

Grade 12
Applied Mathematics
Achievement Test

Marking Guide

January 2013

Manitoba Education Cataloguing in Publication Data

Grade 12 applied mathematics achievement test. Marking guide. January 2013 [electronic resource]

ISBN: 978-0-7711-5291-7

1. Educational tests and measurements—Manitoba.
 2. Mathematical ability—Testing.
 3. Mathematics—Examinations, questions, etc.
 4. Mathematics—Study and teaching (Secondary)—Manitoba.
- I. Manitoba. Manitoba Education.
510.76

Manitoba Education
School Programs Division
Winnipeg, Manitoba, Canada

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Available in alternate formats upon request.

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General Marking Instructions

Please do not make any marks in the test booklets. Any marks in a test booklet will have to be erased by departmental staff before the sample marking if the booklet is selected.

Please ensure that

- the student booklet number and the number on the *Scoring Sheet* are identical
- **only a pencil is used to complete the *Scoring Sheet***
- each student's final result is recorded, by booklet number, on the corresponding *Scoring Sheet*
- the *Scoring Sheet* is complete and a copy has been made for school records

Once marking is completed, please forward the *Scoring Sheets* to Manitoba Education in the envelope provided (for more information, see the administration manual).

Marking the Questions

Explanations for common errors for multiple-choice questions have been provided if applicable.

To receive full marks for a question, a student's response must be complete and correct. Partial marks may be awarded for an "appropriate strategy" with execution errors. **An appropriate strategy is defined as one that is consistent with the learning outcomes and mathematical processes associated with the question and, if properly executed, would lead to the correct answer.**

Some questions require a form of explanation or justification from students. Depending on the student's learning style, the explanation or justification can be given through a labelled diagram, in words, by showing mathematical operations for answer verification, or by referring to a software or calculator program. For this reason, appropriate flexibility is required when marking student responses.

Student Errors

As a guiding principle, students should only be penalized once for each error committed in the context of a test question. For example, students may choose an inappropriate strategy for a question, but carry it through correctly and arrive at an incorrect answer. In such cases, students should be penalized for having selected an inappropriate strategy for the task at hand, but should be given credit for having arrived at an answer consistent with their choice of strategy.

Errors which are conceptually related to the learning outcomes associated with the question will result in a 1 mark deduction.

The following communication errors, which are not conceptually related to the learning outcomes associated with the question, may result in a 0.5 mark deduction.

The student

- Ⓔ1 → does not include one of the following in the equation: “y =”, “sin”, “ln”, or “x”, or writes parameters separately from the equation
- Ⓔ2 → does not include the units in the final answer
- Ⓔ3 → does not include one of the following on the graph: labels for the axes, units for the axes, or scales for the axes
- Ⓔ4 → does not state or incorrectly states the final answer
- Ⓔ5 → rounds too soon or rounds incorrectly
- Ⓔ6 → does not use whole units appropriately

Irregularities in Provincial Tests

During the administration of provincial tests, supervising teachers may encounter irregularities. Markers may also encounter irregularities during local marking sessions. Appendix C provides examples of such irregularities as well as procedures to follow to report irregularities.

If a *Scoring Sheet* is marked with “0” and/or “NR” only (e.g., student was present but did not attempt any questions) please document this on the *Irregular Test Booklet Report*.

Assistance

If, during marking, any issue arises that cannot be resolved locally, please call Manitoba Education at the earliest opportunity to advise us of the situation and seek assistance if necessary.

You must contact the Assessment Consultant responsible for this project before making any modifications to the marking keys.

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Grade 12 Applied Mathematics
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Toll-Free: 1-800-282-8069, ext. 4035
Email: barbara.riou@gov.mb.ca

Information for Markers

The marks allocated to questions are primarily based on the concepts associated with the learning outcomes in the curriculum. For each question, shade in the circle on the *Scoring Sheet* that represents the mark awarded based on the concepts. A total of these marks will provide the preliminary mark.

