

# MTG315123 GENERAL MATHEMATICS

## 2024 EXEMPLAR

### DISCLAIMER

This document is provided as an exemplar to illustrate the structure and types of questions that will appear in the final exam, and was developed in consultation with the General Mathematics Marking Coordinators. Please note the following important details:

- **Changes Implemented:** The 2023 General Mathematics (MTG315123) exam has been used as the basis for this exemplar. Criterion 3 questions have been removed from the sections on bivariate data analysis, growth and decay in sequences and finance. A new section (Section A) has been created exclusively for Criterion 3.
- **Impact on Question Flow:** The sections from which Criterion 3 has been removed have not undergone modifications to adjust the flow of questions and question items. As a result, these sections may not exhibit a seamless progression.
- **Purpose:** This exemplar is intended to provide an overview of the layout and nature of questions. It serves as a visual aid for students to understand what to expect in the actual exam.
- **Validity:** The content and structure in this exemplar may differ from the final exam paper. Students should refer to the official study materials and [MTG315123 General Mathematics External Assessment Specifications](#) for accurate preparation.

This document should be used for illustrative purposes only and not as a definitive guide for exam content.

Sample Assessment 2024

# GENERAL MATHEMATICS

MTG315123

## Section A Application, Investigation, Representation and Analysis

Pages: 20

Questions: 6

Information Sheet: 1

**Preparation time for this exam:** 15 minutes

**Suggested working time:** 36 minutes

### Instructions:

- Answer **all** questions and **all** items within each section.
- Write your answers in the spaces provided in this exam paper.
  - Spare diagrams have been provided at the end of each section. Indicate in the box provided if you have used the spare diagrams.
- TASC-approved calculators are allowed.
- The exam is **three (3)** hours in length. It is suggested that you spend **approximately 36 minutes**.
- The General Mathematics Information Sheet can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C3	/ 36

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EXEMPLAR

# Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
This Section <b>A</b>		6	6	36 minutes	36 marks
Section <b>B</b>		4	4	36 minutes	36 marks
Section <b>C</b>		5	5	36 minutes	36 marks
Section <b>D</b>		5	5	36 minutes	36 marks
Section <b>E</b>	Part 1 OR	4	4	36 minutes	36 marks
	Part 2	5	5	36 minutes	36 marks
<b>Totals</b>		<b>29</b>	<b>24 or 25</b>	<b>180 minutes (3 hours)</b>	<b>180 marks</b>

## Criterion

You **must** make sure your answers address:

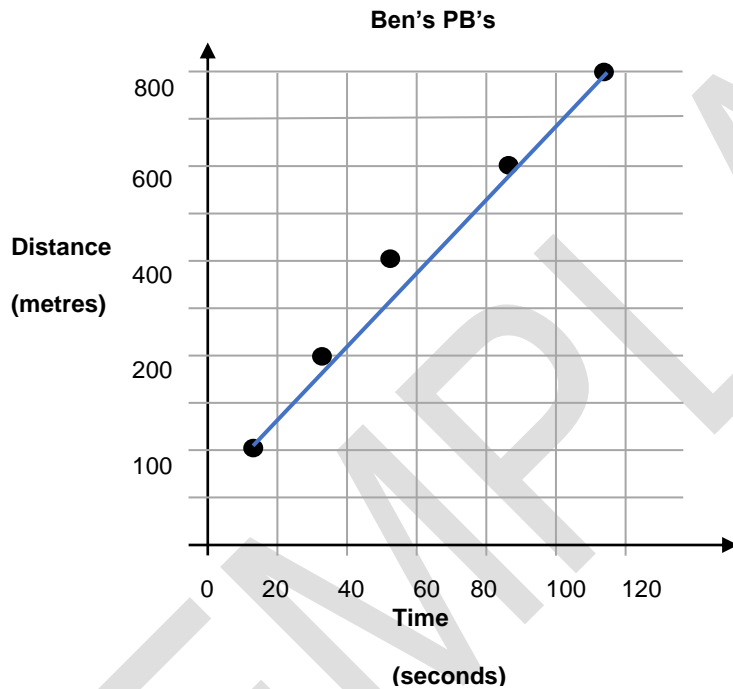
- Criterion 3 apply mathematical and statistical models to investigate, represent and analyse real-world situations and solve problems.

**Question 1**

Ben is a talented young runner and has the following PB's (Personal Best) for different distances.

Distance (metres)	100	200	400	600	800
Time (seconds)	12.5	25.6	52.3	83.4	113.9

Ben attempted to plot his data on a graph (shown below) but he **has made some errors**.



Spare diagram used (X)

a) On the graph above, circle the **one** point that has been plotted inaccurately.

There are at least **4 other errors (or omissions)** with Ben's graph.

b) Briefly describe or identify any **one** of these errors.

/1

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**Question 1 continues**

Question 1 continued

Marker use

Ben has recently started racing over longer distances.

Below is a new summary of all of Ben's PB's including times for some longer distances.

Distance (metres)	100	200	400	600	800	1500	3000	5000
Time (seconds)	12.5	25.6	52.3	83.4	113.9	232.5	514.7	874.2

A linear regression (using a calculator) gave the following information:

**Gradient = 0.178      y-intercept = -19.2      r = 0.9995      r<sup>2</sup> = 0.9991**

c) Explain what the **value of the gradient** represents.

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d) **Comment** on the value of the **y intercept**.

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e) Write a sentence explaining what the value of the **co-efficient of determination (r<sup>2</sup>)** represents.

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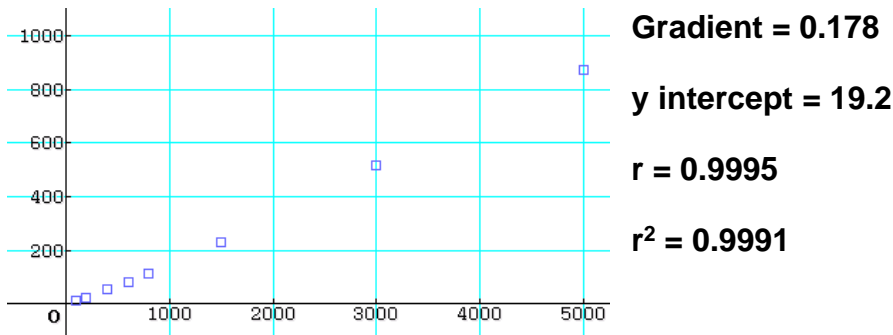
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Question 1 continues

**Question 1 continued**

A data plot on a calculator (shown below) seems to confirm a strong positive linear correlation:



Ben plans to run a marathon which is 42195 metres (i.e. more than 42 km) in length.

He uses the equation:  $T = 0.178 D - 19.2$  to calculate that he will take 7492 seconds to complete the marathon. (This is actually 2 hours 4 minutes and 52 seconds: an Australian record.)

- f) Use relevant terminology and/or the data provided to comment on Ben's likelihood of achieving this time.

/2

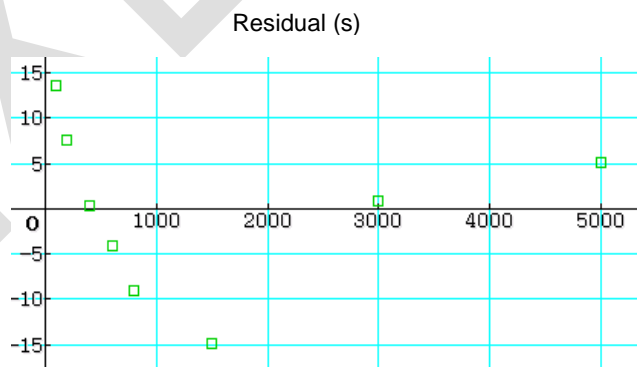
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A **residual** plot often helps with the analysis. The residual plot for Ben's data is shown below.



- g) Does the residual plot indicate that a linear model can be used to accurately predict times? Give reasons why or why not.

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**Total**  
**Q1**  
**/12**

## Question 2

Marker use

Jane bought a chocolate bar that has 21 square pieces as shown.



To make it last for a week, she decides to eat just one row every day.

The number of squares left after each day forms a sequence where:

$T_n$  is the number of pieces of chocolate that are left, after  $n$  days.

- a) Will the sequence formed be arithmetic, geometric or neither?

/1

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- b) Write a **difference equation** that generates the sequence for this scenario.

/2

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Total  
Q2  
/3

**Question 3**

Marker use

Greg is a dedicated employee. His 'boss' suspects that he works too much extra time on a weekend.

The extra time (**in minutes**) that Greg has worked over the past four weekends is shown below:

**128, 160, 200, 250**

a) Demonstrate that the sequence is **not arithmetic**.

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b) Given that the sequence is geometric, what is the **common ratio**?

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c) If a geometric pattern continues, how long will it be until Greg works more than 10 hours extra time on a weekend?

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**Total  
Q3  
/4**

#### Question 4

Marker use

Lucy owns a farm that has a dam which currently holds 1000 ML (megalitres) of water.

Unfortunately, drought is predicted for the next 2 years, and negligible (very little) rainfall is expected.

Lucy is advised that she will lose 20% of the volume of water each month through evaporation.

She can only afford to buy 30 ML of water every month and will add that to the dam.

The **recursive equation** for the volume of water in Lucy's dam ( $T_n$ ) each month is given below:

$$T_{n+1} = 0.80 T_n + 30 \quad T_0 = 1000$$

- a) Will the sequence formed be arithmetic, geometric or neither?

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- b) Briefly explain why the value of **0.80** appears in the recursive equation.

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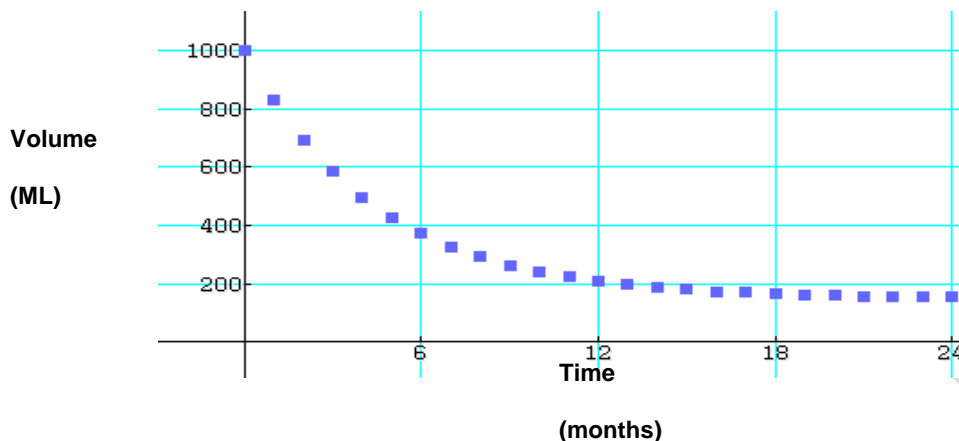
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Question 4 continues

Question 4 continued

Marker use

The graph below shows the expected volume of the dam over the next 24 months.



c) Give a detailed explanation why the graph has this shape.

/ 3

You should include mathematical reasoning a part of your answer.

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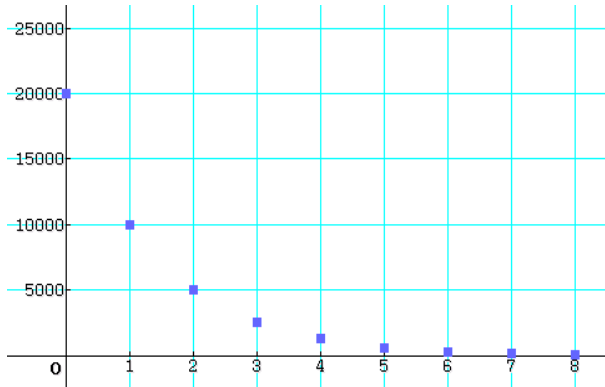
Total  
Q4  
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### Question 5

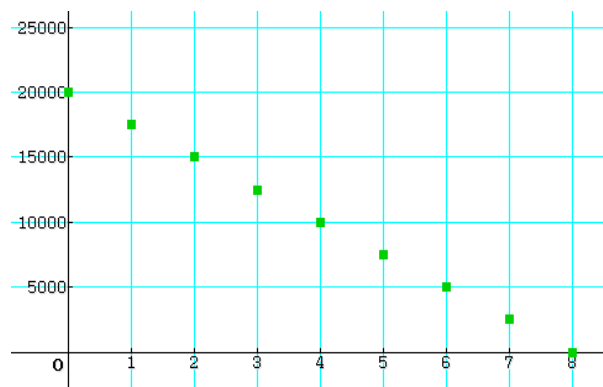
Marker use

The six graphs drawn below represent different financial scenarios over an 8-year period. The horizontal axes on each graph detail time (years) and the vertical axes detail dollar value.

