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### Semester One Examination, 2020

### Question/Answer booklet

# MATHEMATICS

If required by your examination administrator, please place your student identification label in this box

**APPLICATIONS**

**UNIT 3**

## Section One:

## Calculator-free

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| WA student number: In figures |  |  |  |  |  |  |  |  |  |  |

In words

Your name

|  |  |
| --- | --- |
| Number of additional answer booklets used (if applicable): |  |

## Time allowed for this section

Reading time before commencing work: five minutes

Working time: 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 material. 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 examination |
| Section One: Calculator-free | 8 | 8 | 50 | 52 | 35 |
| Section Two: Calculator-assumed | 13 | 13 | 100 | 98 | 65 |
|  | | |  | **Total** | 100 |

|  |  |  |
| --- | --- | --- |
| Markers use only | | |
| Question | Maximum | Mark |
| 1 | 6 |  |
| 2 | 6 |  |
| 3 | 6 |  |
| 4 | 7 |  |
| 5 | 6 |  |
| 6 | 7 |  |
| 7 | 7 |  |
| 8 | 7 |  |
| S1 Total | 52 |  |
| S1 Wt (×0.6731) | 35% |  |
| S2 Wt | 65% |  |
| Total | 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 preferably using a blue/black pen.  
Do not use erasable or gel pens.

3. You must be careful to confine your answers to the specific question asked and to follow any instructions that are specific 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.

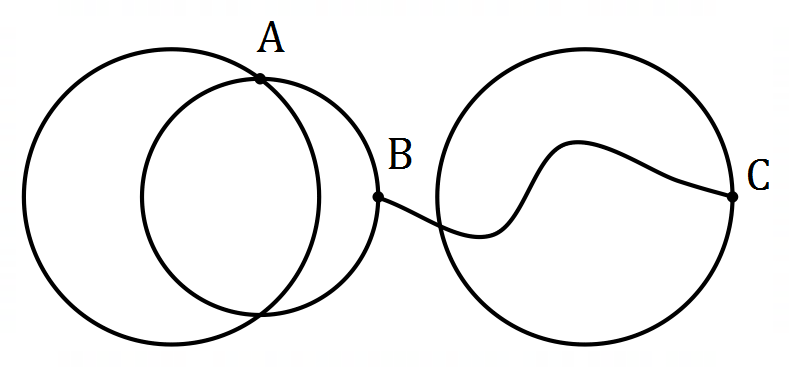
Section One: Calculator-free 35% (52 Marks)

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

Working time: 50 minutes.

Question 1 (6 marks)

Consider the following graph .



(a) Draw in the plane, to clearly show that it is planar. (2 marks)

(b) State the degree of each vertex and the degree sum for . (2 marks)

(c) Explain how to recognise a bridge in a connected graph and state, with justification, whether contains a bridge. (2 marks)

Question 2 (6 marks)

