is semi-Eulerian.



- (i) Clearly explain why the graph is semi-Eulerian. (2 marks)
- (ii) Classify the graph as Hamiltonian, semi-Hamiltonian or neither of these. Justify your classification. (2 marks)

**Question 3**

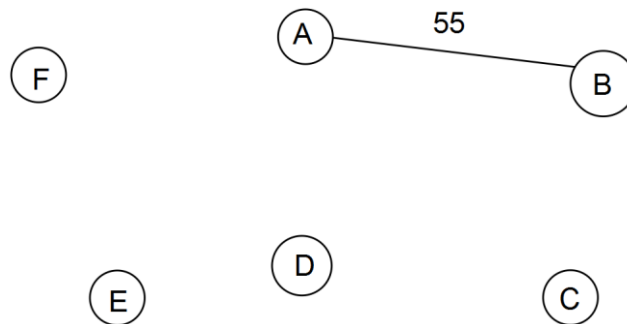
**(8 marks)**

A small park has nine pathways linking six entrances (A, B, C, D, E and F) together. The distances along pathways from one entrance to another are shown in the table below in metres.

	A	B	C	D	E	F
A	-	55	65	50	-	60
B	55	-	50	-	-	-
C	65	50	-	55	-	-
D	50	-	55	-	50	55
E	-	-	-	50	-	45
F	60	-	-	55	45	-

- (a) Complete this weighted graph to represent the above information.

**(3 marks)**



- (b) Determine the shortest route from entrance E to entrance B, stating the vertices visited and the minimum distance.

**(2 marks)**

- (c) A dog-walker wanted to stroll along every pathway in the park, without walking along any pathway more than once. State whether this is possible and if it is, suggest a possible starting and finishing point. If it is not possible, briefly explain why not.

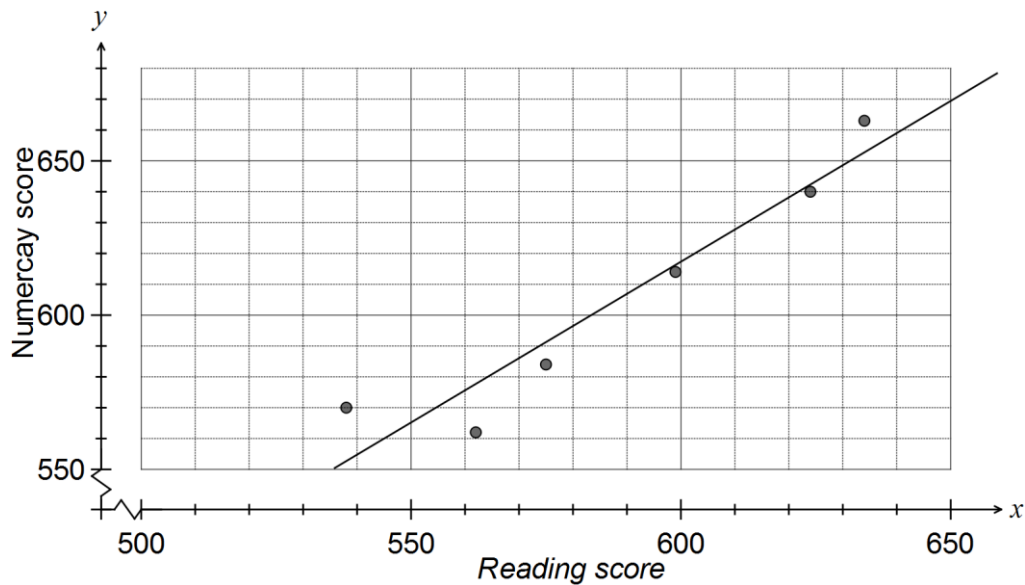
**(2 marks)**

- (d) Park authorities plan to create a second pathway from A to C. Explain whether this additional pathway will change your answer to (c).

**(1 mark)**

**Question 4****(11 marks)**

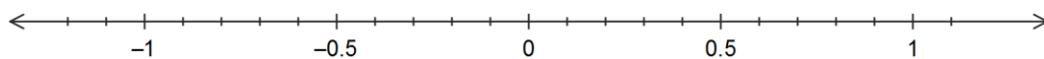
Researchers looking for an association between reading and numeracy levels of students compared achievement at six schools using NAPLAN test results. The graph below shows the average reading and numeracy scores for the schools and the linear regression model  $y = 1.042x - 8.055$  calculated from the data.



- (a) Describe, in words, the association between the variables  $x$  (reading score) and  $y$  (numeracy score) for these schools in terms of direction and strength. (2 marks)

- (b) Consider the correlation coefficient  $r$  between the variables  $x$  and  $y$ .

