

Semester One Examination 2017 Question/Answer Booklet

MATHEMATICS APPLICATIONS UNIT 3

Section Two: Calculator-assumed

Student Name: _____

Teacher's Name: _____

Time allowed for this section

Reading time before commencing work: ten minutes
Working time for paper: one hundred minutes

Material required/recommended for this section

To be provided by the supervisor

This Question/Answer booklet
Formula Sheet (retained from Section One)

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
correction tape/fluid, erasers, ruler, highlighters

Special Items: drawing instruments, templates, notes on two unfolded sheets of A4 paper,
and up to three calculators approved for use in the WACE examinations.

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

	Number of questions available	Number of questions to be attempted	Suggested working time (minutes)	Marks available
Section One Calculator—free	8	8	50 minutes	50
Section Two Calculator—assumed	9	9	100 minutes	100
				150

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2017*. Sitting this examination implies that you agree to abide by these rules.
2. Answer the questions according to the following instructions.

Section Two: Write answers in this Question/Answer Booklet. Answer **all** questions.

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.

It is recommended that you **do not use pencil**, except in diagrams.

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 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. The Formula Sheet is **not** handed in with your Question/Answer Booklet.

Section Two: Calculator–assumed**100 marks**

This section has **nine (9)** questions. Attempt **all** questions. Write your answers in the spaces provided.

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(s) that you are continuing to answer at the top of the page.

Working time: 100 minutes

Question 9 (8 marks)

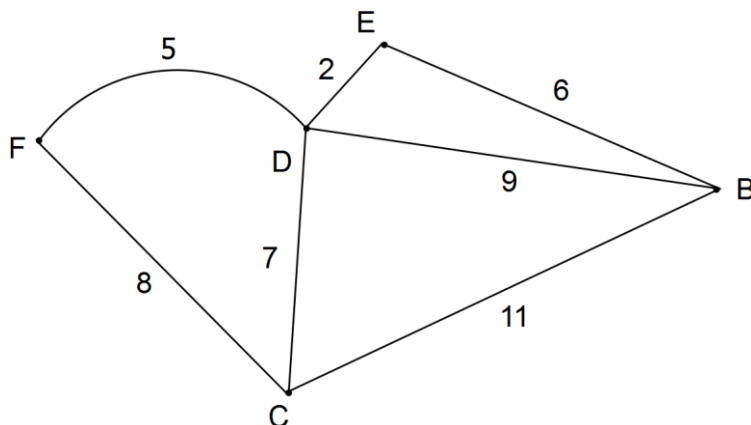
A high school for Years 7 – 12 has been built in a newly established housing development and opened on 1st January 2016. The expected annual Year 7 student population is based on the following:

$$X_n = 1.015X_{n-1} \quad X_0 = 240$$

- (a) The Principal of the school was only expecting a beginning population of 160. How many more students were enrolled? (1 mark)
- (b) Determine the annual percentage growth rate of the Year 7 student population. (1 mark)
- (c) Given no students leave throughout the year, determine the year 7 population at the end of each year for the first three years of the school's operation. (3 marks)
- (d) During which year is the Year 7 population 20% more than the original population? (2 marks)
- (e) Determine the year when all year levels i.e. years 7 – 12 will have students. (1 mark)

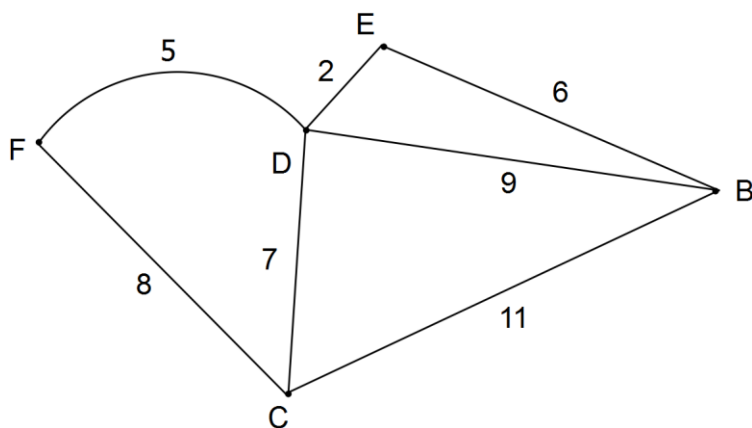
Question 10 (15 marks)

(a) The graph below shows the distances (in '00 kilometres) between several places for a regional airline company.