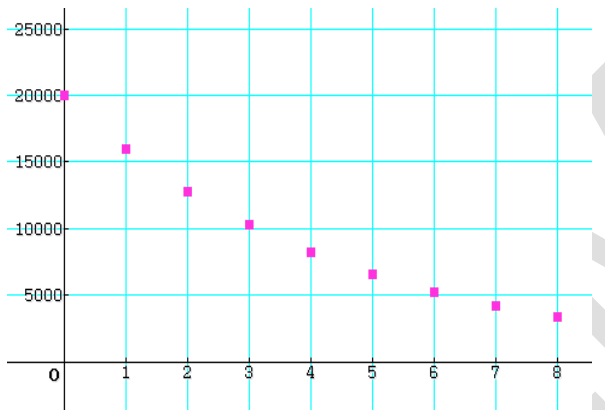
**Graph A**



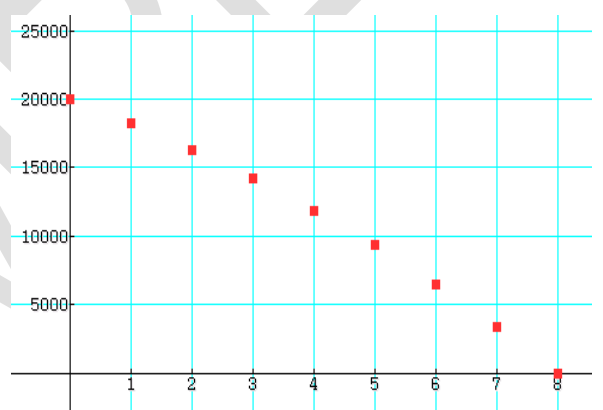
**Graph B**



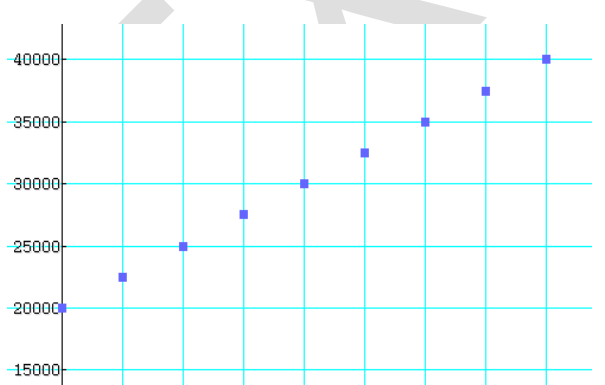
**Graph C**



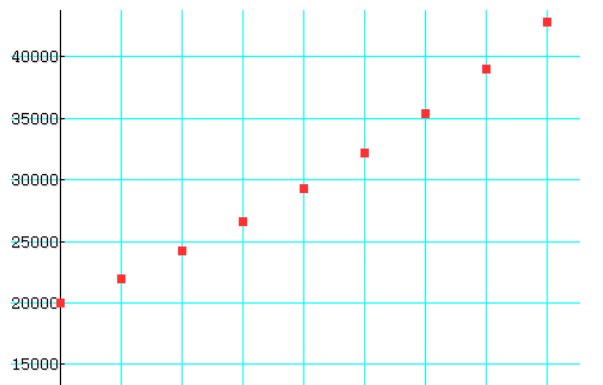
**Graph D**



**Graph E**



**Graph F**



Question 5 continues

**Question 5 continued**

Marker use

For each scenario described below, select one of the six graphs from the previous page that best matches the description.

No explanation is required. Simply write e.g. "Graph X" as your answer in the space provided.

(Note that there is only one correct answer for each scenario.)

a) A \$20 000 vehicle is **depreciated by 20% p.a.** of its previous year's book value for 8 years.

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b) \$20 000 is invested in an account paying **10% p.a. compounding annually** for 8 years.

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c) Computer equipment valued at \$20 000 is **depreciated by \$2 500** every year for 8 years.

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d) \$20 000 is borrowed from a bank which charges an **effective interest rate of 10% p.a.** The loan is to be repaid in full by **fixed annual payments** for 8 years.

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**Total  
Q5  
/4**

## Question 6

A section of a credit card statement is shown below:

XXX Bank	
Credit Card	Statement
J Citizen	Hobart, Tas

Statement duration	1 Aug – 30 Aug 2023
Account number	0123456789
Minimum payment due	\$30

Overdue	Opening Balance	New Charges	Payments/Refunds	Closing Balance
\$0.00	\$1000	\$800	***	\$1600

Date	Transaction Details	Debits	Credits
2 Aug 23	AAA Newsagent	50	
6 Aug 23	BBB Electrical	400	
15 Aug 23	Payment		-200
19 Aug 23	CCC Online	350	

Question 6 continues

a) State the minimum payment required.

/1

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b) There is a value missing from the statement in the **Payments/Refunds** column.

/1

Payments/Refunds

\*\*\*

What is the missing value?

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c) Compared to other loans, credit cards have a reputation for **very high interest rates** and a relatively **low minimum payment**.

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Why would banks allow customers to pay a relatively low minimum payment?

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J citizen has taken out a **\$500,000** loan from a bank to invest in a new business.

They are given the following three options of repaying the loan, each option has an effective interest rate of 5% p.a:

Option 1: Repay \$32694.47 per month for 20 years.

Option 2: Repay \$16347.24 per fortnight.

Option 3: Take an "interest only" repayment plan for 5 years (about \$2083.33 per month) and then pay \$3925.38 per month for the next 15 years.

d) Explain why Option 2 might be a better option than Option 1.

/3

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e) What are the advantages and disadvantages of Option 3 compared to the other options?

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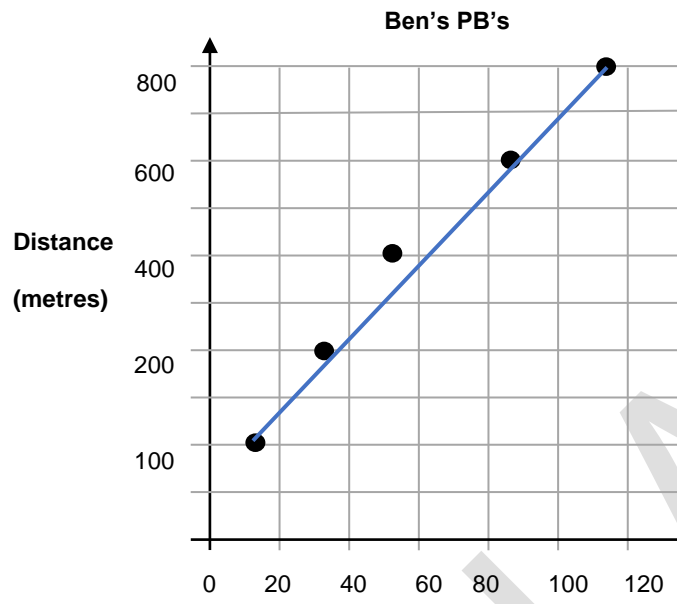
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**Total**  
**Q6**  
**/8**

# Spare Diagrams

## Question 1



End of Section A  
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External Assessment 2023

# GENERAL MATHEMATICS

MTG315123

## Section **B** Bivariate Data Analysis

Pages: 16

Questions: 4

Information Sheet: 1

**Suggested working time:** 36 minutes

### Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
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- TASC approved calculators are allowed.
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- All answers must be written in **English**.
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Marker use	
C5	/ 36

# Guide to Exam Structure

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	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section <b>A</b>		6	6	36 minutes	36 marks
This Section <b>B</b>		4	4	36 minutes	36 marks
Section <b>C</b>		5	5	36 minutes	36 marks
Section <b>D</b>		5	5	36 minutes	36 marks
Section <b>E</b>	Part 1 OR	4	4	36 minutes	36 marks
	Part 2	5	5	36 minutes	36 marks
<b>Totals</b>		<b>29</b>	<b>24 or 25</b>	<b>180 minutes (3 hours)</b>	<b>180 marks</b>

## Criterion

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You **must** make sure your answers address:

- Criterion 5 interpret concepts and apply mathematical techniques to solve problems involving bivariate data analysis and time series analysis using the statistical investigation process.

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EXEMPLAR

**Question 8**

A city council surveys local business owners and local residents to gauge their opinion on a multi-story hotel development that is proposed for a prime waterfront site.

	Local Residents	Local Business Owners	Total
In favour of the development	401	122	523
Against the development	589	12	601
Total	990	134	1124

*Table 1*

- a) Convert the survey data into percentage form in Table 2, and display it on the segmented bar chart in Figure 1.

	Local Residents %	Local Business Owners %
In favour of the development		91.0
Against the development		9.0
Total	100	100

*Table 2*

/4

**Question 8 continues**

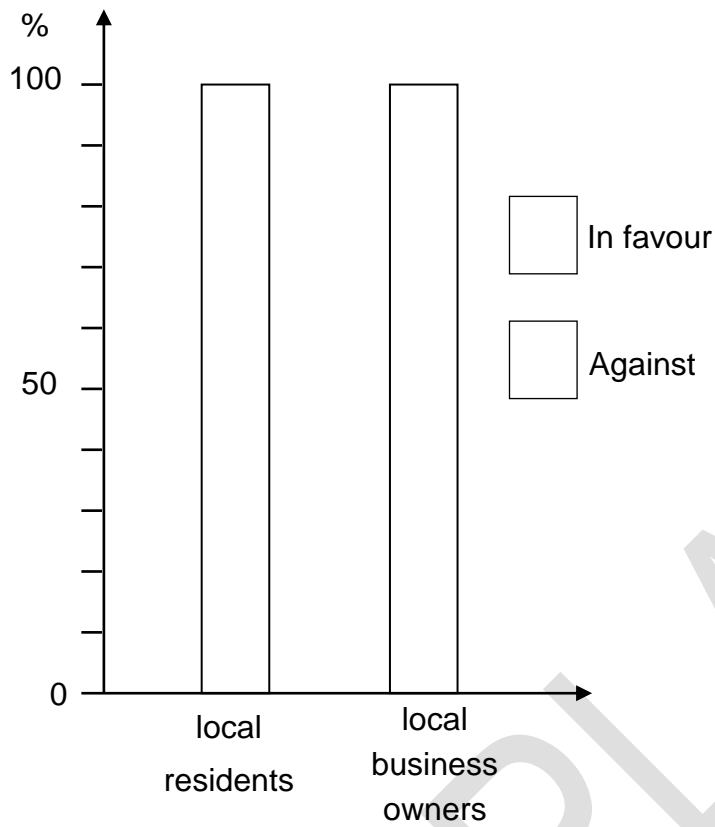


Figure 1: Graph for answering Question 1 a).

Spare diagram used (X)

### Question 9

Marker use

Six (6) zucchini plants are grown in the same greenhouse, but each is given a different amount of fertiliser. The total harvest (in kg) of zucchini from each plant is shown in the data in Table 3 and Figure 2.

	Amount of fertiliser (g)	Amount of harvest (kg)	XY	X <sup>2</sup>
	10	1.5	15	100
	20	1.9	38	400
	30	2.8	84	900
	40	2.9	116	1600
	50	3.7		
	60	3.9		
Totals	210	16.7	672	

Table 3

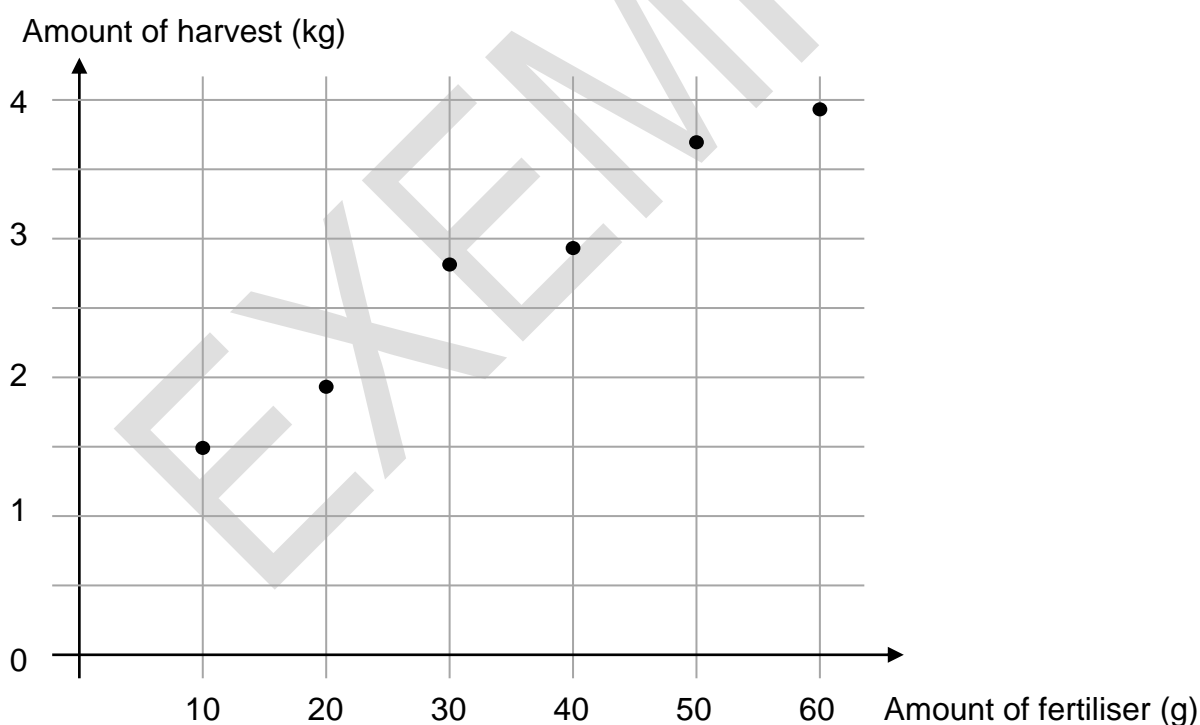


Figure 2: Graph for answering Question 2 b).