- (i) Place a cross on the scale below for your estimate of  $r$ . (1 mark)



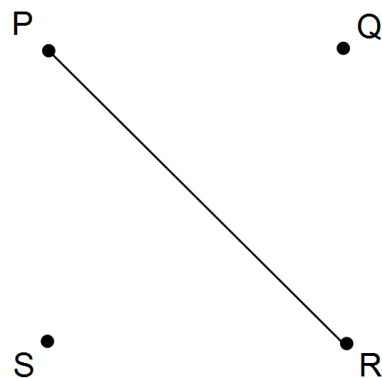
- (ii) Would you expect  $r$  to increase or decrease if the data point (538, 570) was removed from the data set? Explain your answer. (2 marks)

- (c) A principal looking at the data concluded that because students at her school performed well at reading then they would perform well at numeracy. Comment on her reasoning. (1 mark)
- (d) One of the data points is at (562, 562). Would you predict that another school with a reading score of 562 will also have a numeracy score of 562? Justify your answer. (2 marks)
- (e) Another data points is at (634, 663). Write down a calculation to determine the residual for the linear regression model at this point, but do **not** evaluate it. (2 marks)
- (f) State one way the researchers could improve the reliability of their findings when investigating the association between reading and numeracy levels of students. (1 mark)

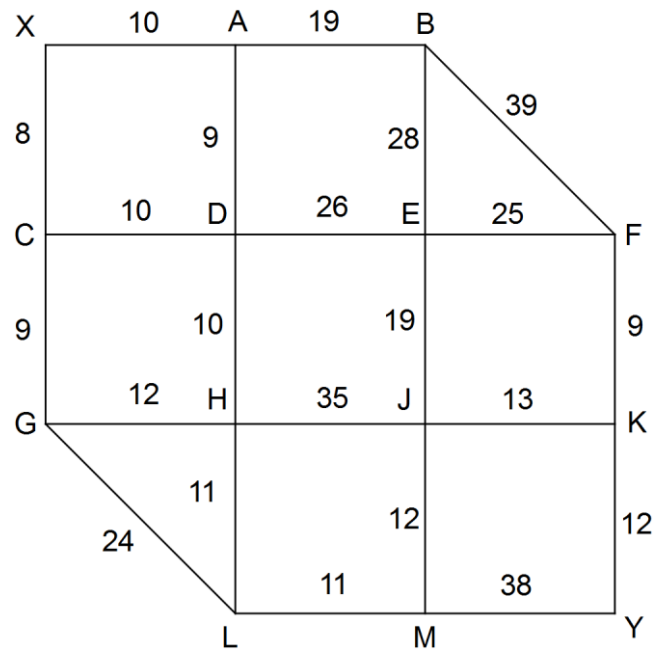
### Question 5

**(6 marks)**

- (a) Complete the non-directed graph below using the following adjacency matrix. (2 marks)

$$\begin{array}{c} P \\ Q \\ R \\ S \end{array} \begin{bmatrix} 0 & 0 & 1 & 2 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 2 \\ 2 & 0 & 2 & 0 \end{bmatrix}$$


- (b) The number on each edge of the network shown below is the time, in minutes, required to travel between the vertices at the end of the edge. Determine the shortest time to travel from X to Y. List the vertices visited in order, from first to last. (4 marks)





**Question 6****(8 marks)**

(a) A sequence is defined by  $T_{n+1} = T_n + 10$ ,  $T_1 = 45$ .

(i) Determine the next two terms of the sequence. (1 mark)

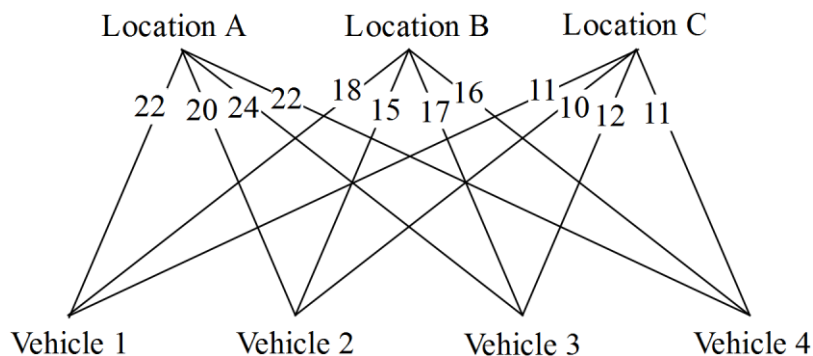
(ii) State a rule for the  $n^{\text{th}}$  term of this sequence. (2 marks)

(iii) Determine  $T_{45}$ . (1 mark)

(b) The first-order recurrence relation  $T_{n+1} = aT_n + b$  was used with  $T_1 = 3$  to calculate  $T_2 = 4$  and  $T_3 = 7$ . Determine the values of  $a$ ,  $b$  and  $T_5$ . (4 marks)

**Question 7****(6 marks)**

A transport company has packages to collect from three locations A, B and C, and has four vehicles that are available. The graph below shows the current distances of each vehicle from the locations in kilometres.



- (a) Represent the information in the graph as a matrix. (1 mark)

- (b) Show use of the Hungarian algorithm to determine which vehicle should collect which package in order that the total distance travelled by the vehicles is a minimum and state what this minimum distance is. (4 marks)

- (c) If the initial distance of vehicle 3 from location A was reduced by 2 km, explain what effect, if any, this would have on your answer to (b). (1 mark)

**Additional working space**

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