- (i) Places E and D are connected to each other by one or more edges.
They are said to be _____ places/vertices. (1 mark)
- (ii) Which place is directly connected to all other places? _____ (1 mark)
- (iii) Determine the shortest route and distance between F and B. (2 marks)

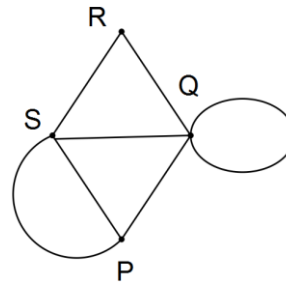
(b) The graph in (a) (shown below) is not a complete graph.



- (i) Determine the least number of edges that need to be added to make it a complete graph. (1 mark)
- (ii) Draw the complete graph on the graph above. (1 mark)

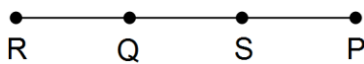
Question 10 continued

(c) The graph below is not a simple graph.



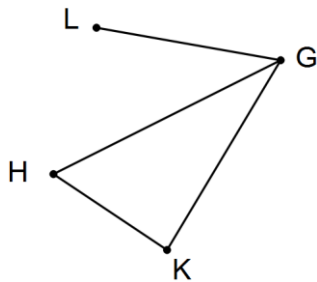
(i) Explain why it is not a simple graph. (2 marks)

(ii) Is the graph below a subgraph of the above? (1 mark)



(iii) Draw a subgraph with only two edges. (1 mark)

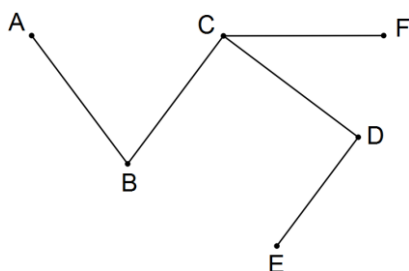
(d) Redraw the graph below without the bridge between G and L. (1 mark)



(e) Complete the table below showing the number of vertices a complete graph would have given the number of edges. (2 marks)

Vertices	2	3	4	5	6		50
Edges	1	3	6		15	45	1225

(f) Redraw the following to show that it is a bipartite graph. (2 marks)



Question 11 (11 marks)

1200 senior high school students were asked to complete a survey to determine the mode of transport they use to travel to school. The following statistics were obtained.

- There 720 girls in the school.
- 360 students ride a bike to school.
- 30% of students travelled by car.
- 50% of the boys rode bikes to school.
- The same number of boys and girls travelled by car.

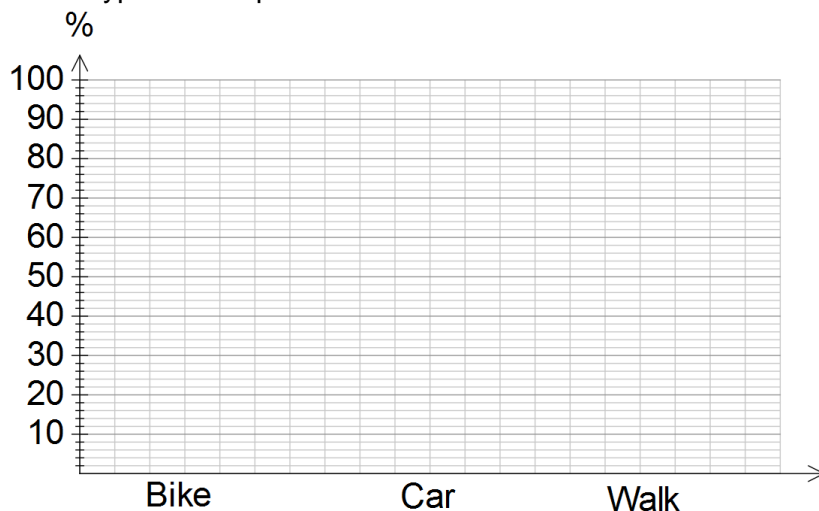
(a) Complete the percentage two-way table below. (4 marks)

Transport/Gender	Boys	Girls	Total
Bike			
Car			
Walk			
Total			100%

(b) The data was further analysed to determine the gender and type of transport used.