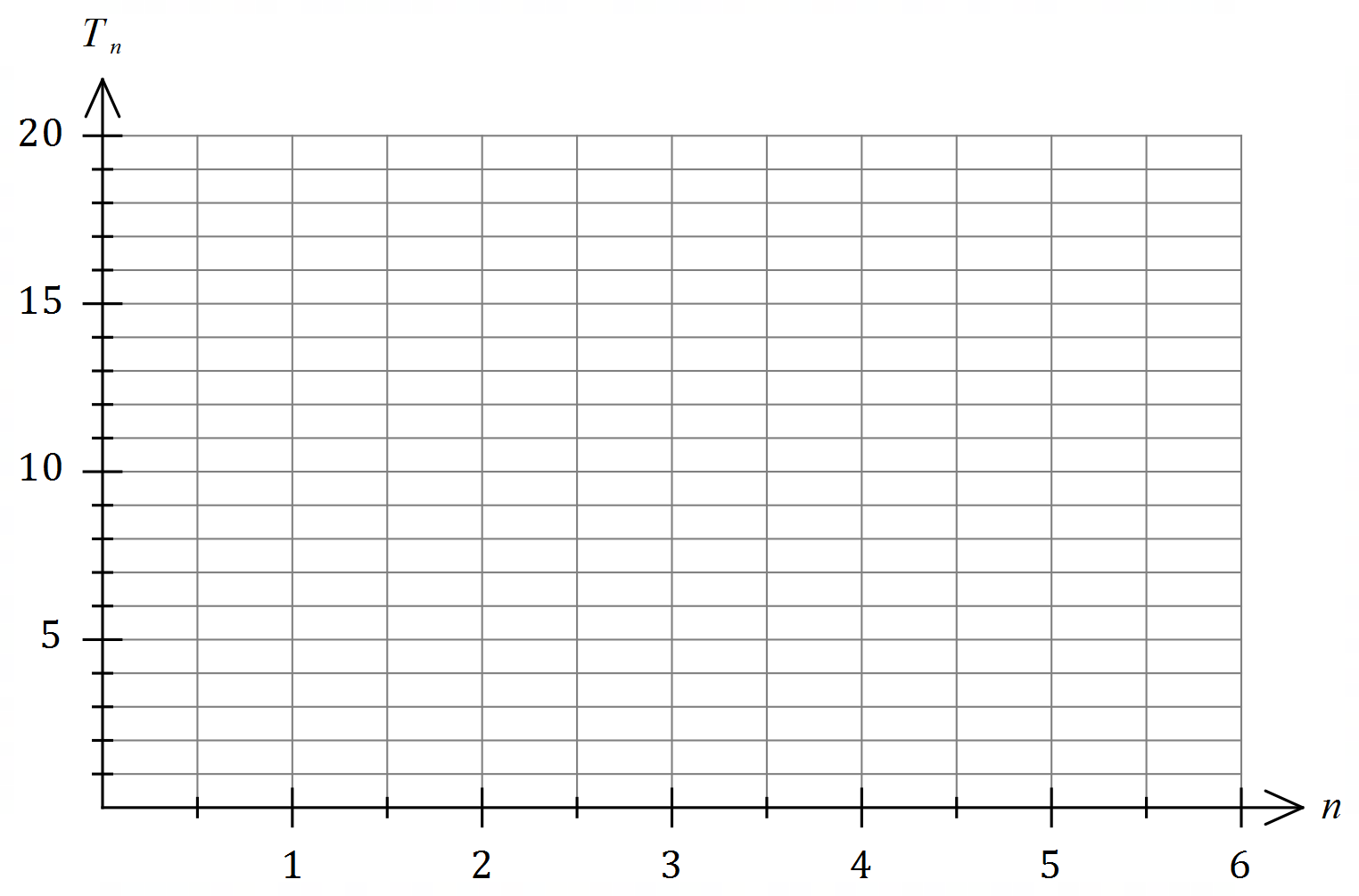
A recursive rule for a sequence is .

(a) Briefly explain which feature of the recursive rule indicates that the sequence is arithmetic.

(1 mark)

(b) Determine and . (2 marks)

(c) Graph the first six terms of the sequence on the axes below. (2 marks)



(d) What feature of the graph indicates that the sequence is arithmetic? (1 mark)

Question 3 (6 marks)

(a) Connected planar graph has vertices and edges.