Errors that are not related to the concepts are called “Communication Errors” and these will be indicated on the *Scoring Sheet* in a separate section (see example below). There will be a 0.5 mark deduction for each type of communication error committed, regardless of the number of errors committed for a certain type (i.e., committing a second error for any type will not further affect a student’s mark). There is a maximum deduction of 3 marks (approximately 5% of the total test mark) for communication errors.

The student’s final mark is determined by subtracting the communication errors from the preliminary mark.

Example:

A student has a preliminary mark of 46. The student committed two E1 errors (0.5 mark deduction) and three E4 errors (0.5 mark deduction).

E1 ●
does not include one of the following in the equation: “y =”, “sin”, “ln”, or “x”, or writes parameters separately from the equation
E2 ○
does not include the units in the final answer
E3 ○
does not include one of the following on the graph: labels for the axes, units for the axes, or scales for the axes

E4 ●
does not state or incorrectly states the final answer
E5 ○
rounds too soon or rounds incorrectly
E6 ○
does not use whole units appropriately

Communication Errors				
Preliminary Mark	–	$\left(\begin{array}{l} 0.5 \times \# \text{ of error types for a} \\ \text{maximum deduction of 3 marks} \end{array} \right)$	=	Final Mark
46	–	(0.5×2)	=	45

Marking Keys

Please note that this *Marking Guide* contains screen captures taken from a TI-83 Plus graphing calculator.

RELATIONS AND FUNCTIONS

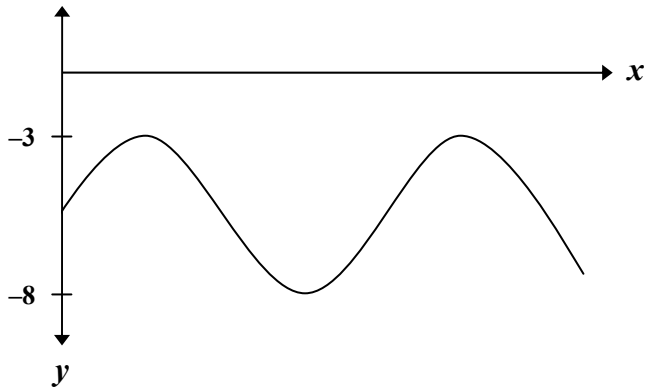
Learning Outcome: 12A.R.3

Question Type: Multiple Choice

Question No. 1 and Answer

Total: 1 mark

Circle the sinusoidal equation below which is best represented by the following graph.

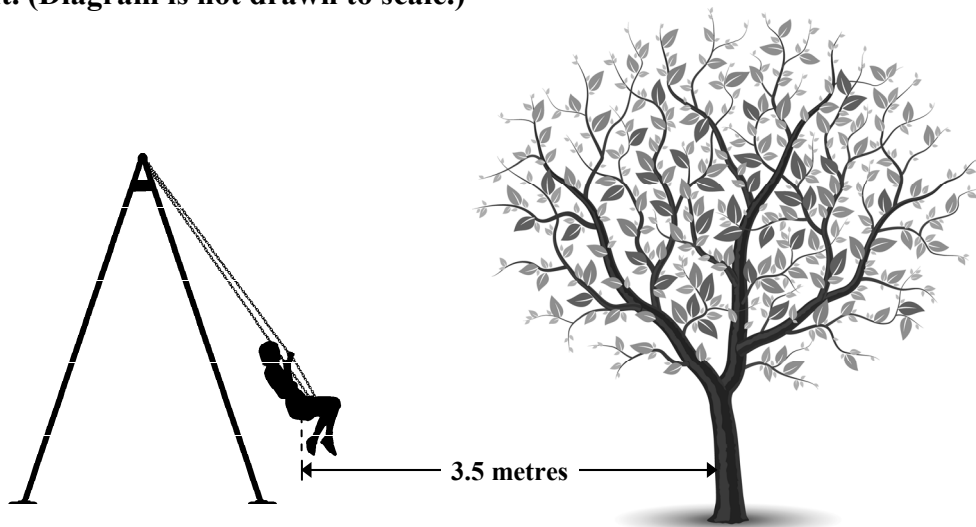


- A) $y = 2.5 \sin(x) + 5.5$
- ✓ B) $y = 2.5 \sin(x) - 5.5$
- C) $y = 5 \sin(x) + 5.5$
- D) $y = 5 \sin(x) - 5.5$