Transport/Gender	Boys	Girls	Total
Bike	67	33	100%
Car	50	50	100%
Walk	12.5	87.5	100%

(i) Represent this data in a proportional column graph where the columns reflect the type of transport used. (3 marks)



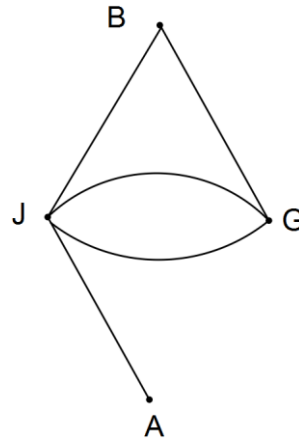
(ii) State how the proportions change in each category of Gender as you move across the Transport categories. (2 marks)

(iii) Determine the number of girls that did not travel by car? (2 marks)

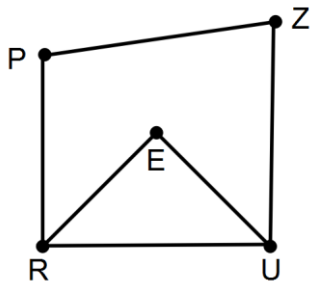
Question 12 (8 marks)

(a) Complete the matrix and graph using the information given. (2 marks)

	B	G	J	A
B	1	1	1	0
G	1	0		1
J	1	2	0	1
A	0	1	1	0

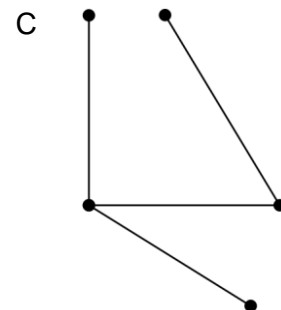
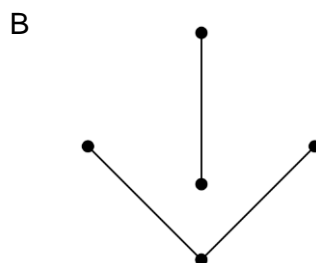
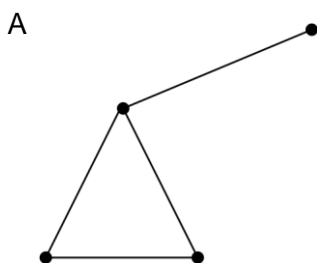


(b) (i) Explain why the graph below is a semi – Eulerian graph. (2 marks)



(ii) State the semi – Eulerian path. (1 mark)

(c) Which of the following is a tree? Explain why the other graphs are not trees. (3 marks)



Question 13 (6 marks)

Louisa borrows an amount of a money to purchase her first car with repayments that she can easily afford. The following equation shows the amount she borrowed and her monthly repayments.

$$L_{n+1} = 1.00805 L_n - 225 \quad L_0 = 8500$$

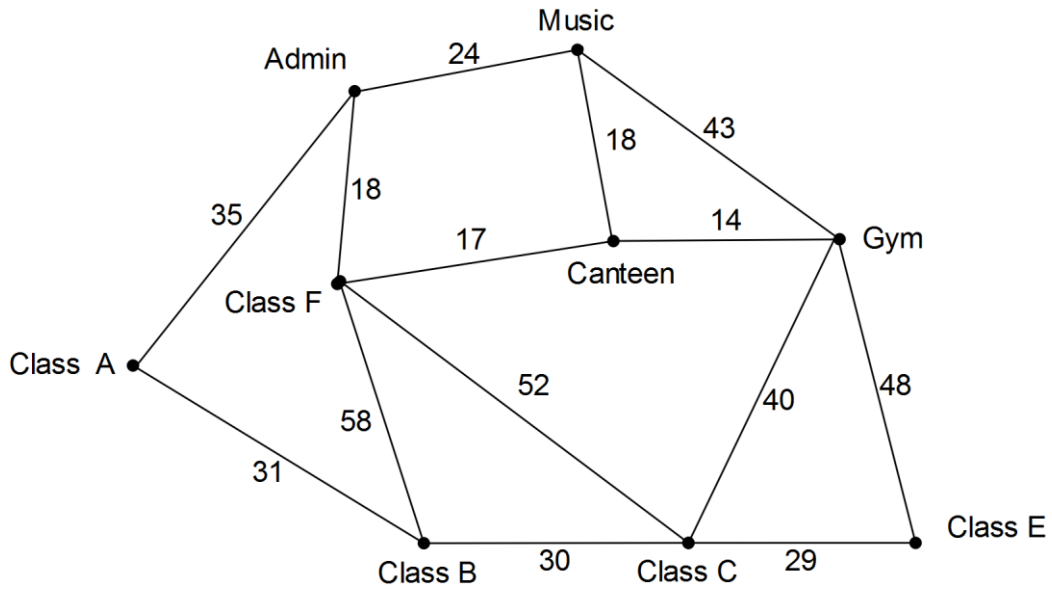
- (a)** Determine the following:
- (i)** The amount of the loan. (1 mark)

 - (ii)** The annual interest rate. (1 mark)

 - (iii)** The amount she has paid in the first 6 months of the loan (1 mark)
- (b)** Determine how many years and months it will take for Louisa to pay off the loan. (1 mark)
- (c)** Determine the amount of interest Louisa will pay over the period of the loan. (2 marks)

Question 14 (5 marks)

The network below shows the distance in metres between various rooms in a primary school.