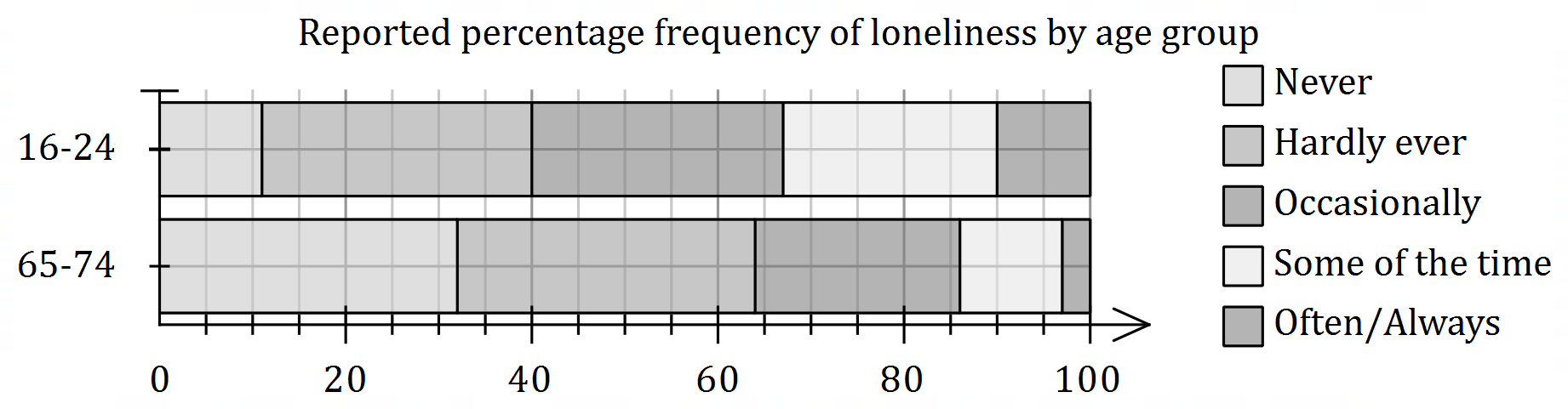
(i) Use Euler's formula to determine the number of faces in . (2 marks)

(ii) Sketch a possible graph . (2 marks)

(b) Graph has vertices and is Eulerian. The length of the Eulerian trail is . Sketch a possible graph . (2 marks)

Question 4 (7 marks)

A recent survey asked people their age and the question "How often do you feel lonely?". The responses for the age groups years and years are shown below. The categories in the key are shown from left to right in the stacked percentage frequency graph.



(a) State the second largest category for the age group. (1 mark)

(b) State the percentage of those

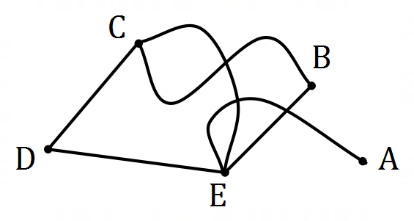
(i) in the age group who responded with 'Some of the time'. (1 mark)

(ii) in the age group who responded with 'Hardly ever' or 'Occasionally'. (1 mark)

(c) Use the graph to explain why the data suggests an association exists between feeling lonely and age. (2 marks)

(d) Briefly discuss non-causal explanations for the observed association. (2 marks)

Question 5 (6 marks)



Graph is shown. and are subgraphs of , so that each subgraph has vertices but one less edge than .