Question No. 2 and Answer

Total: 2 marks

A swing is located directly in front of a tree. As Danielle swings, she is 7.3 metres away from the tree at the furthest point of her swing and 3.5 metres away from the tree at the closest point. (Diagram is not drawn to scale.)



If a sinusoidal equation is used to represent Danielle's position with respect to the tree, determine:

a) the median

(1 mark)

$$d = \frac{7.3 + 3.5}{2} = \frac{10.8}{2} = 5.4$$

b) the amplitude

(1 mark)

$$a = \frac{7.3 - 3.5}{2} = \frac{3.8}{2} = 1.9$$

Marker Note(s):

→ Answers do not need to be rounded to 2 decimal places since the values in the question have been given to 1 decimal place.

→ Units are not required since the median and the amplitude are parameters of a sinusoidal equation and not distances.

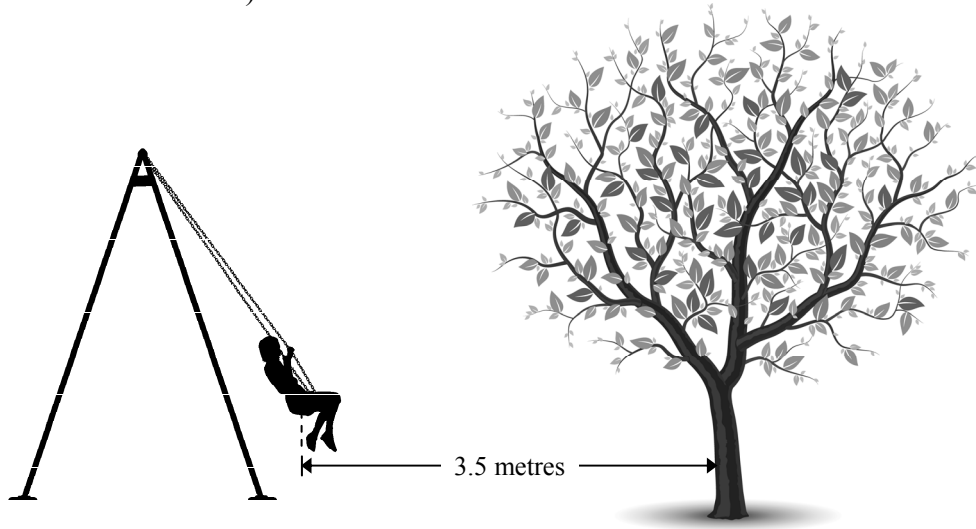
Marking Key	
❶	1 mark for correct answer in (a)
❷	1 mark for correct answer in (b)

Exemplar 1

Question No. 2

Total: 2 marks

A swing is located directly in front of a tree. As Danielle swings, she is 7.3 metres away from the tree at the furthest point of her swing and 3.5 metres away from the tree at the closest point. (Diagram is not drawn to scale.)



If a sinusoidal equation is used to represent Danielle's position with respect to the tree, determine:

- a) the median

$$y = 7.3 \sin(x + 3.5)$$

(1 mark)

$$\frac{\text{max} + \text{min}}{2} = \frac{7.3 - 7.3}{2} = 0$$

$$\text{median} = 0$$

- b) the amplitude

(1 mark)

$$\begin{aligned} a &= \text{max} - \text{med.} \\ &= 7.3 - 0 \\ &= 7.3 \end{aligned}$$

1 mark:

② → 1 mark for correct answer in (b)

Note: Mark ② was awarded based on the student's answer in (a).

