**Papers written by Australian Maths Software**

# SEMESTER ONE

# YEAR 12, UNIT 3

# MATHEMATICS APPLICATIONS
# REVISION 2
# 2016

# Section Two
# (Calculator–assumed)

**Name:** _____

**Teacher:** _____

**TIME ALLOWED FOR THIS SECTION**

Reading time before commencing work: 10 minutes
Working time for section: 100 minutes

**MATERIAL REQUIRED / RECOMMENDED FOR THIS SECTION**

**To be provided by the candidate**

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

Special items: drawing instruments, templates, notes on up to two unfolded sheet 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.

**To be provided by the supervisor**
Question/answer booklet for Section Two.
Formula sheet retained from Section One.
**Structure of this examination**

| | 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 | 52 | 35 |
| **Section Two Calculator—assumed** | **9** | **9** | **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.

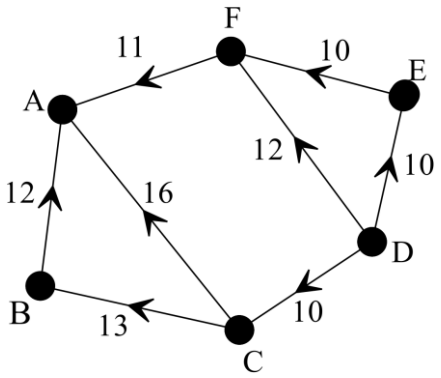
5. Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two 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.

7. (4 marks)

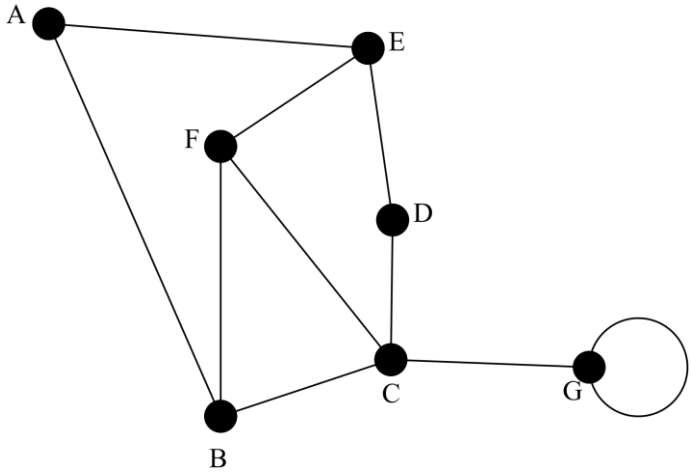
The vertices on the following graph represent towns and the numbers represent cycling times between the towns travelling in the indicated direction.
Consider the following graph:




(a) Choose, with reasons, which of the following terms best describes the graph.

*Bipartite graph, simple graph, complete graph, directed graph.* (2)

(b) Label the loop and a vertex with degree 4 in the graph below. (2)



8. (27 marks)

(a) The following scatter diagram shows the heart rate (i.e. beats per minute) against the temperature of the body.

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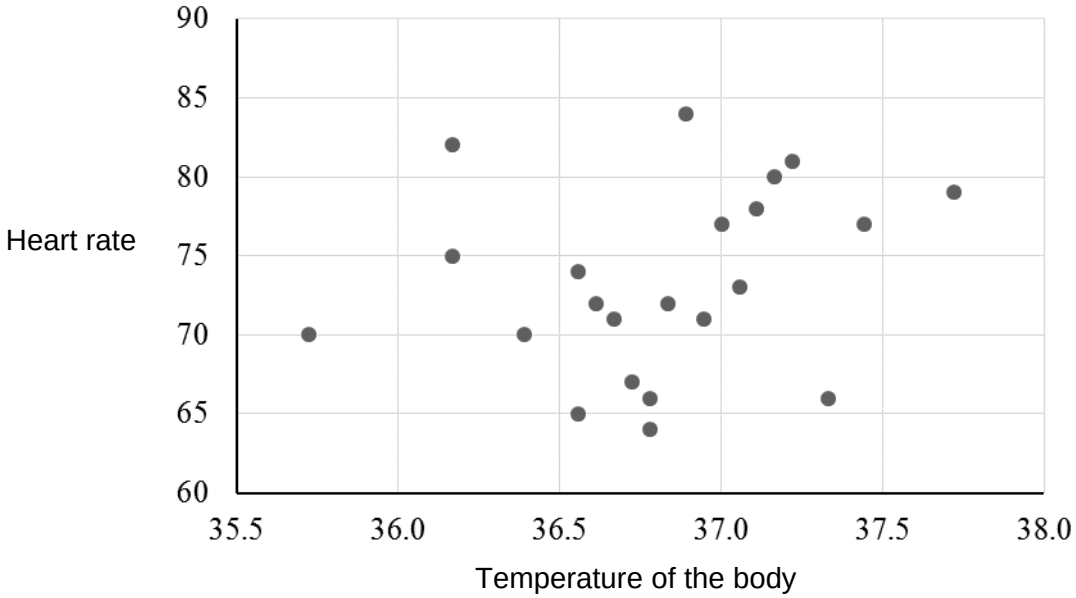