Spare diagram used (X)

Question 9 continues

Question 9 continued

Marker use

- a) Complete the data in Table 3 and use a formula to determine the linear relationship between amount of fertiliser ( $f$ ) and size of the zucchini harvest ( $Z$ ). Express numbers to two (2) decimal places.

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- b) Use your equation to find **two** points on the regression line and use them to locate the regression line on Figure 2.

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- c) Use your equation to estimate the amount of fertiliser necessary to produce a harvest of 3.2 kg of zucchinis.

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Total  
Q9  
/9

**Question 10**

Table 4 and Figure 4 give information about the length of the each of the yachts in an ocean race and the time taken for them to complete the race.

	Yacht Name	Yacht Length (m)	Time taken to complete race (min)	Residual (min)
A	Gravy Train	26.5	1230	98.4
B	Constellation	25.8	1200	21.4
C	Grace	18.4	1420	-255.4
D	Helter Skelter	17.0	1830	
E	Box Seat	16.2	1613	-210.2
F	Fire Fly	14.7	1950	26.1
G	Unshackled	12.6	2435	370.1
H	Bondi Bullet	10.2	2115	-111.0

Table 4

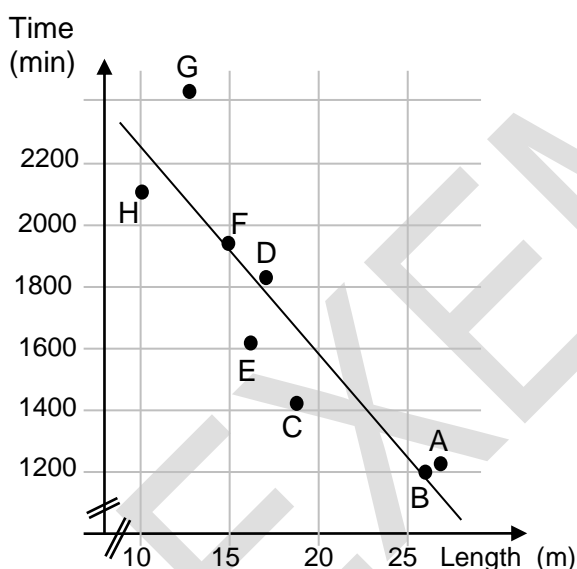


Figure 4 a: Graph of time taken against yacht length.

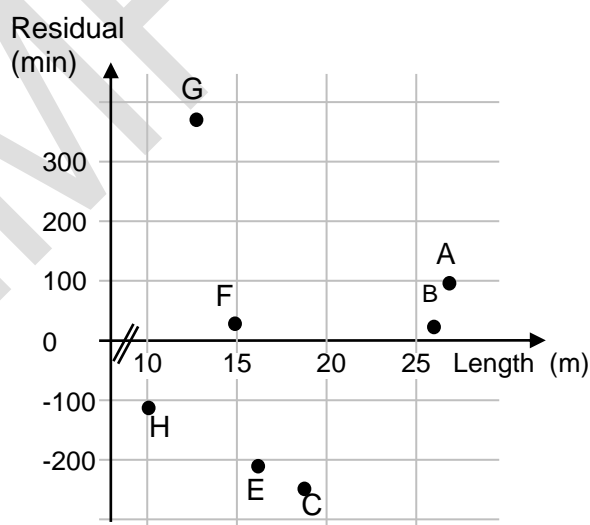


Figure 4 b: Graph of residual time against yacht length.

Spare diagram used (X)

Question 11 continues

**Question 10 continued**

Marker use

a) Use your calculator to find the equation of the linear relationship between time taken to complete the race (T) and the length of the yacht (L). Express numbers to one (1) decimal place.

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b) Find the correlation coefficient and interpret it in terms of the variables.

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c) The residual for 'Helter Skelter' is missing from the data in Table 4 and Graph 4.

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i. Use your equation to predict the time taken for 'Helter Skelter' to finish the race.

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ii. Use this to find the residual time for 'Helter Skelter' and plot it on the residuals graph.

/3

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In ocean sailing there are often two (2) trophies presented:

- The 'line honours winner' awarded to the first yacht home, and,
- The 'handicap winner' awarded to the boat who performed best for its size.

d) Which boat would win the line honours division? Explain with reference to either Figure 4a or Figure 4b

/2

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e) Which boat would win the handicap division? Explain with reference to either Figure 4a or Figure 4b.

/2

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**Total**  
**Q10**  
**/13**

**Question 11**

A shop sells specialist bushwalking equipment. The data in Table 5 and Figure 5 below give information about the profit of the shop both in raw and seasonally adjusted terms.

	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
Quarter	1	2	3	4	5	6	7	8	9	10	11	12
Profit (x \$1000)	62	52	30	48	64	51	18	48	70	58	32	52
De-seasonalised Profit (x \$1000)	46.2	47.2	55.4	47.3	47.7	46.3	33.2	47.3				

Table 5

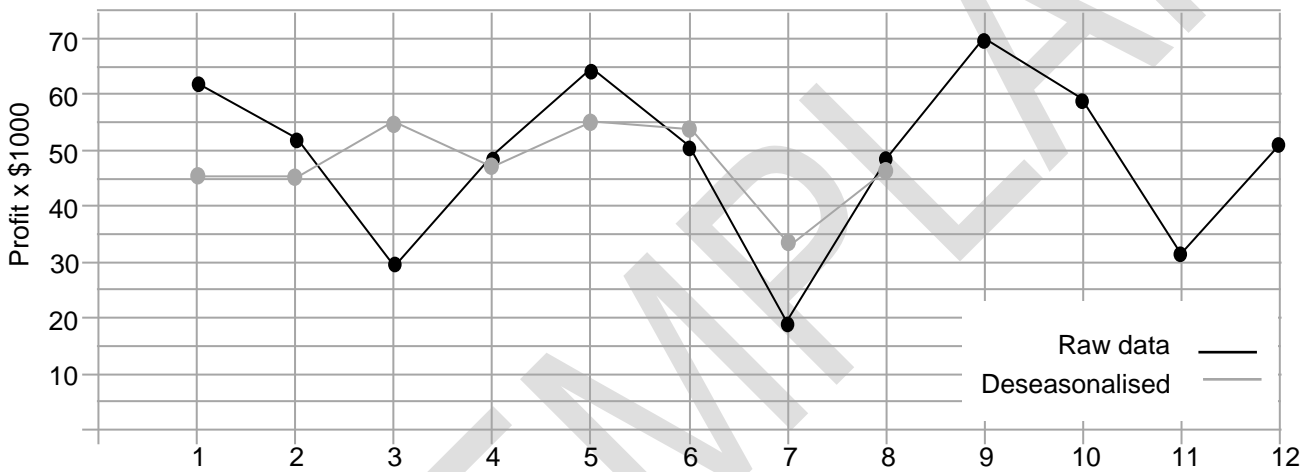


Figure 5: Graph of profits (x \$1000) against quarter.

Spare diagram used (X)

Some seasonal indices are shown in Table 6 below.

	Quarter			
	Summer	Autumn	Winter	Spring
Index	1.342	1.101		1.014

Table 6

Question 12 continues

**Question 11 continued**

Marker use

a) What is a seasonal index?

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b) Find the index for Winter.

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c) Use the seasonal indices to complete the de-seasonalised data in Table 5.

/2

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d) Complete the graph of deseasonalised data (Figure 5).

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e) Which of the quarters 1 – 12 had the greatest sales in de-seasonalised terms?  
Explain what this means.

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f) The next quarter (Q13) recorded a deseasonalised profit of \$44 000. What was the actual profit?

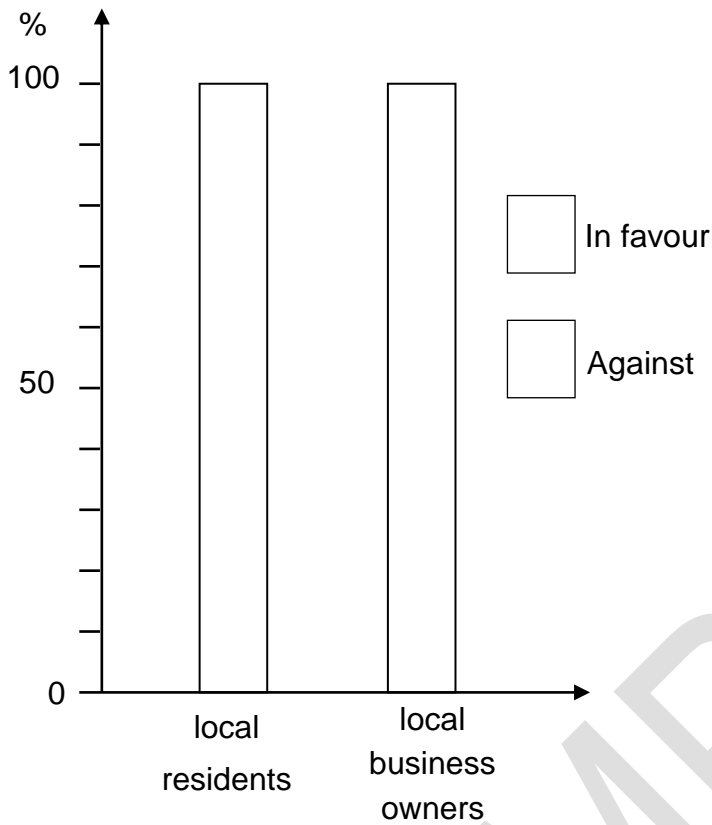
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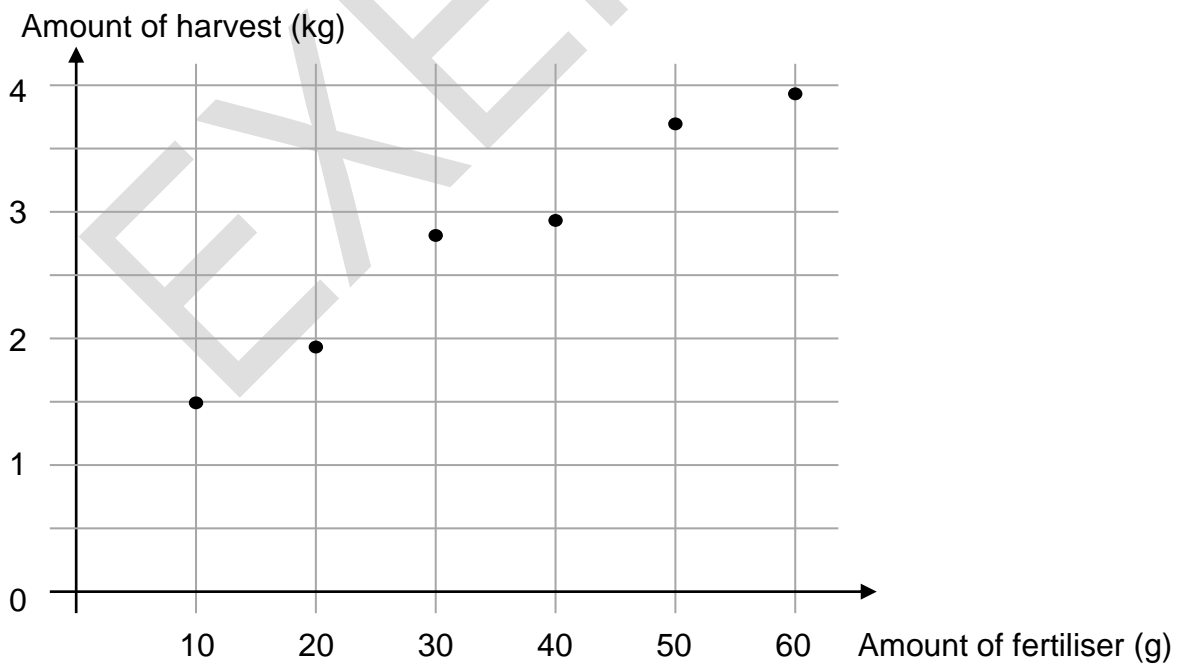
**Total**  
**Q11**  
**/10**