(a) Determine the shortest distance and path from the Admin building to Class E. (3 marks)

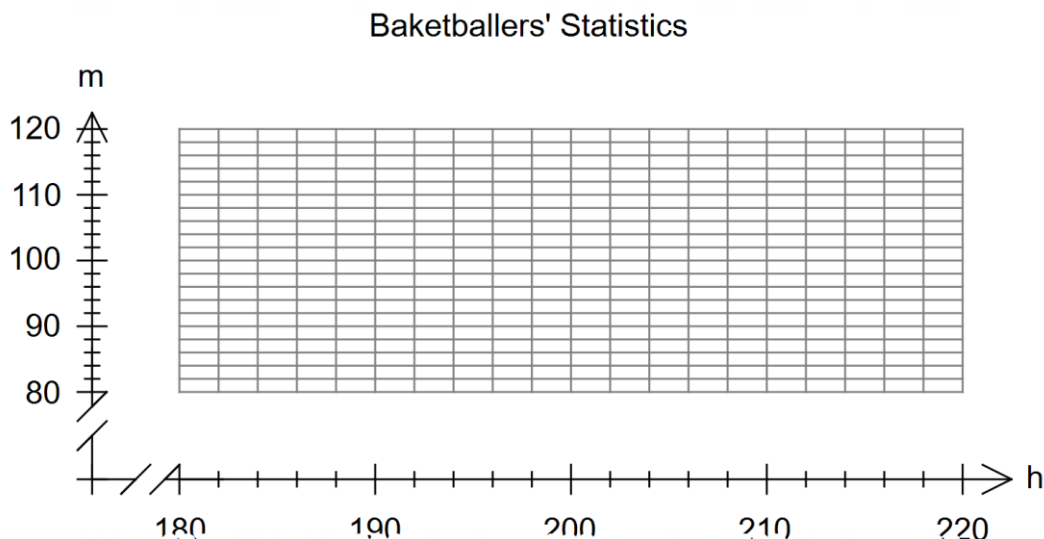
(b) The Principal needs to visit each class once only. Determine the shortest distance and path he can take for the return journey from his Office in the Admin building. He may need to visit some of the other rooms as well. (2 marks)

Question 15 (18 marks)

A team of ten basketballers had their height and mass statistics recorded. The data is displayed in the table below.

Height (h)	200	202	204	186	204	198	208	198	188	198
Mass (m)	98	106	102	94	109	98	110	100	88	88

- (a) Plot the data from the table above. (3 marks)



- (b) (i) Calculate the correlation coefficient r_{hm} of the above data (correct to two decimal places). (2 marks)
- (ii) Describe the linear relationship between the two variables. (2 marks)
- (c) One piece is classified as an outlier. State the height of the outlier. (1 mark)

The outlier is removed.

- (d) When the outlier is removed, the new r_{hm} is 0.89.
- (i) Determine coefficient of determination (correct to two decimal places). (1 mark)
- (ii) Using your answer in d (i) what does this tell us about the data. (1 mark)

Question 15 continued

- (e) Determine the equation of the least squares regression line that models the relationship between the basketballers' statistics (to two decimal places). (2 marks)
- (f) (i) Determine the (\bar{h}, \bar{m}) for the new data set. (1 mark)
- (ii) Plot this point on the graph. (1 mark)
- (iii) Accurately draw in the line of regression. (1 mark)
- (g) Using your equation in (e) predict:
- (i) A player's mass if their height is 210 cm. (1 mark)
- (ii) Explain why the above prediction is not reliable. (1 mark)
- (h) "The strong value of r indicates that a basketballer is heavy because he is tall." Comment. (1 mark)

Question 16 (18 marks)

Consider the four scenarios.

1. The age of students and how fast they can run.
2. The number of hours playing computer games and the score you receive for a test.
3. A person's shoe size and the colour of their eyes.
4. The length of time (in months) that fertiliser has been applied to a tomato bush and the mass of tomatoes ripening on the bush in kilograms.