(i) Comment on the relationship between the temperature of the body and the corresponding heart rate. (2)

(ii) Suggest a value for the correlation between the temperature of the body and the corresponding heart rate. (No calculations are required.) (1)

(b) The following table shows the weight and height of boys aged 2 to 15.

| Age (years) | Height (cm) | Weight (kg) |
|---|---|---|
| 2 | 86 | 12.5 |
| 3 | 93 | 13.2 |
| 4 | 102 | 15.2 |
| 5 | 103 | 17.8 |
| 6 | 114 | 19.7 |
| 7 | 120 | 20.9 |
| 8 | 124 | 22.5 |
| 9 | 129 | 24.9 |
| 10 | 135 | 27.3 |
| 11 | 140 | 31.3 |
| 12 | 146 | 35 |
| 13 | 152 | 39.9 |
| 14 | 158 | 43.8 |
| 15 | 163 | 53 |

(i) Describe the relationship between age and height in terms of direction (positive/negative), form (linear/non-linear) and strength (strong/moderate/weak). (3)

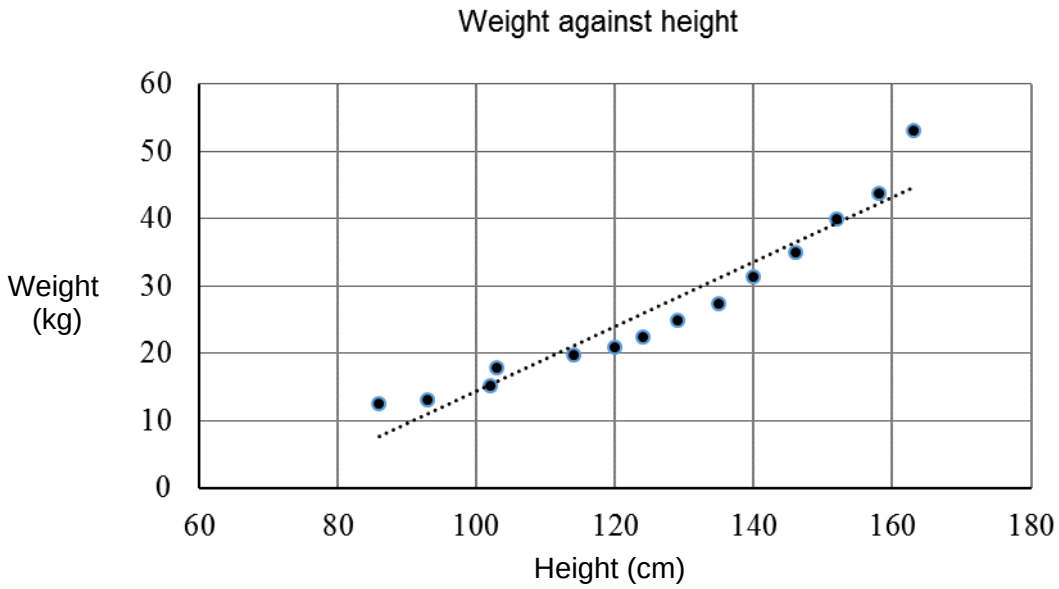
(ii) Describe the shape of a scatterdiagram that illustrates the relationship between age and height. (2)

(iii) Explain why it is not valid to predict the height of an 18 year using this data. (2)

(iv) Consider the two variables weight and height.
Identify the response variable and the explanatory variable. (2)

(v) Find the correlation between height and weight. (2)

The scatterdiagram of the two variables is shown below together with least squares regression line.