# Spare Diagrams

## Question 8 a)

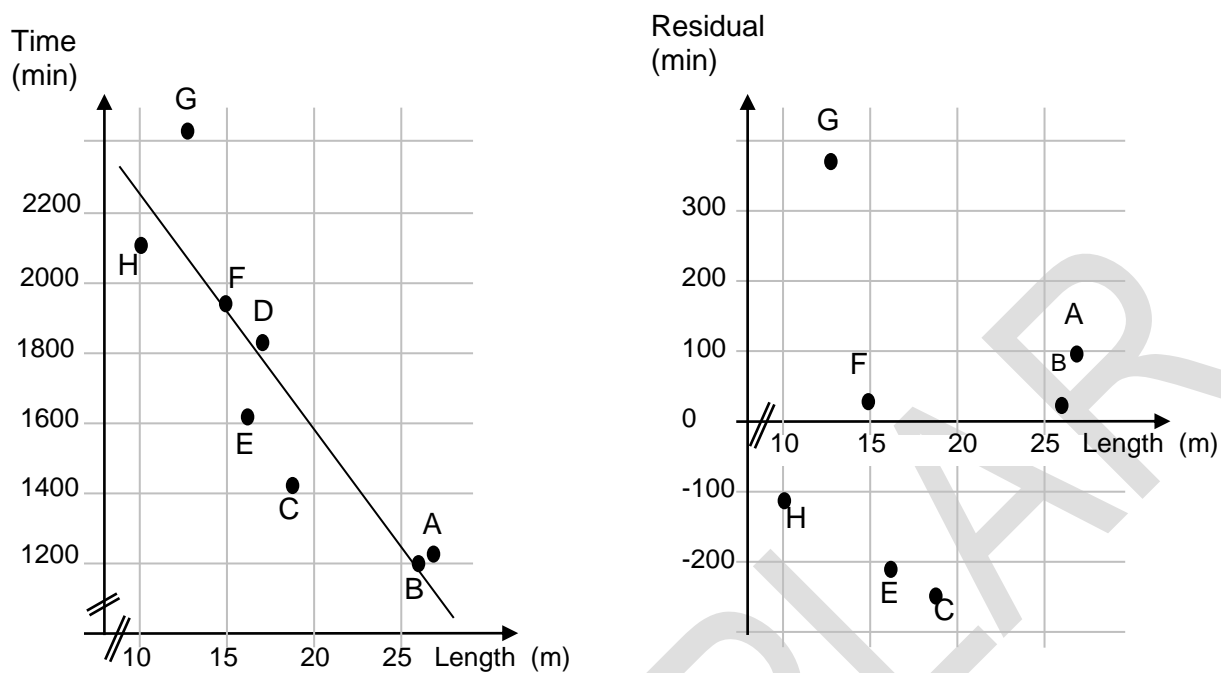


## Question 9 b)

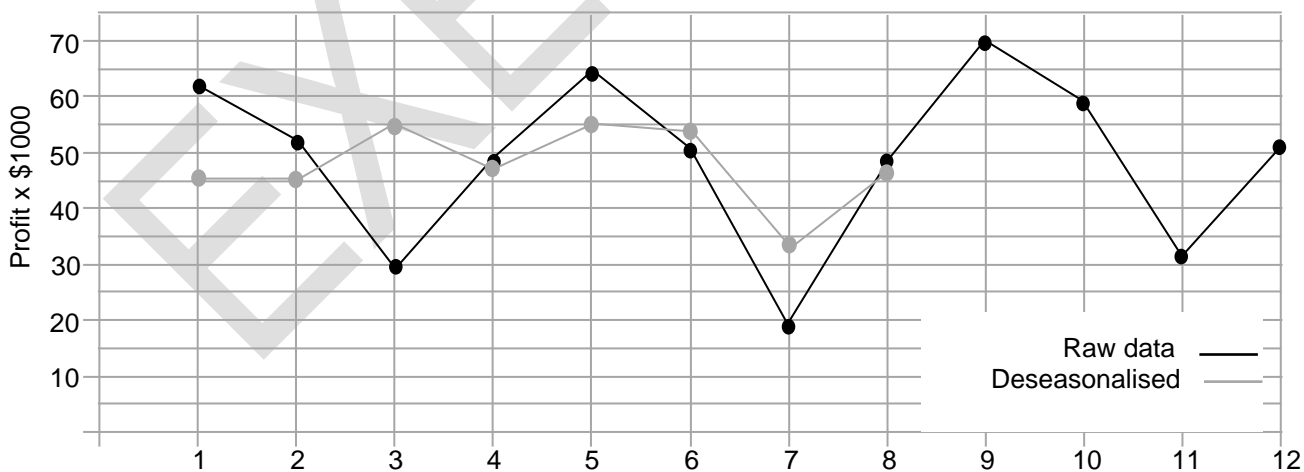


# Spare Diagrams

## Question 10 c)



## Question 11 d)



End of Section B  
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External Assessment 2023

# GENERAL MATHEMATICS

MTG315123

## Section **C** Growth and Decay in Sequences

Pages: 12

Questions: 5

Information Sheet: 1

**Suggested working time:** 48 minutes

### Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
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- TASC approved calculators are allowed.
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- You **must** make sure your answers address the listed criterion.

Marker use	
C6	/ 36

# Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section <b>A</b>		6	6	36 minutes	36 marks
Section <b>B</b>		4	4	36 minutes	36 marks
This Section <b>C</b>		5	5	36 minutes	36 marks
Section <b>D</b>		5	5	36 minutes	36 marks
Section <b>E</b>	Part 1 OR	4	4	36 minutes	36 marks
	Part 2	5	5	36 minutes	36 marks
<b>Totals</b>		<b>29</b>	<b>24 or 25</b>	<b>180 minutes (3 hours)</b>	<b>180 marks</b>

## Criterion

You **must** make sure your answers address:

- Criterion 6 interpret concepts and apply mathematical techniques to model patterns and solve problems involving growth and decay in sequences.

**Question 12**

Marker use

A school has 800 students, but it is expected that the student population will grow by 15% every year. Consider the sequence formed by the annual student population.

/2

- a) Write the sequence rule and use it to generate the first four (4) terms.

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- b) A stockpile of iron ore  $560 \text{ m}^3$  in size is being moved by dump trucks which can carry  $20 \text{ m}^3$  each load. Consider the sequence formed by the changing size of the pile.

/2

Write the sequence rule and use it to generate the first four (4) terms.

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- c) A bank account pays 2.5% p.a. interest, which is compounded annually. A deposit of \$100 is made into the account. Every year the bank charges a \$10 account keeping fee. Consider the sequence formed by the annual balance of the account.

/2

Write a difference equation that models the sequence and use it to generate the first four (4) terms.

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**Total  
Q12  
/6**

**Question 13**

Marker use

A new recruit has a salary package starting at \$58 000, but with scheduled annual increases of \$2100 for the next 10 years.

a) Write, in algebraic form, a rule for the sequence.

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b) Find the salary in the 10<sup>th</sup> year of work.

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/1

c) Find the total paid to the recruit over the 10-year period.

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/1

EXEMPLAR

Total  
Q13  
/3

**Question 14**

Marker use

A bushwalker who is attempting to reach a mountain cabin that is 34 km away walks:

- 6 km in the first hour
- 4.8 km in the second hour
- 3.84 km in the third hour.

a) Show that the terms form a geometric sequence.

/1

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b) Find the distance walked in the 10<sup>th</sup> hour.

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c) Find the total distance covered after 10 hours of walking.

/1

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d) Given that the walker's rate of fatigue remains unchanged, find the minimum distance that he should have covered in the first hour to make reaching the cabin a possibility.

/2

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**Total  
Q14**

**/5**

**Question 15**

Marker use

The Murray River Cod is a native Australian freshwater fish. Last century the Murray River Cod was listed as endangered. The depletion of numbers was thought to be due to the introduction of another fish species – the European Carp. A program was introduced in 2010 to cull the numbers of European Carp. Figure 6 below shows how the estimated populations of both fish in a river reserve have changed since the introduction of the program.

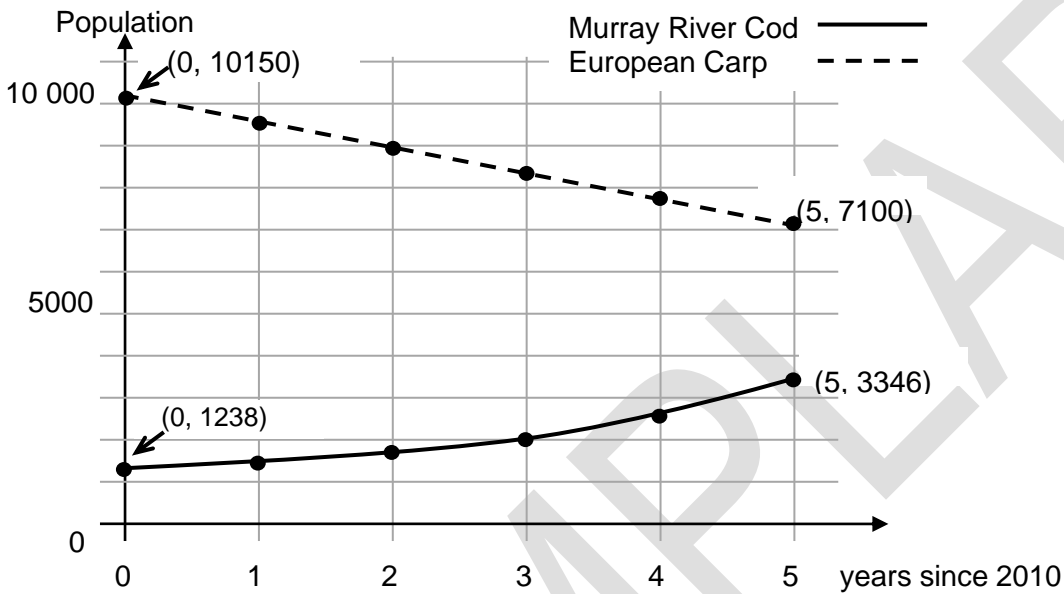


Figure 6: Graph of Murray River Cod and European Carp numbers.

a) Show that the rate of exponential growth for the Murray River Cod is 22% p.a.

/2

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b) Find a difference equation that models the population numbers of Murray River Cod. Use initial term  $T_0 =$

/1

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c) Estimate the number of Murray River Cod in 2020.

/1

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Question 15 continues

**Question 15 continued**

d) Find the annual rate of decline in European Carp numbers.

/2

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e) Find a difference equation that models the population numbers of European Carp.  
Use initial term  $T_0 =$

/1

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g) Estimate the year when there will no longer be a population of European Carp.

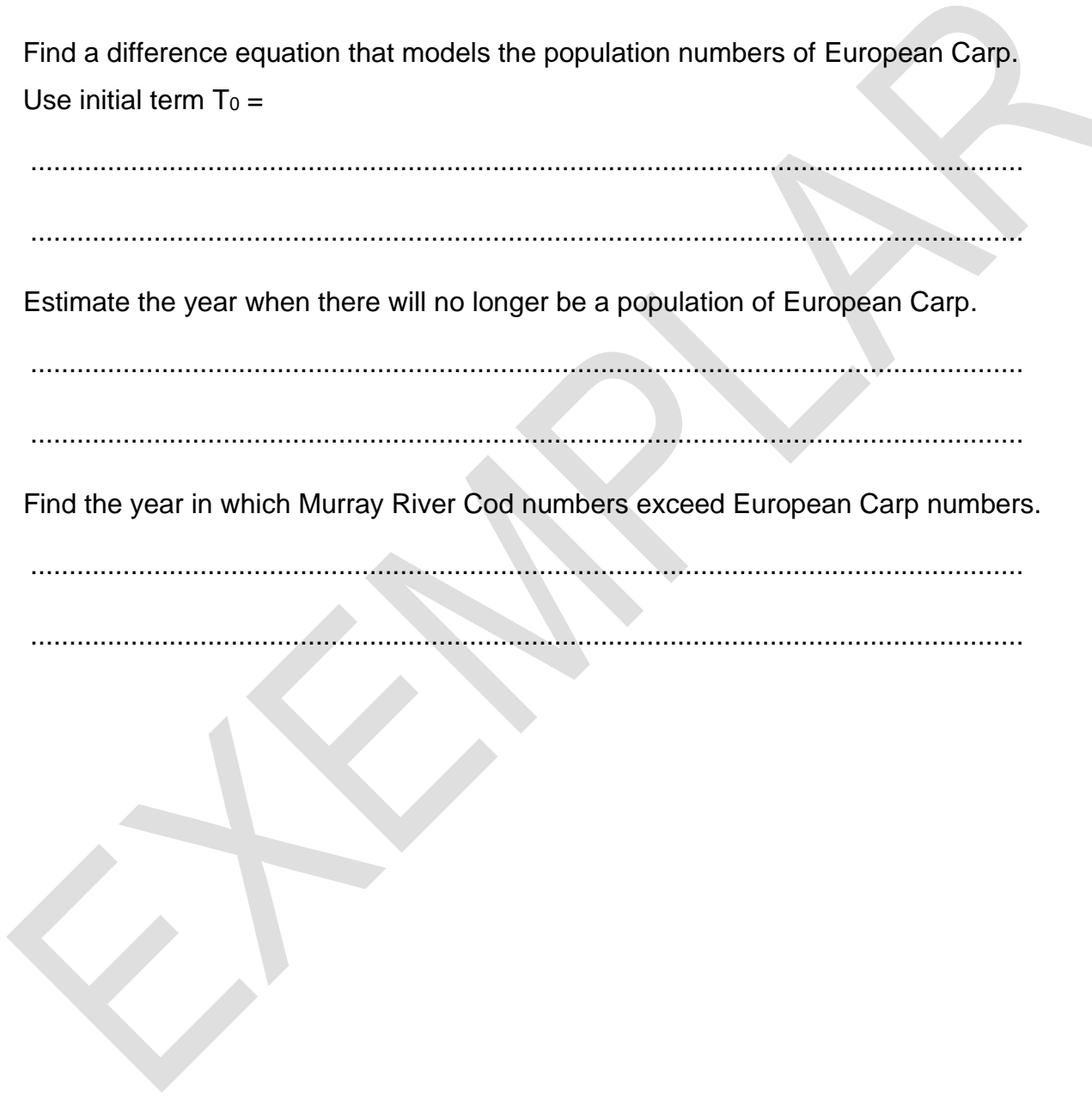
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h) Find the year in which Murray River Cod numbers exceed European Carp numbers.