Question No. 3 and Answer**Total: 3 marks**

The future deer population in a provincial park is described by the function:

$$P = 365(0.98)^t$$

where t is the number of years from now and P is the population.

a) What is the present size of the deer population?

(1 mark)

The present size of the population is 365.

b) How can you tell that the deer population is decreasing?

(1 mark)

The population is decreasing because b is less than 1.

OR

The population is decreasing because the graph of the function falls to the right.

OR

t	P
0	365
1	357.7
2	350.55
3	343.54

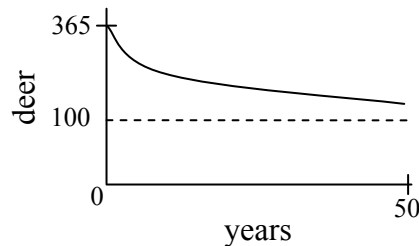
The population is decreasing.

Other explanations are possible.

Question No. 3 continued

- c) The park ranger will implement a conservation plan if the deer population decreases below 100. Could this happen in the next 20 years? Use the function to support the reasoning in your answer.

(1 mark)



No, the population will be greater than 100.

OR

2nd TRACE 1: value $x = 20$, $y = 243$

No, the population will be greater than 100.

OR

$$Y_2 = 100$$

2nd TRACE 5: intersect $x = 64.09$, $y = 100$

No, it will take more than 64 years for the population to decrease below 100.

Other justifications are possible.

Marking Key	
①	1 mark for correct present size in (a)
②	1 mark for correct explanation in (b)
③	1 mark for appropriate support in (c)

Exemplar 1

Question No. 3

Total: 3 marks

The future deer population in a provincial park is described by the function:

$$P = 365(0.98)^t$$

where t is the number of years from now and P is the population.

- a) What is the present size of the deer population?

(1 mark)

365

- b) How can you tell that the deer population is decreasing?

(1 mark)

the population drops by 7.3 each year

- c) The park ranger will implement a conservation plan if the deer population decreases below 100. Could this happen in the next 20 years? Use the function to support the reasoning in your answer.

(1 mark)

$$7.3 \times 20 = 146$$
$$365 - 146 = 219$$

The population should not drop below 100 in the next 20 years.

2 marks:

❶ → 1 mark for correct present size in (a)

❸ → 1 mark for appropriate support in (c)

Note: Mark ❸ was awarded based on the student's answer in (b).

Exemplar 2

Question No. 3

Total: 3 marks

The future deer population in a provincial park is described by the function:

$$P = 365(0.98)^t$$

where t is the number of years from now and P is the population.

- a) What is the present size of the deer population?

(1 mark)

The populations present size is 357.7.

- b) How can you tell that the deer population is decreasing?

(1 mark)

The growth rate is 0.98.

- c) The park ranger will implement a conservation plan if the deer population decreases below 100. Could this happen in the next 20 years? Use the function to support the reasoning in your answer.

(1 mark)

243.67 in 20 years
so the population will not drop below 100.
This is because the growth rate is 0.98, so
it is dropping but not rapidly. In 20 years
the population will be 244.

2 marks:

- ② → 1 mark for correct explanation in (b)
③ → 1 mark for appropriate support in (c)

Question No. 4 and Answer

Total: 3 marks

Felix is examining the growth of bean plants under different growing conditions. The results of one trial are as follows:

Day	Average height of bean plants (cm)
1	5.7
3	12.8
5	16.5
9	19.3
11	19.8
15	20.1

a) Determine a logarithmic equation that best represents the data.

(1 mark)

$$y = 6.44 + 5.55 \ln(x)$$

b) Using your equation in (a), predict the average height of the plants on the 30th day. Indicate your answer to 1 decimal place.

(1 mark)

TRACE 30: $y = 25.3$ cm

OR

$$\begin{aligned} y &= 6.44 + 5.55 \ln(30) \\ &= 25.3 \text{ cm} \end{aligned}$$

Question No. 4 continued

- c) A logarithmic function can represent the average height of the plants, but it has limitations. Explain why the domain or the range is limited in this situation.