(vi) Determine the equation of the least squares regression line. (3)

(vii) Given a boy's height is 115 cm, predict his weight and comment on the validity of your prediction. (3)

(viii) Estimate the boy's age. (2)

Consider the scatterdiagram on the previous page.

(ix) Do you consider a linear fit is the best to use for this data? Give your reasons. (2)

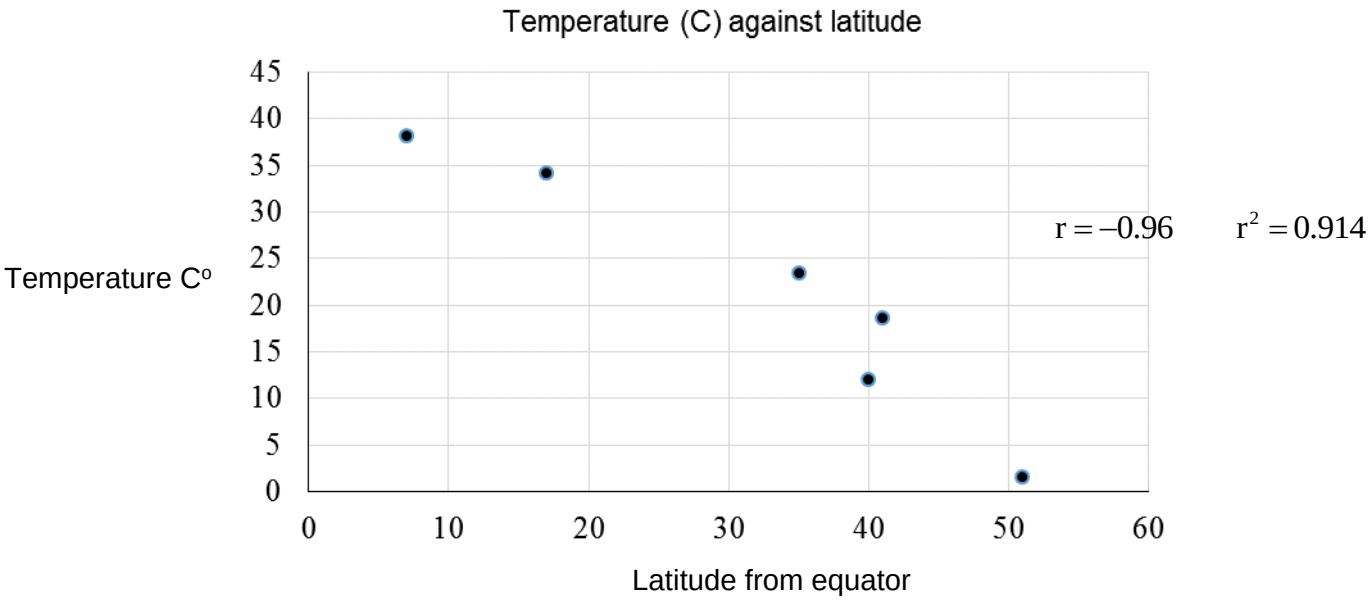
(x) Determine the coefficient of determination and use it to comment on the strength of the linear association between weight and height. (3)

9. (6 marks)