/1

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Total  
Q15  
/9

**Question 16**

Marker use

- a) A lawn bowls club has 800 members, but each year its membership declines by 20%.
- i. Write a difference equation for the situation. Use initial term  $T_0 =$

/1

.....

- ii. Set up the difference equation on your calculator and use it to complete Table 7.

/1

Years	0	5	10	15
Membership	800	262		

*Table 7*

- b) A marketing analyst estimates that if the club promotes itself with television advertising 100 new members will join the club each year (while still losing 20% of the older members).

- i. Write a difference equation for this situation. Use initial term  $T_0 =$

/1

.....

- ii. Set up the difference equation on your calculator and use it to complete Table 8.

/1

Years	0	5	10	15
Membership	800	598	532	

*Table 8*

- c) The analyst estimates that if the club renovates the club rooms and conducts the television advertising then 240 new members will join each year (while still losing 20% of the older members).

- i. Write a difference equation for this situation. Use initial term  $T_0 =$

/1

.....

- ii. Set up the difference equation on your calculator and use it to complete Table 9 below.

/1

Years	0	5	10	15
Membership	800	1069		

*Table 9*

**Question 16 continues**

**Question 16 continued**

Marker use

d) The club's committee decide that what they would really like is to attract just enough new members each year to replace the 20% of members who are leaving the club.

i. Write a difference equation for this situation. Use initial term  $T_0 =$

/2

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ii. Complete Table 10 below.

Years	0	5	10	15
Membership	800			

/1

Table 10

e) Complete Figure 7 showing the scenarios (a) to (d). Show clearly the shape of each graph and any asymptotes or limits.

/4

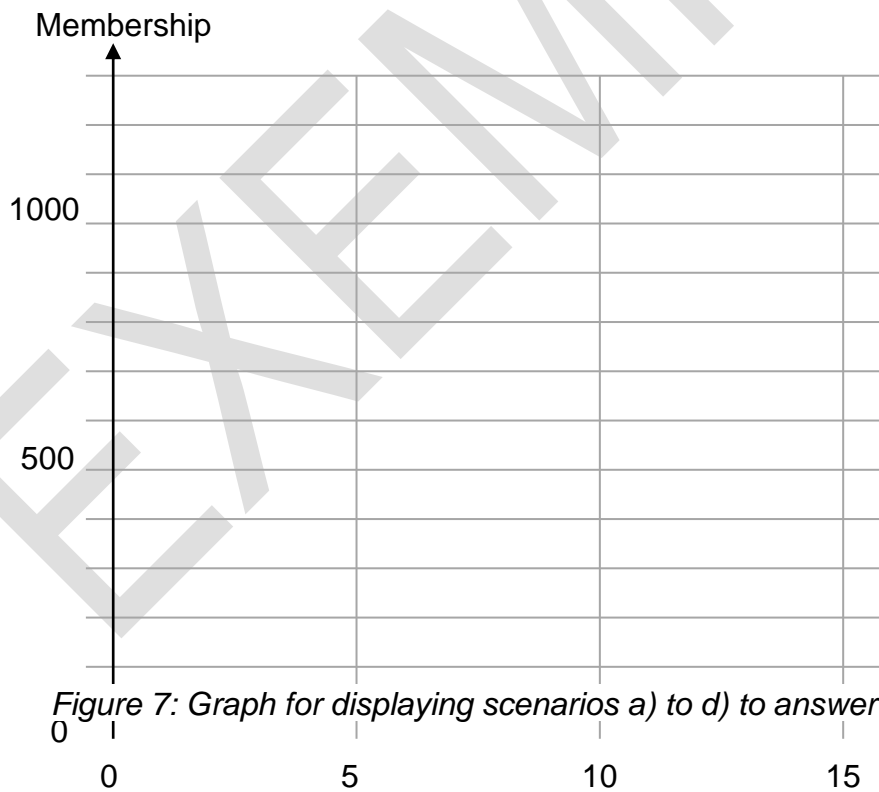
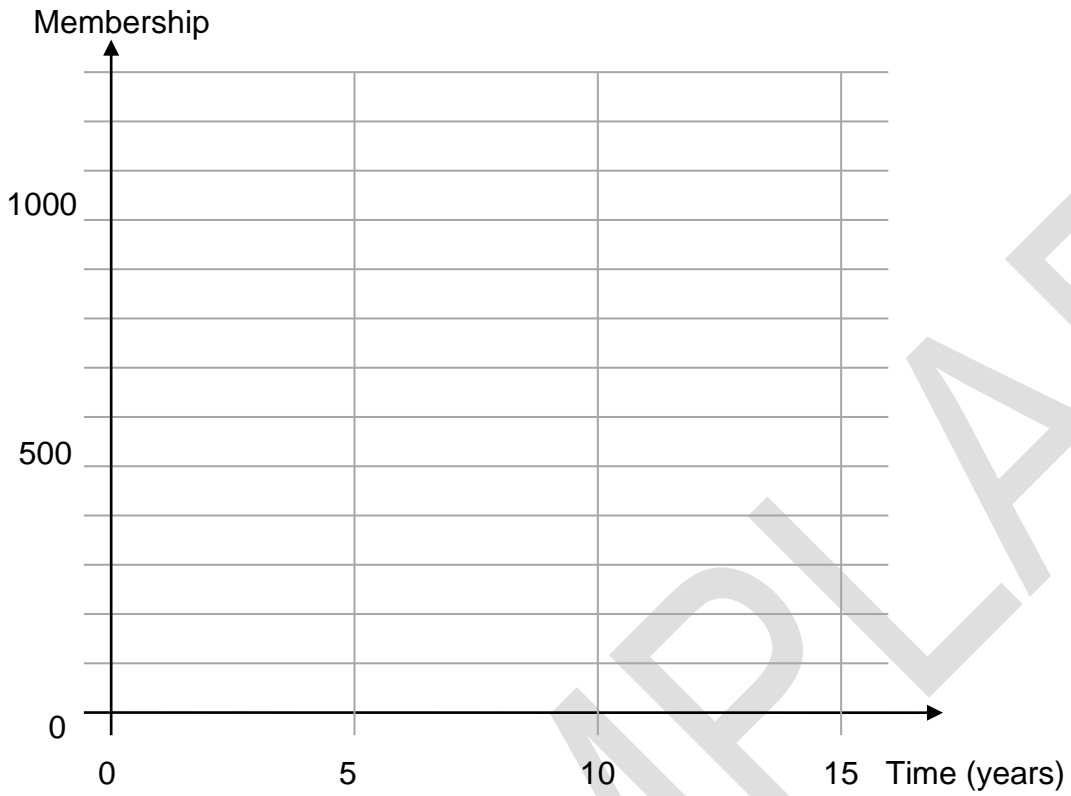


Figure 7: Graph for displaying scenarios a) to d) to answer Question 10 e).

Spare diagram used (X)

**Total**  
**Q16**  
**/13**

## Question 16 e)



End of Section C  
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External Assessment 2023

# GENERAL MATHEMATICS

MTG315123

## Section **D** Finance

Pages: 12

Questions: 5

Information Sheet: 1

**Suggested working time:** 36 minutes

### Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
- TASC approved calculators are allowed.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The General Mathematics Information Sheet can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C7	/ 36

# Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section <b>A</b>		6	6	36 minutes	36 marks
Section <b>B</b>		4	4	36 minutes	36 marks
Section <b>C</b>		5	5	36 minutes	36 marks
Section <b>D</b>		5	5	36 minutes	36 marks
Section <b>E</b>	Part 1 OR	4	4	36 minutes	36 marks
	Part 2	5	5	36 minutes	36 marks
<b>Totals</b>		<b>29</b>	<b>24 or 25</b>	<b>180 minutes (3 hours)</b>	<b>180 marks</b>

## Criterion

You **must** make sure your answers address:

- Criterion 7 interpret concepts and apply mathematical techniques to solve problems involving standard financial models.

**Question 17**

Marker use

Vanessa's credit card has an annual interest rate of 17.2% p.a. compounded daily. Before purchasing a laptop computer for \$1350 Vanessa owed nothing on her credit card account. When Vanessa receives her account statement she notes that the minimum payment required is 3.5% of the balance – which she pays by the due date. When Vanessa gets her next statement she finds that she is charged 30 days interest on the outstanding balance.

a) How much interest was charged?

/3

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b) Use an algebraic formula to find the effective interest rate that Vanessa is paying on her credit card.

/1

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EXEMPLAR

Total  
Q17  
/4

**Question 18**

The following interest factors in Table 11 can be used in situations where monthly compound interest on a loan is calculated:

*Annuities in arrears interest factor table:*  $f = \frac{[1 - (1 + i)^{-n}]}{i}$

*Present value of a \$1 regular payment*

Interest rate per period	0.00083	0.00167	0.00250	0.00333	0.00417	0.00500	0.00583	0.00667
1	0.9992	0.9983	0.9975	0.9967	0.9959	0.9950	0.9942	0.9934
2	1.9975	1.9950	1.9925	1.9900	1.9876	1.9851	1.9826	1.9802
3	2.9950	2.9900	2.9851	2.9801	2.9752	2.9702	2.9653	2.9604
4	3.9917	3.9834	3.9751	3.9669	3.9587	3.9505	3.9423	3.9342
5	4.9875	4.9751	4.9627	4.9504	4.9381	4.9259	4.9137	4.9015
6	5.9825	5.9652	5.9478	5.9306	5.9135	5.8964	5.8794	5.8625
7	6.9767	6.9536	6.9305	6.9076	6.8848	6.8621	6.8395	6.8170
8	7.9701	7.9403	7.9107	7.8813	7.8521	7.8230	7.7940	7.7652
9	8.9626	8.9255	8.8885	8.8518	8.8153	8.7791	8.7430	8.7072
10	9.9543	9.9089	9.8639	9.8191	9.7746	9.7304	9.6865	9.6429
11	10.9452	10.8908	10.8368	10.7831	10.7299	10.6770	10.6245	10.5724
12	11.9353	11.8710	11.8073	11.7440	11.6812	11.6189	11.5571	11.4958
24	23.7518	23.5071	23.2660	23.0283	22.7939	22.5629	22.3351	22.1105
36	35.4508	34.9131	34.3865	33.8708	33.3657	32.8710	32.3865	31.9118
48	47.0335	46.0933	45.1787	44.2888	43.4230	42.5803	41.7602	40.9619
60	58.5009	57.0524	55.6524	54.2991	52.9907	51.7256	50.5020	49.3184
72	69.8543	67.7946	65.8169	63.9174	62.0928	60.3395	58.6544	57.0345
84	81.0948	78.3243	75.6813	73.1593	70.7519	68.4530	66.2573	64.1593
96	92.2235	88.6456	85.2546	82.0393	78.9895	76.0952	73.3476	70.7380
108	103.2415	98.7628	94.5453	90.5718	86.8261	83.2934	79.9599	76.8125
120	114.1499	108.6798	103.5618	98.7702	94.2814	90.0735	86.1264	82.4215
240	217.4413	197.6740	180.3109	165.0219	151.5254	139.5808	128.9825	119.5543
360	310.9072	270.5485	237.1894	209.4613	186.2818	166.7916	150.3076	136.2835

Table 11

Question 18 continues

**Question 18 continued**

Marker use

- a) Use the interest factor table to find the amount borrowed over a 10-year loan period if monthly repayments of \$1665.31 are made and the interest rate is 6% p.a. compounded monthly.