(1 mark)

The domain is limited because plants do not grow indefinitely; they eventually die.

OR

The range is limited because plants do not grow infinitely tall; they reach a maximum height.

Other answers are possible.

Marker Note(s):

→ *Regression equations may vary depending on the software used.*

Marking Key	
❶	<i>1 mark for correct logarithmic equation in (a)</i>
❷	<i>1 mark for correct answer in (b)</i>
❸	<i>1 mark for appropriate explanation in (c)</i>

Exemplar 1

Question No. 4**Total: 3 marks**

Felix is examining the growth of bean plants under different growing conditions. The results of one trial are as follows:

Day	Average height of bean plants (cm)
1	5.7
3	12.8
5	16.5
9	19.3
11	19.8
15	20.1

- a) Determine a logarithmic equation that best represents the data.

(1 mark)

Cubic equation

$$0.01x^3 - 0.45x^2 + 4.98x + 1.27$$

- b) Using your equation in (a), predict the average height of the plants on the 30th day. Indicate your answer to 1 decimal place.

(1 mark)

$$x=30$$
$$y = \underline{107.12 \text{ cm}}$$

The average height of the plants on day 30 would be around 107.12 cm.

Exemplar 1 (continued)

- c) A logarithmic function can represent the average height of the plants, but it has limitations. Explain why the domain or the range is limited in this situation.

(1 mark)

Plants can't live forever and they may dry up before they can reach their height potential.

2 marks:

② → 1 mark for correct answer in (b)

③ → 1 mark for appropriate explanation in (c)

Note: Mark ② was awarded based on the student's equation in (a).

Ⓔ1 → no 0.5 mark deduction since mark ① was not awarded

Ⓔ5 → 0.5 mark deduction (if applicable) for rounding too soon or rounding incorrectly

Exemplar 2

Question No. 4**Total: 3 marks**

Felix is examining the growth of bean plants under different growing conditions. The results of one trial are as follows:

Day	Average height of bean plants (cm)
1	5.7
3	12.8
5	16.5
9	19.3
11	19.8
15	20.1

- a) Determine a logarithmic equation that best represents the data.

(1 mark)

$$y = a \sin(bx + c) + d$$
$$y = 6.57 \sin(0.59x + (-2.80)) + 17.46$$

- b) Using your equation in (a), predict the average height of the plants on the 30th day. Indicate your answer to 1 decimal place.

(1 mark)

The average height of the plants on the 30th day is 22.2.

Exemplar 2 (continued)

- c) A logarithmic function can represent the average height of the plants, but it has limitations. Explain why the domain or the range is limited in this situation.

(1 mark)

One limitation to consider is that some plants will be larger and some may not be growing at all. Also consider how much sunlight and water the plants get.

1 mark:

② → 1 mark for correct answer in (b)

ⓔ2 → 0.5 mark deduction (if applicable) for not including the units in the final answer