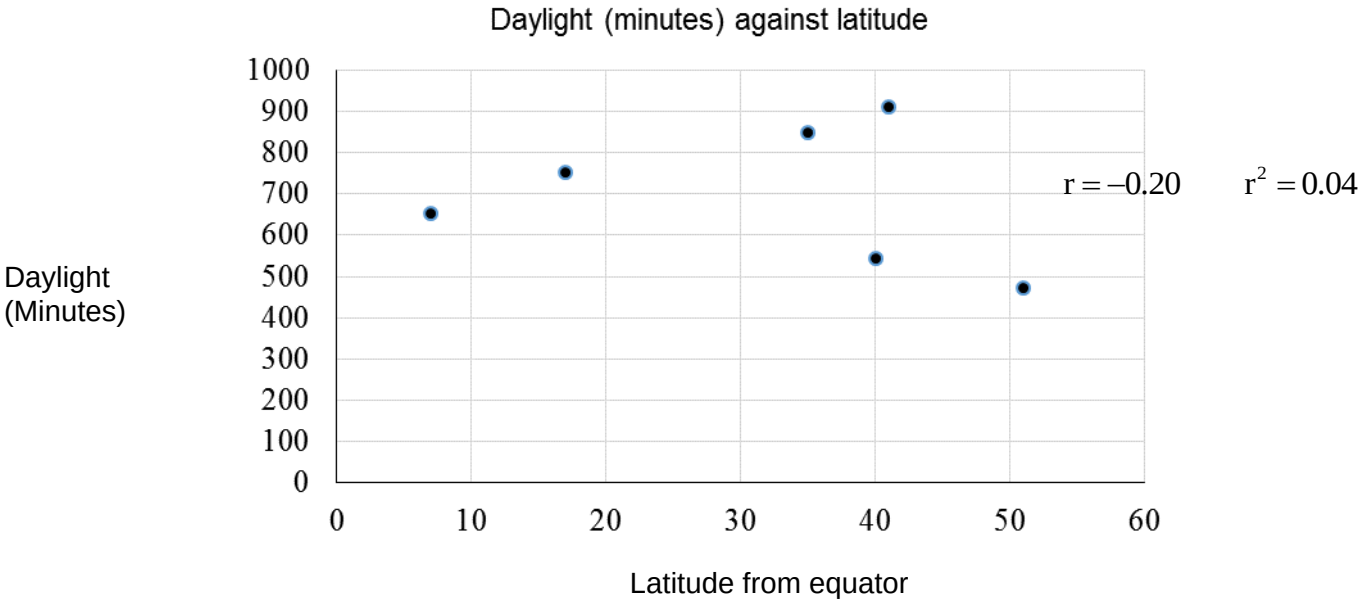
Consider the following data below.

| Latitude | Temperature C | Daylight (minutes) |
|---|---|---|
| 41 | 18.6 | 912 |
| 35 | 23.5 | 850 |
| 17 | 34.2 | 752 |
| 7 | 38.2 | 652 |
| 40 | 12 | 545 |
| 51 | 1.6 | 473 |

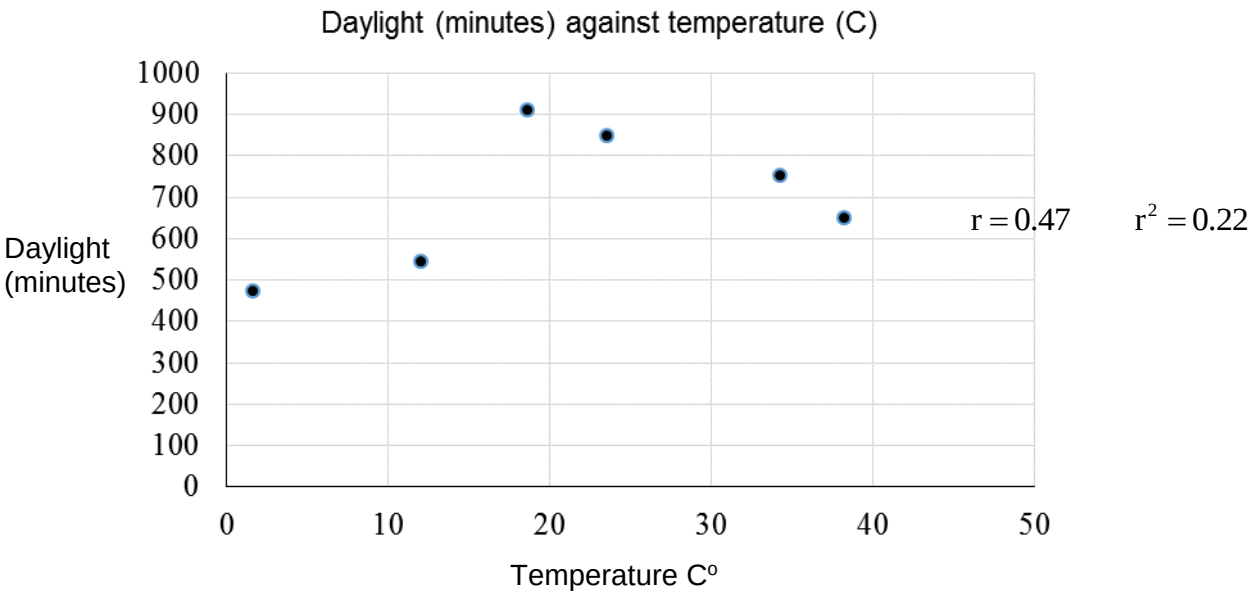
(a)




(b)



(c)




Write up a summary of the relationships between the three sets of data including the strength and direction of each relationship including whether or not it is useful to use the relationship for prediction. (You may use point form.) (6)

10. (22 marks)

(a) A particular plant has been observed to grow to a height of about one metre in the first year. In each subsequent years, the growth is 60% of the previous year's growth.