/2

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- b) Find the size of the monthly repayments on a loan of \$200 000 taken over a 20-year period at 5% p.a. compounded monthly.

/2

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- c) How long would it take to repay \$5000 if monthly repayments of \$425.75 were made and the interest rate was 4% p.a. compounded monthly.

/2

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Total  
Q18  
/6

**Question 19**

Marker use

An accountant is trying to determine the value of a wood-working machine which cost \$9200 when new. It has an estimated lifetime of 8000 hours of operating time, after which it will be worthless.

- a) Find an equation for the value of the machine if the accountant uses the unit cost method.

/2

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- b) Find the value of the machine after three (3) years if the machine is used for 910 hours in the first year, 360 hours in the second year and 570 hours in the third year of ownership.

/1

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Another way that the accountant may find the value of the machine is by using the straight line depreciation method.

- c) Find the value of the machine after three (3) years if the accountant applies the straight line depreciation method based on 15% of its purchase price every year.

/2

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**Total  
Q19  
/5**

**Question 20**

Marker use

A business has recently purchased a new vehicle that the management expect will last about 10 years. In preparation for replacing the vehicle, the business pays \$2500 every quarter into an investment fund which pays 5.8% p.a. (compounding quarterly).

a) Use a difference equation to model the amount in the fund. Use initial term  $T_0 =$

/2

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b) How much is in the fund after 10 years?

/2

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Instead, the company make an initial deposit of \$10 000 into the account followed by the quarterly instalments of \$2500.

c) Remodel the difference equation to reflect the new situation. Use initial term  $T_0 =$

/2

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d) How much will be in the account after 10 years?

/1

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e) What would the present value of the investment's total be?

/2

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Total  
Q20  
/9

**Question 21**

Marker use

Jude would like to buy a new car which would cost \$32 000. She is considering two (2) options:

**OPTION A**

**SAVE TO BUY**

By making a suitable deposit every month into an account paying 5.9% p.a. compound interest (compounding monthly) over a 3-year time frame.

This option would mean that she would also have to allow for 3% p.a. increase in the price of the vehicle due to inflation.

**OPTION B**

**BORROW AND BUY NOW**

Purchase the \$32 000 vehicle by taking out a personal loan offering the following terms:

- no deposit
- monthly repayments at 8.2% p.a. (compounding monthly) for 3 years.

If Jude chooses to save to buy the car (Option A):

a) What would the expected price of the car be, allowing for the effects of inflation?

/2

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b) What should her monthly savings payment be?

/2

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c) How much will she pay for the car in total?

/1

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**Question 21 continues**

**Question 21 continued**

Marker use

If Jude chooses to borrow to buy the car now (Option B):

- d) Use an algebraic formula to show that the size of the loan repayment is \$1005.72.

/3

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- e) How much will she pay in total for the car?

/1

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Jude decides to follow option B (Borrow and Buy Now). After making payments for 12 months Jude thinks that she can pay the loan off more quickly.

- f) Find the monthly payment required to pay off the remaining loan over the next 6 months.

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**End of Section D**

Total  
Q21  
/12

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External Assessment 2023

# GENERAL MATHEMATICS

MTG315123

## Section **E** Networks or Trigonometry

Pages: 20

Questions: 9

Information Sheet: 1

**Suggested working time:** 36 minutes

### Instructions:

- There are **two (2)** parts to this section. Answer **all** questions in **one (1)** part. Either:
  - Part 1** – networks and decision mathematics

**OR**

  - Part 2** – trigonometry and Earth geometry – Part 2 commences on page 14.
- Write your answers in the spaces provided in this exam paper.
  - Spare diagrams have been provided at the end of each section. Indicate using the box provided if you have used the spare diagram.
- TASC approved calculators are allowed.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The General Mathematics Information Sheet can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C8	/ 36

# Guide to Exam Structure

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	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section A		6	6	36 minutes	36 marks
Section B		4	4	36 minutes	36 marks
Section C		5	5	36 minutes	36 marks
Section D		5	5	36 minutes	36 marks
Section E	Part 1	4	4	36 minutes	36 marks
	OR				
	Part 2	5	5	36 minutes	36 marks
<b>Totals</b>		<b>29</b>	<b>24 or 25</b>	<b>180 minutes (3 hours)</b>	<b>180 marks</b>

## Criterion

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You **must** make sure your answers address:

- Criterion 8 interpret concepts and apply mathematical techniques to represent, analyse and solve practical problems in the two-dimensional plane.

# Part 1 - Networks

- **Either** answer **all** questions in this part **OR all** questions in Part 2.

## Question 22

Figure 8 below represents the network of walking tracks that join campsites in a national park. The weights on the edges of the graph represent the length of each track in km.

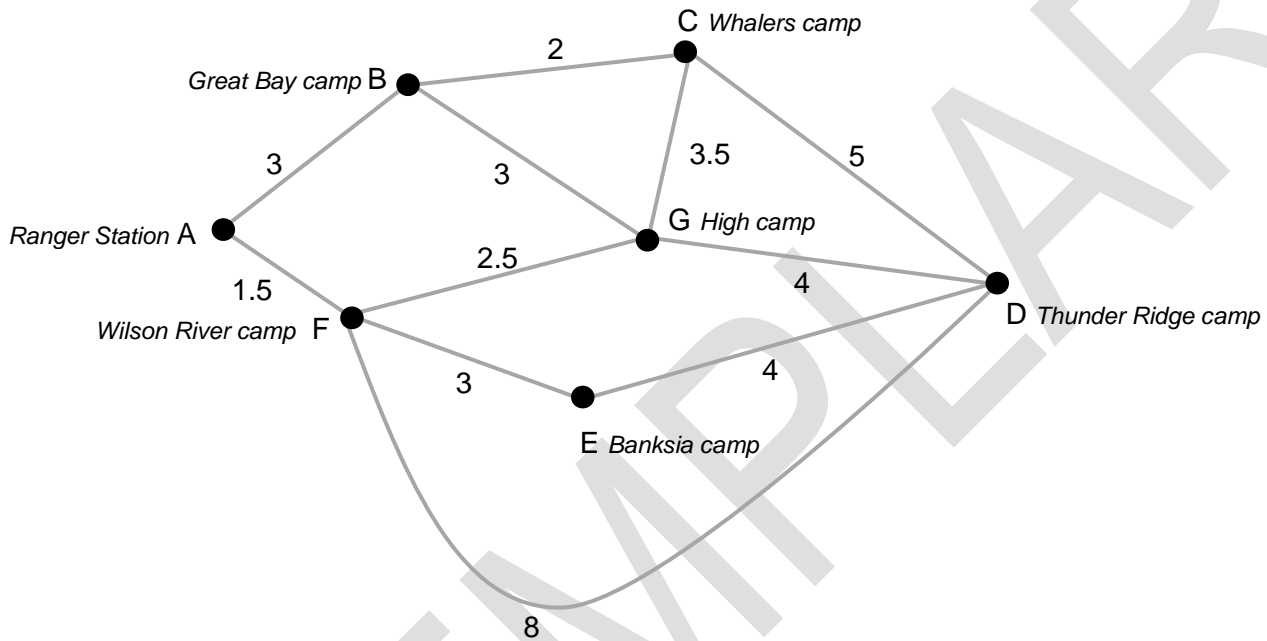


Figure 8: Graph of the network of walking tracks in a national park.

The ranger wishes to visit every campsite to check that they are clean. She wishes to do this without having to walk the same track twice, or visit the same campsite twice, and she wants to start and finish at the Ranger Station.

- a) What mathematical name is given to this type of route?

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/1

Question 22 continues

**Question 22 continued**

Marker use

- b) Give **two (2)** examples of such a route by marking them on the graphs below (Figure 9).

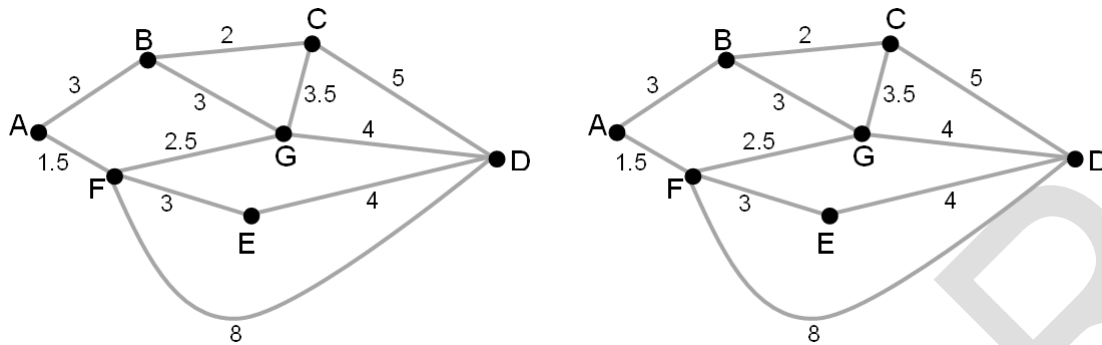


Figure 9: Graphs for providing two (2) example routes to answer Question 19 b).

Spare diagram used (X)

- c) Hence, find the length of the shortest route that the ranger should follow to accomplish her mission.

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On other occasions the ranger wishes to walk every track in the park to check that they are all in good condition. She wishes to do this without travelling the same track twice and wants to start and finish at the Ranger Station.

- d) What mathematical name is given to this type of route?

.....

- e) Is such a route possible? How can you tell?

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- f) What is the shortest distance that the ranger would have to walk to be able to check all the tracks (starting and finishing at the Ranger Station)?

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- g) Which track, if any, would need to be walked twice?

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/2

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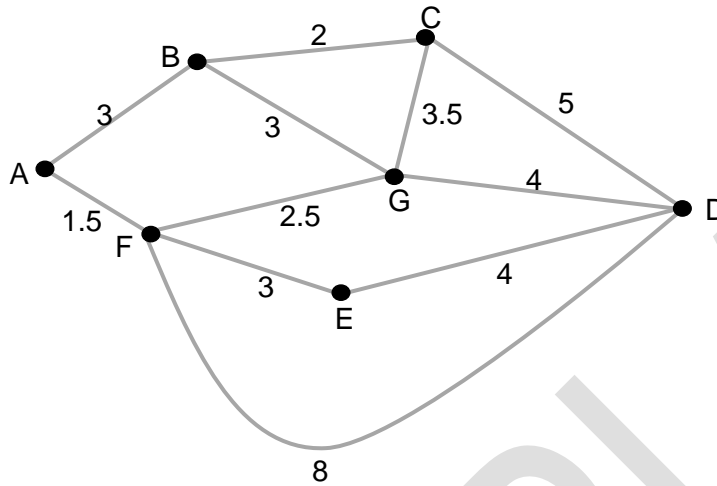
/1

**Question 22 continued**

Marker use

The management of the park want to upgrade some tracks so that all campsites can be reached via bicycle. They wish to do this in a way which minimises the total length of track that needs upgrading.

h) Mark the recommended sections for upgrade on Figure 10 below.



/2

Figure 10: Graph for marking recommended sections to answer Question 19 h).

Spare diagram used (X)

i) What is the minimum length of track that must be upgraded to meet bicycle use standards?

/1

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Total  
Q22  
/11

**Question 23**

Marker use

At the end of a football game spectators must exit the grandstand. The weights on the graph below show the number of people per minute that can be moved through the different areas of a grandstand as it empties.

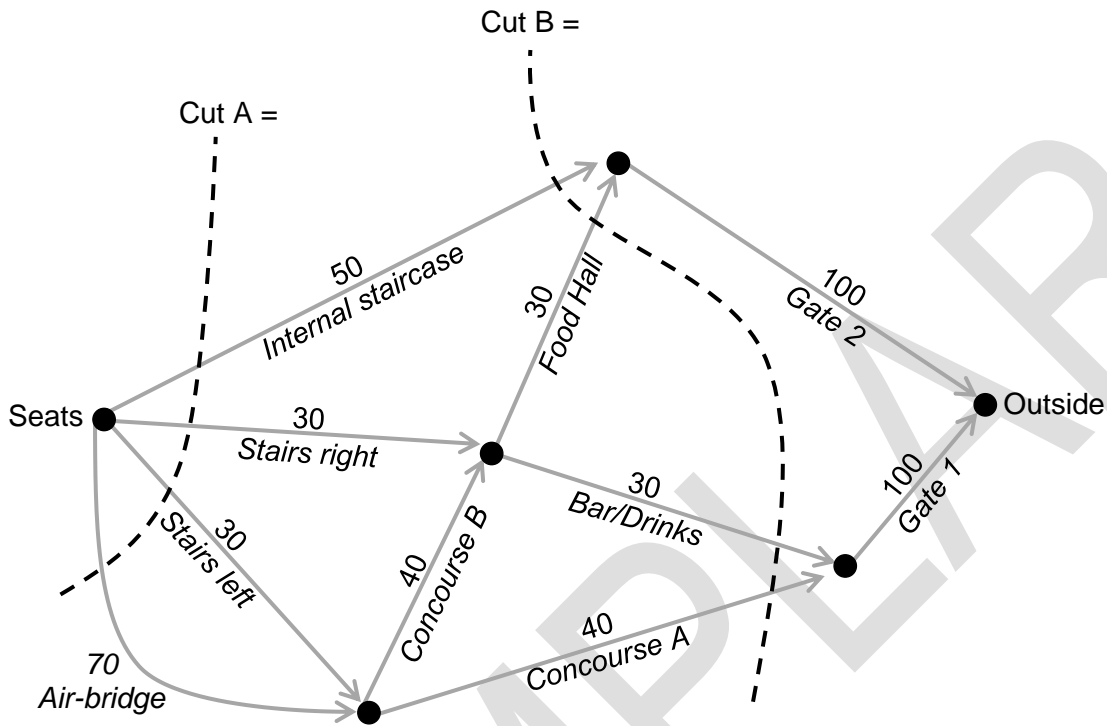


Figure 11: Graph showing the number of people per minute who can move through each grandstand section.