Question No. 5 and Answer

Total: 5 marks

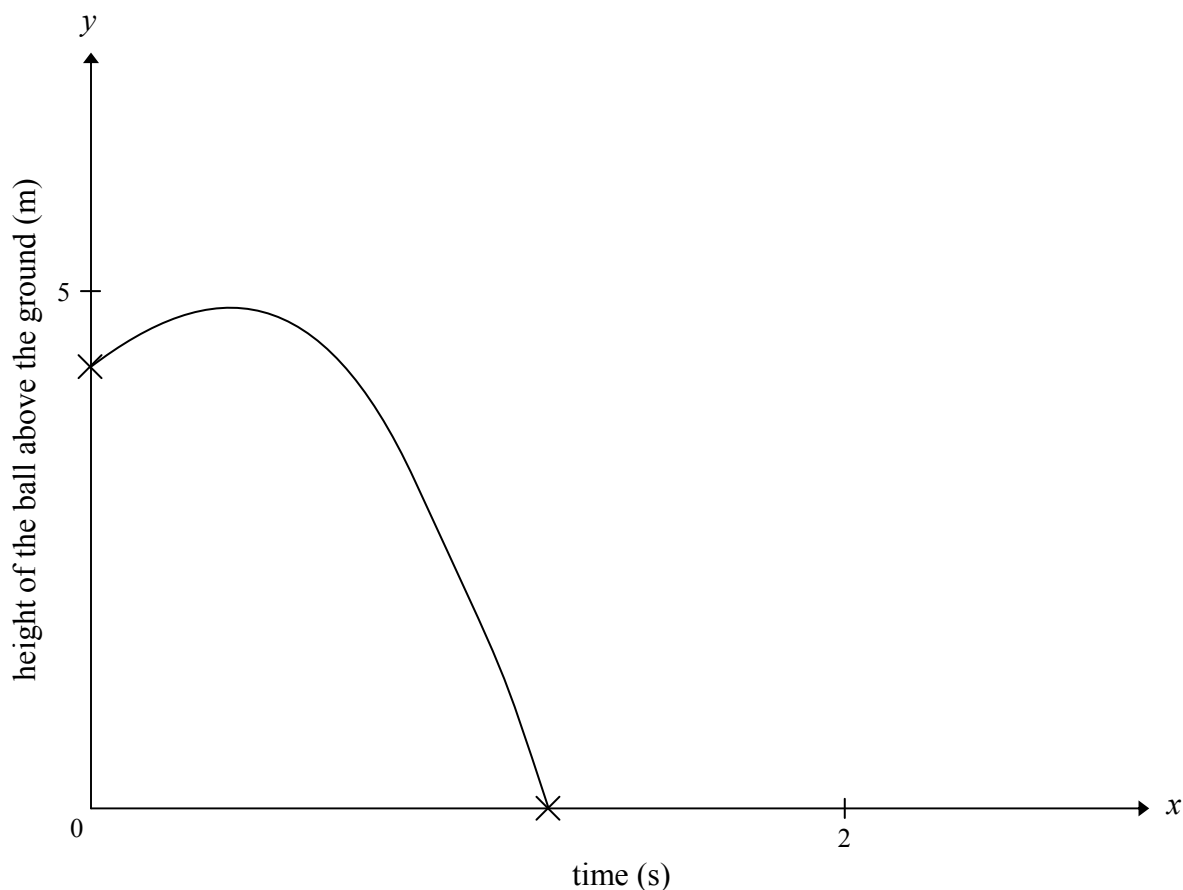
During a science experiment, Roger, who is on a platform, throws a ball toward the ground. He collects the following data:

time (s)	0.0	0.4	0.8	1.2
height of the ball above the ground (m)	4.50	4.72	3.36	0.44

- a) Determine the quadratic equation that best represents the data. Sketch a clearly labelled graph of the equation.

(3 marks)

quadratic equation: $y = -4.91x^2 + 2.50x + 4.50$



Question No. 5 continued

- b) How much time (to 2 decimal places) will it take for the ball to hit the ground? Show your work.

(2 marks)

It will take 1.25 seconds.

Students could solve this question using

- the point of intersection with $y = 0$
- the x -intercept
- an algebraic solution

Marker Note(s):

→ Regression equations may vary depending on the software used.

→ If student does not include **one** of the following on the graph: labels for the axes, units for the axes, or scales for the axes, award mark ③ with a 0.5 mark deduction for ③E.

Marking Key	
①	1 mark for correct quadratic equation in (a)
②	1 mark for correct graph with appropriate shape in (a)
③	1 mark for including: labels for the axes, units for the axes, and scales for the axes in (a)
④	1 mark for appropriate work in (b)
⑤	1 mark for correct answer in (b)