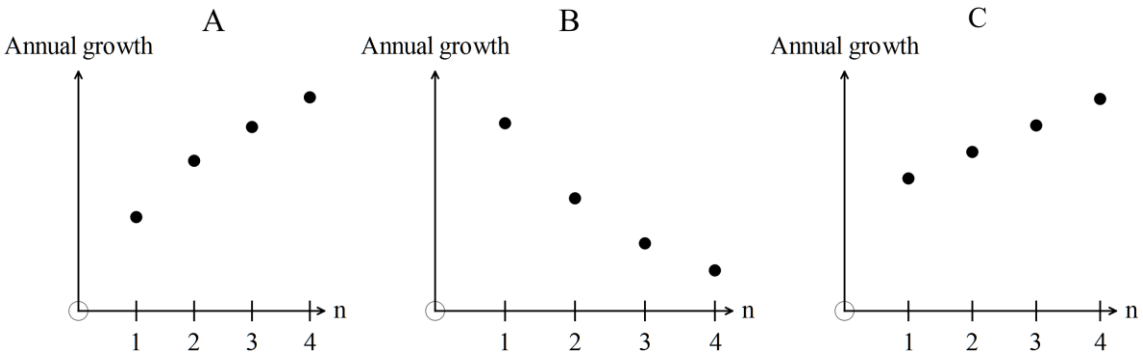
(i) Write down the rule for the growth in the nth year in terms of n. (1)

(ii) Find the growth in the 2nd year. (1)

(iii) Complete the chart below (2)

| Year n | Annual Growth |
|---|---|
| 1 | 1 m |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

(iv) Select the graph that best describes the annual growth of the plant. (2)




(v) How tall is the plant after 3 years? (1)

(b) The rungs of a wooden ladder go from 30 cm wide at the top to 50 cm wide at the base. The ladder has six rungs.

(i) What is the difference between the length of adjacent rungs? (3)

(ii) What is the length of the two middle rungs? (2)

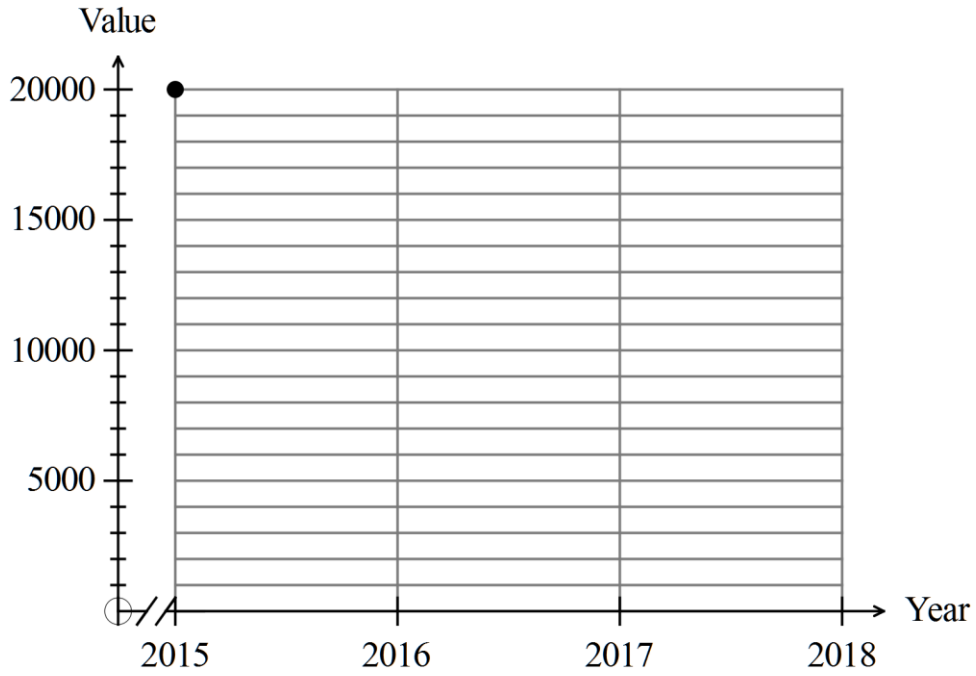
(iii) What is the total length of wood needed to make the rungs? (2)

(c) A car depreciates at a rate of 20% per annum.
Jamie bought a second hand car for $20 000 at the beginning of 2015.