Spare diagram used (X)

a) What is meant by the term 'cut' as it relates to a flow graph?

/1

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b) Find the capacity of cut A and cut B, and mark them on Figure 11.

/1

c) Draw **four (4)** more cuts and find the capacity of each.

/2

d) What is the maximum flow of people exiting the grandstand?

/1

.....

Question 23 continues

**Question 23 continued**

Marker use

e) Which of the following would be likely to produce a greater flow of people exiting the grandstand? Explain your answer:

- Widen the exit gates.
- Remove obstructions in the Food Hall.
- Put a high-speed travelator (conveyor belt) in the air-bridge, for people to walk on.

/2

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f) By how much would the overall flow through the network increase if the flow through the 'Drinks/Bar' area was increased to 50 people/min? Explain your answer.

/2

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**Total  
Q23  
/9**

**Question 24**

Marker use

A football club is building new locker rooms. The project manager is preparing a critical path analysis of the project and has prepared Figure 12. The weights represent the time taken for each activity in days.

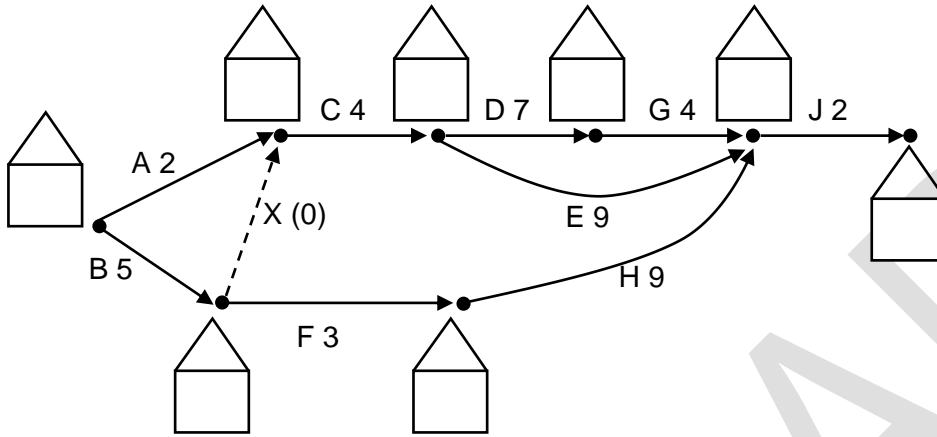


Figure 12: Critical path analysis for building locker rooms.

Spare diagram used (X)

a) Explain why the dummy edge X had to be used between the end of B and the beginning of C.

/2

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b) Find the EST and LFT for each activity and write them appropriately on Figure 12.

/2

c) Mark the critical path on Figure 12.

/1

d) What is the earliest completion time for the project?

/1

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e) Find the 'float' involved in activity H.

/1

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Question 24 continues

**Question 24 continued**

Marker use

- f) The project manager suggests that the builders could complete the project earlier by saving time on activity D. What is the maximum worthwhile saving of time on this activity? Explain your answer.

/2

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Total  
Q24  
/9

**Question 25**

A factory manager wishes to minimise the time that it takes to manufacture items. He is considering allocating his four (4) workers so that each specialises in one of the four tasks that are involved in producing the item.

He times how long it takes each worker to do each of the tasks. The results are shown in Table 12 below.

	Time taken (minutes)			
	Case assembly	Motor installation	Electronics	Control panel
Allie	16	20	17	26
Bob	20	15	20	12
Chloe	12	20	17	14
Dave	20	15	10	13

Table 12

- a) Use the Hungarian algorithm to reduce the matrix into a form where an assignment which minimises production time can be made.

/3

(Start with row reduction first.)

$\left[ \begin{array}{ c c c c } \hline & & & \\ \hline & & & \\ \hline & & & \\ \hline & & & \\ \hline \end{array} \right]$	$\left[ \begin{array}{ c c c c } \hline & & & \\ \hline & & & \\ \hline & & & \\ \hline & & & \\ \hline \end{array} \right]$	$\left[ \begin{array}{ c c c c } \hline & & & \\ \hline & & & \\ \hline & & & \\ \hline & & & \\ \hline \end{array} \right]$
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Spare diagram used (X)

**Question 25 continues**

**Question 25 continued**

Marker use

b) Who should be assigned to each task?

/1

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c) What is the expected production time to produce one complete unit?

/1

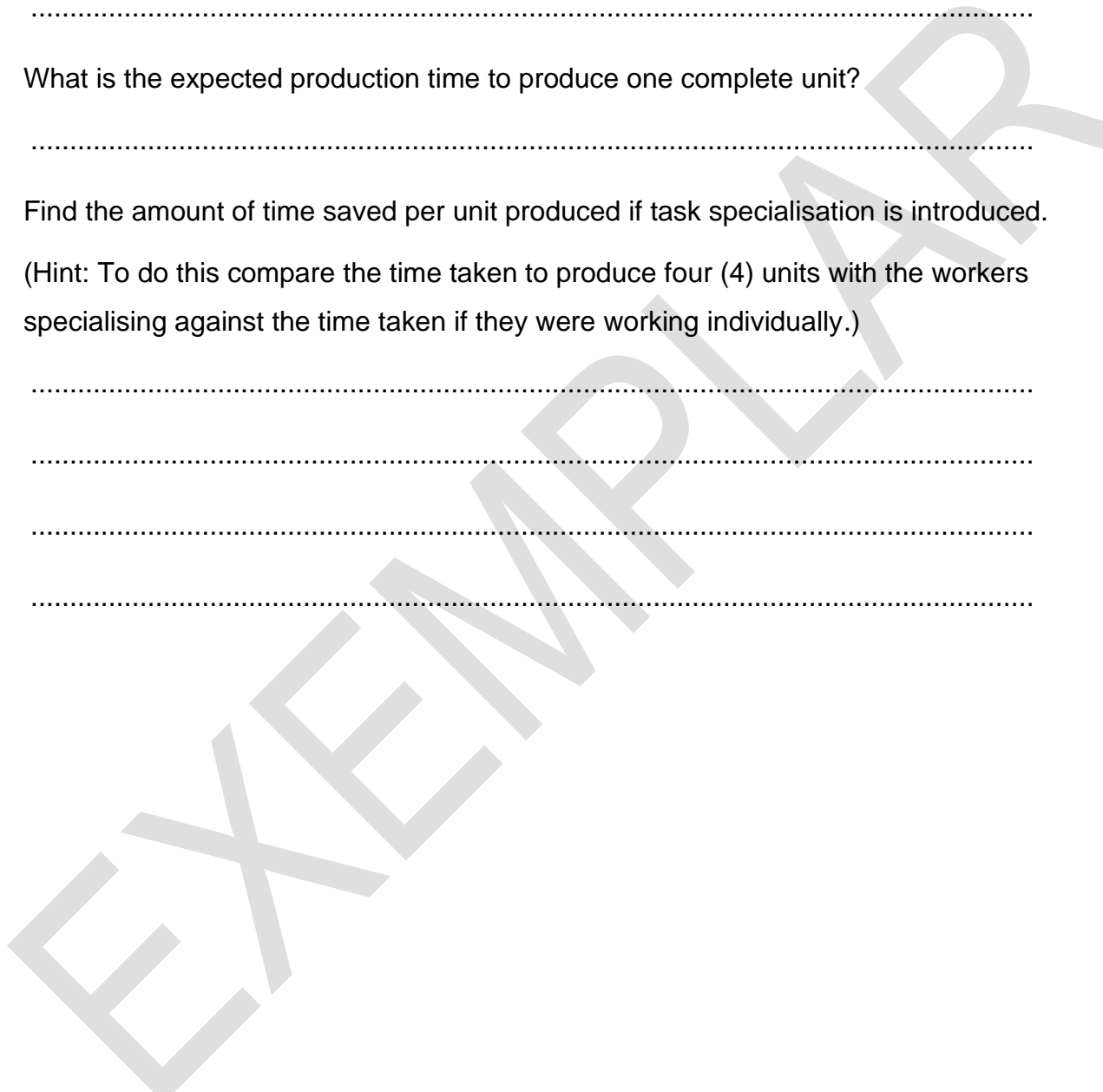
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d) Find the amount of time saved per unit produced if task specialisation is introduced.

/2

(Hint: To do this compare the time taken to produce four (4) units with the workers specialising against the time taken if they were working individually.)

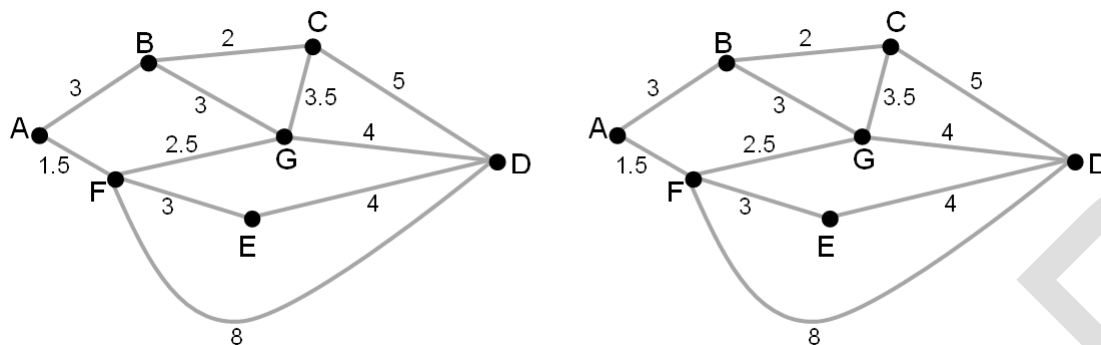
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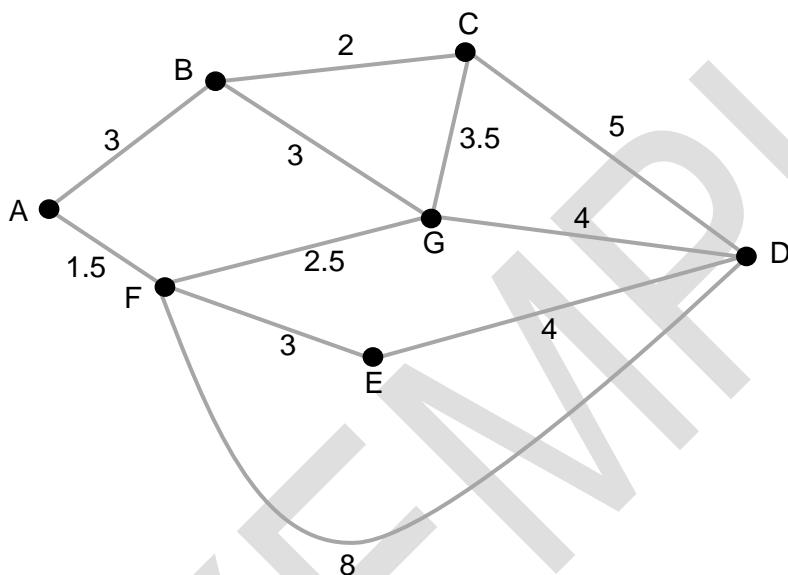
**Total  
Q25  
/7**