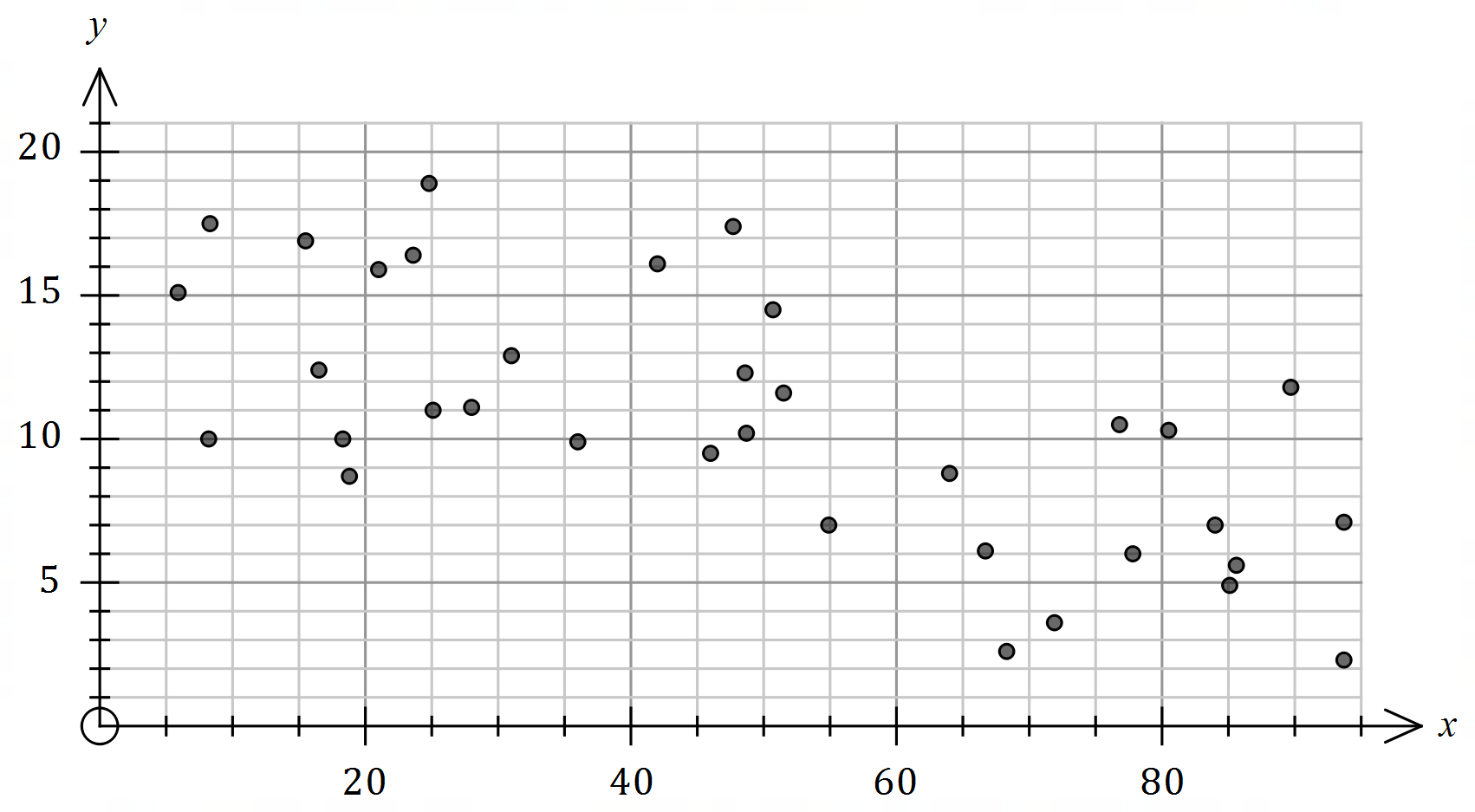
(a) does not satisfy Euler's formula. State which edge must be removed from , and show that does not satisfy Euler's formula. (3 marks)

(b) is bipartite. State which edge must be removed from , and draw to clearly show the partite sets. (3 marks)

Question 6 (7 marks)

The scatterplot below shows the number of PC's per people on the -axis and the

unemployment rate, as a percentage, on the -axis for a selection of countries in .



(a) Describe the strength and direction of the association between the variables. (2 marks)

(b) The equation of the least-squares line for the data is . Interpret the intercept and the slope of this line. (3 marks)

(c) A newspaper article used the graph to claim that increasing the number of PC's per person in a country caused the unemployment rate to fall. Comment on this claim.

(2 marks)

Question 7 (7 marks)

In a set of pages on a website, there are hyperlinks from page to page , from page to  
page , from page to page , from page to pages and , and from page to page .

(a) Construct digraph to show the above information, where pages are represented by vertices and links by directed edges. (2 marks)

(b) Construct an adjacency matrix for . (2 marks)

(c) List, starting at page and in the order visited, vertices in that form a

(i) walk of length . (1 mark)

(ii) cycle of length . (1 mark)

(iii) trail of length . (1 mark)

Question 8 (7 marks)

Every day, of the water in a tank is drained for crop irrigation and then the tank is topped up with kL of water. The tank has a maximum capacity of kL.

At the start of Day , before water is drained for the crops, the tank contains kL.

(a) Determine the amount of water in the tank at the start of Day . (2 marks)

(b) Determine a recursive rule for the amount of water, , in the tank at the start of Day .

(2 marks)

(c) Explain why the tank will never empty. (1 mark)

(d) State, with justification, whether the tank will overflow. (2 marks)

Supplementary page

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

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