(i) Complete the following table (3)

| Beginning of year | Value |
|---|---|
| 2015 | $20 000 |
| 2016 | |
| 2017 | |
| 2018 | |

(ii) Sketch the data on the set of axes below (2)




(iii) In what year was the car worth less than $5 000? (3)

11. (6 marks)

Mrs Jones lived in an old house.

Local council rates for her house were $2500 in 2014.
Each year the rates increased by 5%.
Each year there is a flat rate charge of $250 for rubbish collection.

(a) Find the cost of the rates and rubbish collection after one year. (1)

(b) Find the cost of the rates and rubbish collection after two years. (1)

(c) Find an expression for the cost of the rates and rubbish collection after n years. (1)

Mrs Jones could no longer stay in the house if the rates and rubbish charges exceeded $4000.

(d) In what year would this occur? (3)

12. (5 marks)

Judy took out a loan of $10 000. The total charges (interest plus bank charges) per year were $1000.

(a) If Judy paid $1 500 per year, does her debt increase or decrease? (1)

(b) What amount would she pay per year if the debt neither increased nor decreased? (1)

(c) How much does she owe after three years if she pays $1 500 per annum? Show all working.
(Assume the total charges remain the same.) (3)

13. (11 marks)

The following proposal was put to the public
"*Local politicians who are found to be misusing public funds should resign immediately."*

The results of a survey show people have different opinions. Some live in the electorate of the person who rorted the system and others live in different electorates. The results are tabulated below.

| | Live in electorate | Do not live in the electorate | |
|---|---|---|---|
| Resign | 120 | 480 | 600 |
| Not resign | 80 | 120 | 200 |
| | 200 | 600 | **800** |

(a) (i) Construct a two way table illustrating the breakdown of percentages of those living within and not within the electorate amongst those that want the resignation. Do the same for those who do not want the resignation. (3)

| | Live in electorate | Do not live in the electorate | |
|---|---|---|---|
| Resign | | | 100% |
| Not resign | | | 100% |

(ii) Comment on what the percentages reveal. (2)

(b) (i) Construct the two-way table that illustrates the breakdown of percentages of those that want the politician to resign and those who do not want the resignation for those that live in the electorate.
Do the same for those who live in a different electorate. (3)

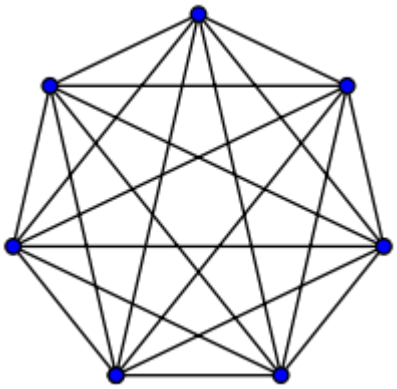
| | Live in electorate | Do not live in the electorate |
|---|---|---|
| Resign | | |
| Not resign | | |
| | 100% | 100% |

(ii) What can you conclude from the table? (2)

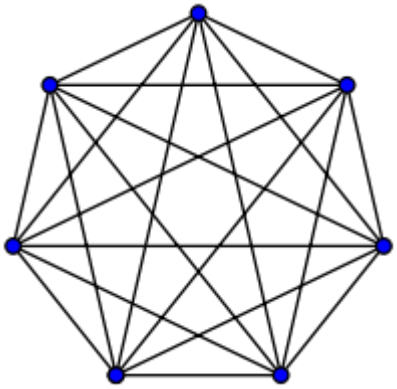
(iii) Comment on the possible reason for the differences. (1)

14. (13 marks)