# Spare Diagrams

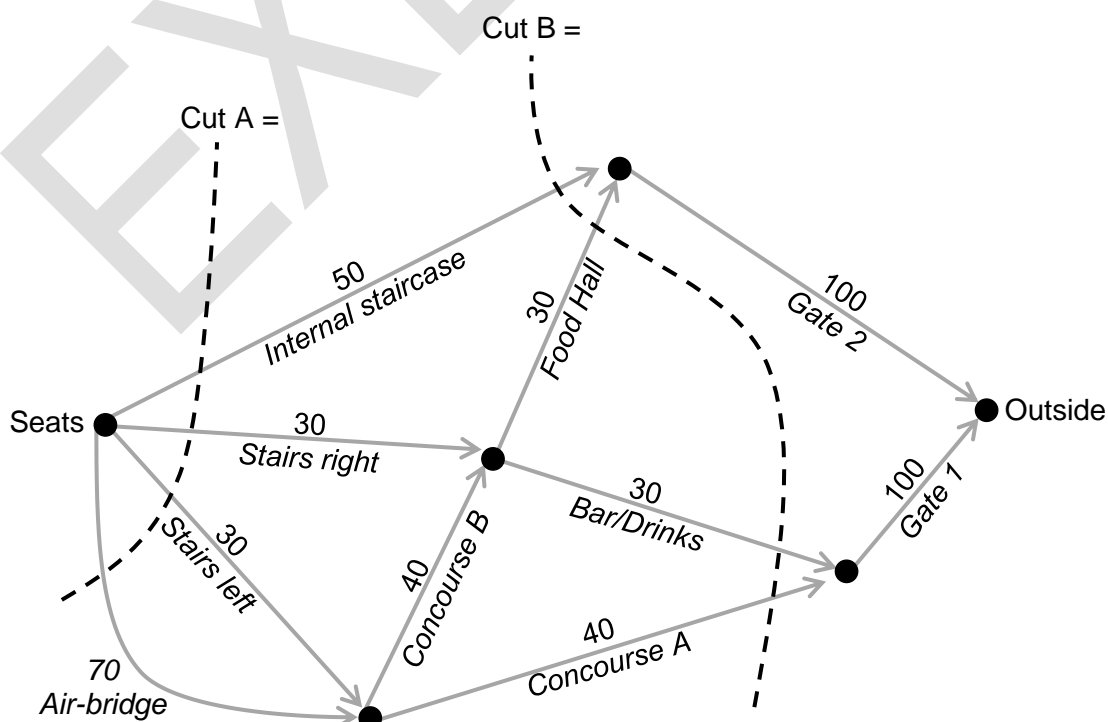
Question 19 b)



Question 19 h)

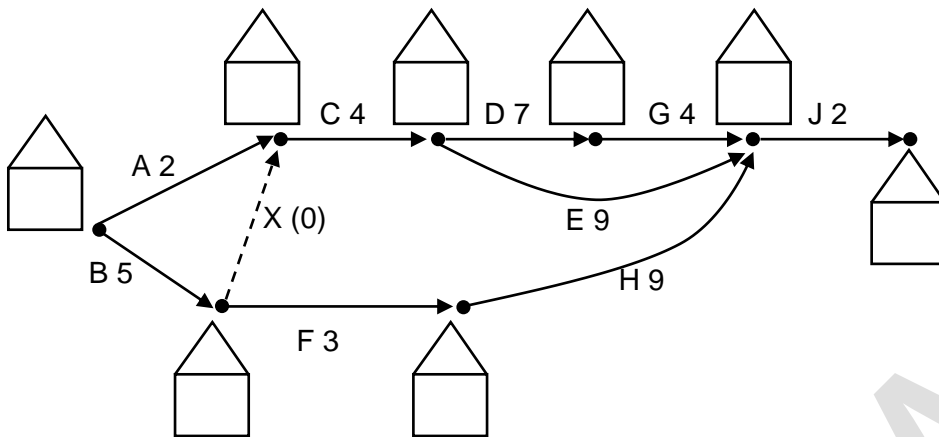


Question 20 b) and c)



# Spare Diagrams

Question 21 c)



Question 22 a)






End of Part 1

# Part 2 - Trigonometry

Marker use

- **Either** answer **all** questions in this part **OR all** questions in Part 1.

## Question 26

A surveyor who wishes to find the area of a block of land divides it into **two (2)** parts and makes measurements as shown by Figure 13.

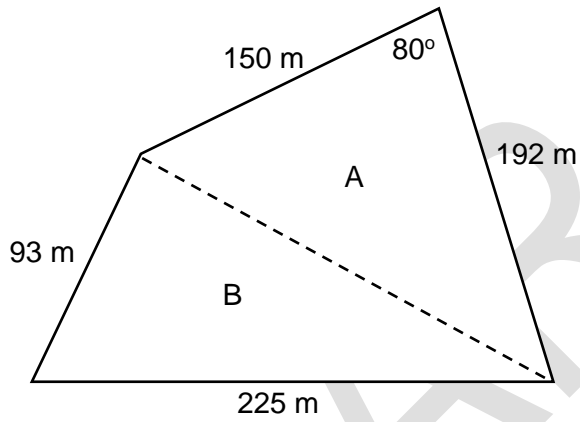


Figure 13: Diagram of a block of land divided into two (2) parts.

- a) Find the area of triangle A.

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/2

- b) Find the length of the dotted line.

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/2

- c) Hence, find the area of triangle B.

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/2

- d) Find the total area of the block of land, expressing your answer in **hectares**.  
(1 ha = 10 000 m<sup>2</sup>)

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/1

Total Q26

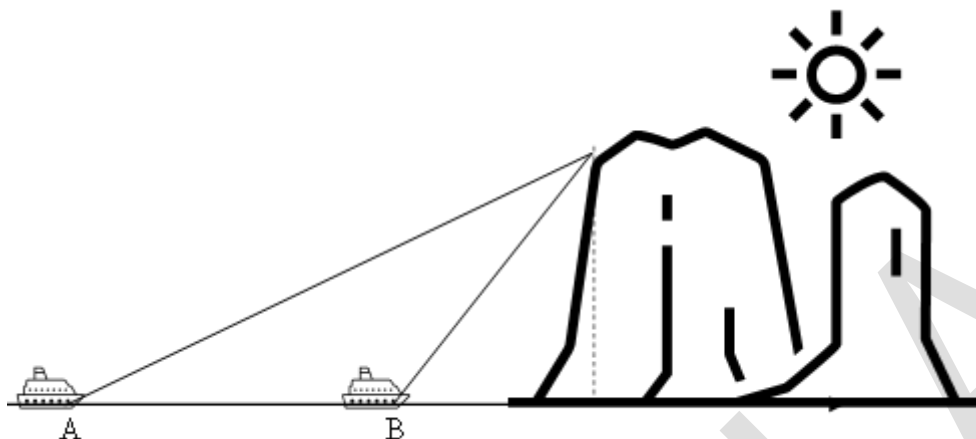
/7

**Question 27**

Marker use

From the top of a 120 metre high cliff the angle of depression to a small boat at sea is  $29^\circ$ . After some time the observer notices that the boat has moved and the angle has become  $65^\circ$ .

a) Add this information to the diagram below:



/3

b) Find the distance that the boat has moved between the two (2) observations.

/4

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Total  
Q27  
/7

**Question 28**

The bearing of a beacon on a rocky reef is  $N40^\circ W$  when observed from a harbour 300 m away. The captain of a ship at sea identifies the beacon on a bearing  $S75^\circ W$  and 420 m away.

Marker use

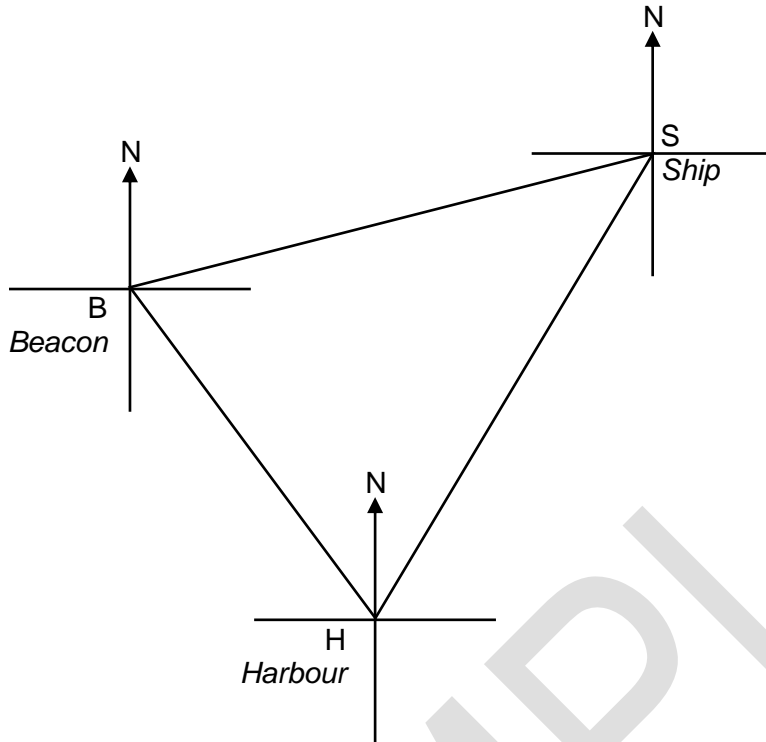


Figure 14: Diagram for marking bearings to answer Question 25 a).

Spare diagram used (X)

a) Mark the bearings on Figure 14.

b) Find the distance of the ship from the harbour.

/2

/3

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c) On what bearing should the captain be heading to safely make the harbour?  
Answer to the nearest minute.

/3

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Total  
Q28  
/8

**Question 29**

Marker use

A jet leaves Perth (-31.95, 115.86) at 7:15 p.m. on Tuesday. It flies to Dubai (25.08, 55.31) by the shortest possible route and maintains a speed of 840 km/h. (Note: GPS bearings).

a) What is meant by the expression 'shortest possible route' in the context of distances on the surface of a sphere?

/1

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b) Find the shortest distance from Perth to Dubai.

/3

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c) Find the time zones (UTC) of Perth and Dubai.

/2

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d) Find the estimated time of arrival (ETA) of the jet in Dubai.

/3

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**Total  
Q29  
/9**

**Question 30**

Marker use

Rome and Copenhagen are both situated on the same meridian of longitude.

Copenhagen has location  $56^\circ\text{N}$ ,  $13^\circ\text{E}$ . It is 1557 km due North of Rome.

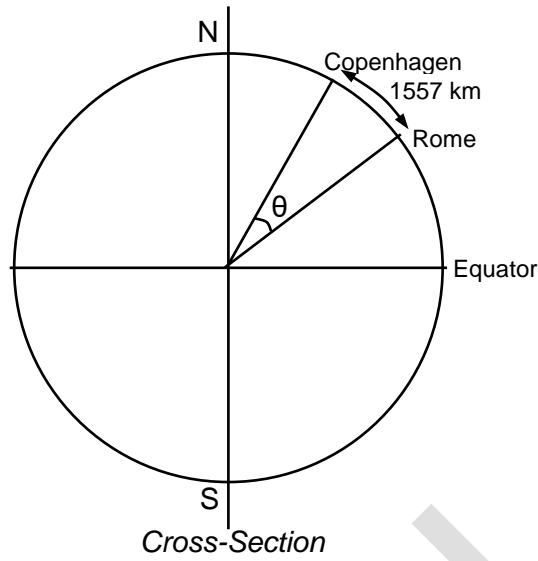


Figure 15: Diagram showing location of cities.

a) Find the angle  $\theta$  subtended by the cities.

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/3

b) Hence find the co-ordinates of Rome. (Answer to the nearest whole degree.)

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.....

/2

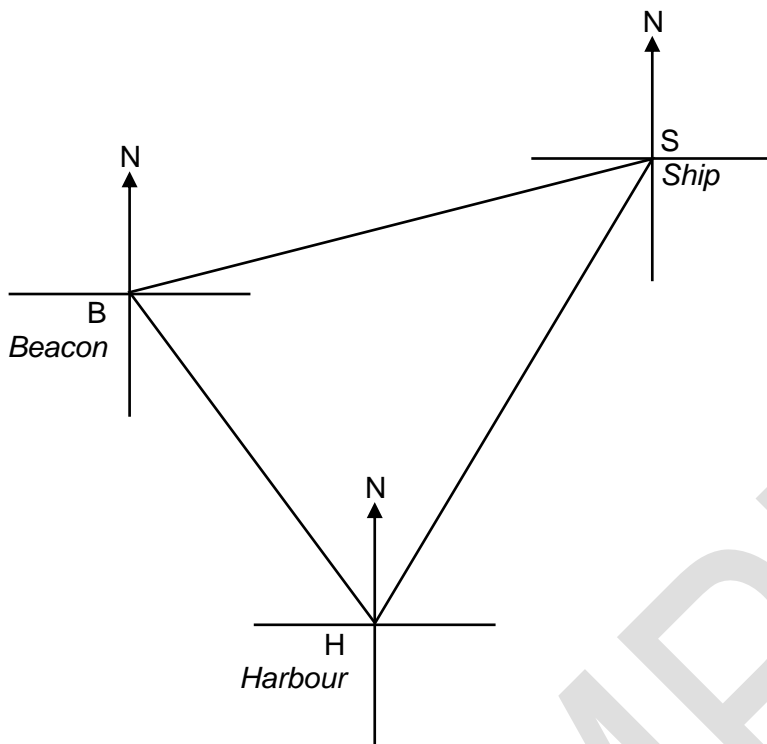
End of Part 2

Total  
Q30  
/5

# Spare Diagrams

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Question 28 a)



End of Exam

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