(a) The Year 12 Maths Applications teacher was telling her class that based on data she had collected, scenario 2 showed that the more students played computer games the lower their test scores were.

(i) Draw a clearly labelled scatterplot for this scenario. (2 marks)

(ii) A student in the class, stated that he was a heavy user of computer games and yet his mean course mark was 88%. Comment on this statement. (2 marks)

(b) The line of regression equation for scenario 4 is given by the equation $\hat{y} = 2 + 1.25x$, where x is the length of time (in months) that fertiliser has been applied.

(i) Is the trend increasing or decreasing? (1 mark)

(ii) What mass of tomatoes would you predict for the 8th month? (1 mark)

(iii) When is the mass of tomatoes 52 kilograms? (1 mark)

(iv) What is the average mass of tomatoes ripening per month? (1 mark)

Question 16 continued

(c) (i) Choose a correlation coefficient range for scenario 3 from the following. (1 mark)

0 – 0.3, 0.31 – 0.7, 0.71 – 1.00

(ii) Explain why you chose this value. (1 mark)

(d) The correlation coefficient for scenario 1 is 0.83.
Comment on this value. (2 marks)

(e) The correlation coefficient for scenario 2 is -0.93.
Which of the two scenarios (1 or 2) have the stronger correlation coefficient value? Explain. (2 marks)

(f) The data for scenario 1 was only collected for people between the ages of 6 to 15 years of age. The fastest runner in the school, who is aged 14 years of age, was excited when he was told his predicted time was very reliable. Apart from the high correlation coefficient, why would this prediction be reliable? (1 mark)

(g) The two graphs below show scenario 4. The After graph shows the outlier removed.

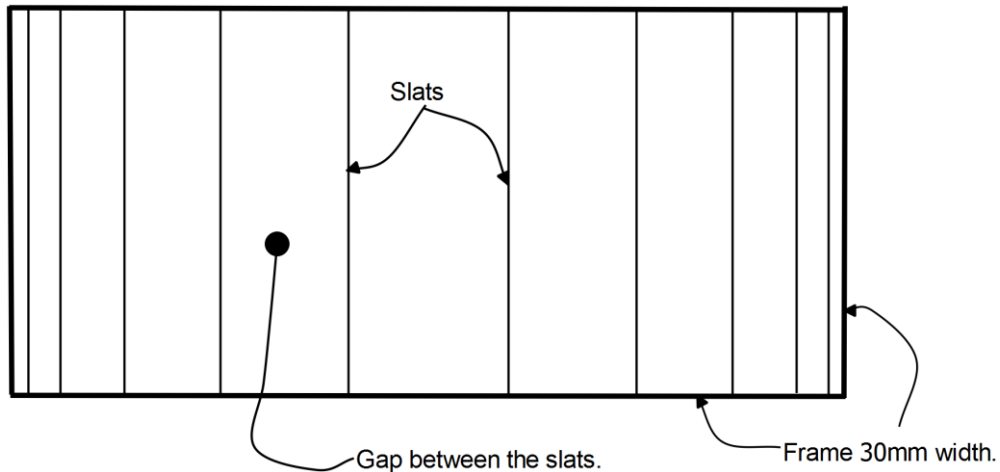


(i) Explain the effect on the correlation coefficient value. (1 mark)

(ii) Explain the effect on the prediction of future values. (2 marks)

Question 17 (11 marks)

A rectangular gate has a frame on all sides as shown. The frame is filled with thin 100 mm slats with gaps of differing widths between the slats, as shown. The first gap is 5 mm from the left-hand section of frame. The second gap is 8 mm from the slat. The next gap is 3 mm wider than the second gap. When the gap becomes 20 mm in size, the gaps then reduce in size so that the appearance of the gate is symmetrical about the centre.



- (a) Determine a recursive definition for the gaps between the slats up to and including the 20 mm gap. (2 marks)

- (b) Determine the gap between the third and fourth slat. (1 mark)

- (c) Determine the amount of gap between the second and fifth slat. (2 marks)

- (d) Determine a recursive definition from the 20 mm gap to the other side of the frame. (2 marks)

- (e) Determine the total amount of gap between the two frames. (2 marks)

- (f) The frame itself is made of metal 30 mm wide. Calculate the width of the gate, including the frame. (2 marks)

END OF QUESTIONS

Additional working space

Question number(s):

WATP acknowledges the permission of School Curriculum and Assessment Authority in providing instructions to students.