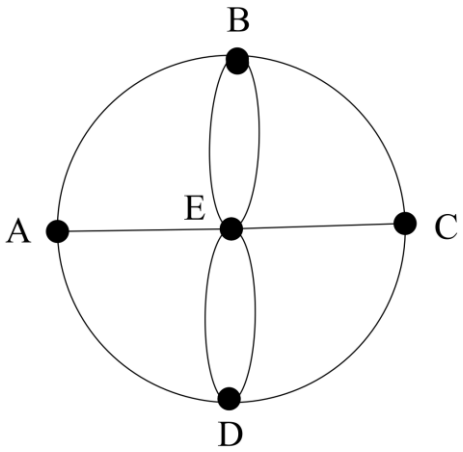
(a) (i) Explain why the graph below is Eulerian. Give your reasons. (2)



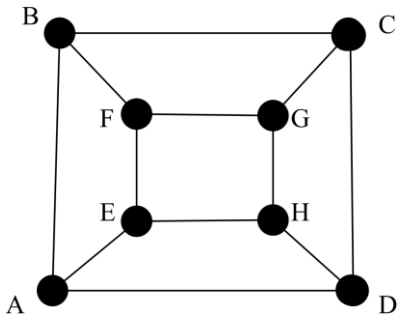
(ii) Illustrate and explain why the graph below is Hamiltonian. (2)



(iii) Illustrate and explain why the graph below is semi Eulerian. (2)

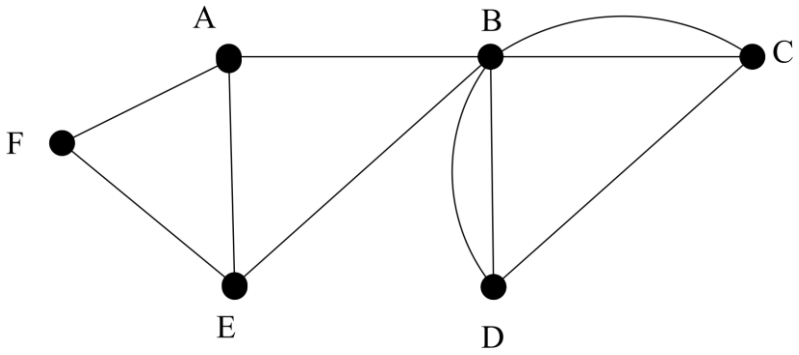



(iv) Illustrate and explain why the graph below is semi Hamiltonian. (2)



(b) An athletics club introduces a game to keep the young boys interested. They have to run over a series of paths from one point to another running over every path exactly once.

(i) Explain why this is not possible on the set of paths below. (2)

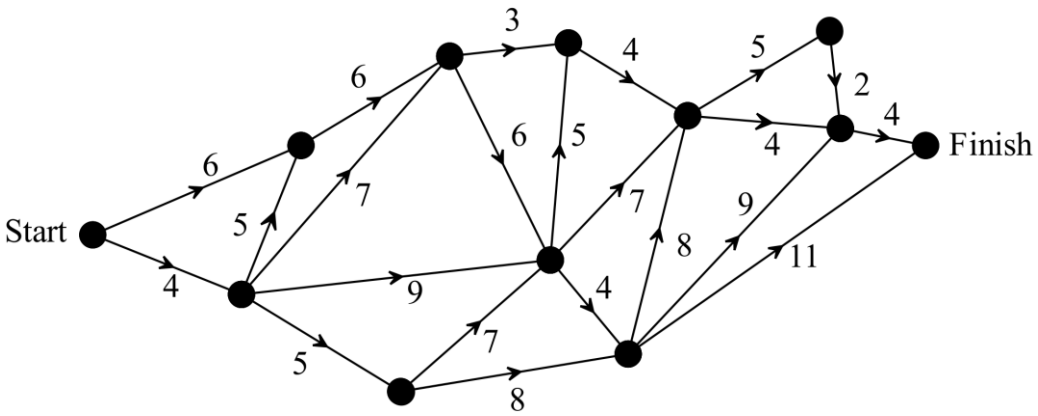



(ii) Draw one more arc on the graph to enable the run. (1)

(iii) State the starting and finsihing points of the run. (2)

15. (4 marks)

Highlight the route that uses the shortest distance between “start” and “finish”.
on the graph.




What is the shortest distance between “start” and “finish? (4)

**END OF SECTION TWO**