Exemplar 1

Question No. 5

Total: 5 marks

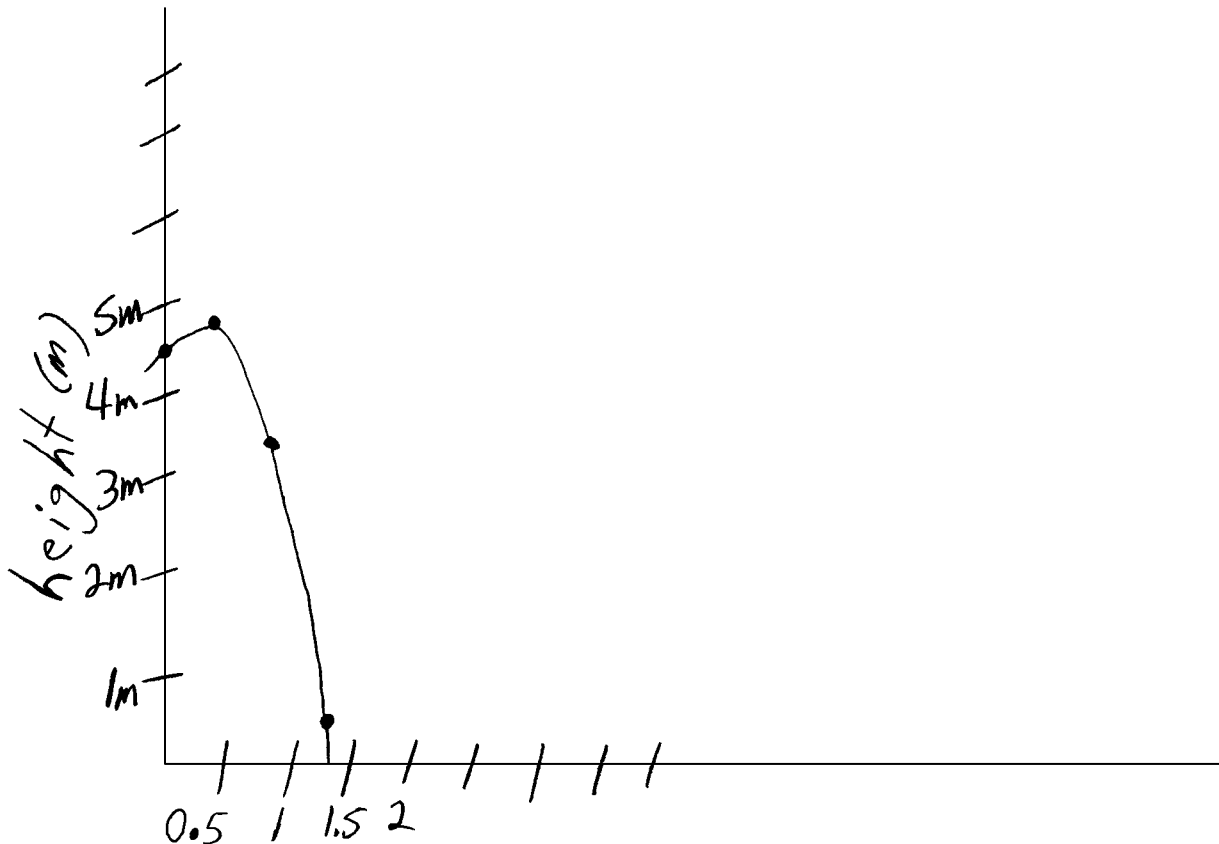
During a science experiment, Roger, who is on a platform, throws a ball toward the ground. He collects the following data:

time (s)	0.0	0.4	0.8	1.2
height of the ball above the ground (m)	4.50	4.72	3.36	0.44

- a) Determine the quadratic equation that best represents the data. Sketch a clearly labelled graph of the equation.

(3 marks)

quadratic equation: $y = (-4.906)x^2 + (2.503)x + (4.5)$



Exemplar 1 (continued)

- b) How much time (to 2 decimal places) will it take for the ball to hit the ground? Show your work.

(2 marks)

1.24 Seconds to hit the ground
(Calculator)

4 marks:

- ① → 1 mark for correct quadratic equation in (a)
- ② → 1 mark for correct graph with appropriate shape in (a)
- ③ → 1 mark for including: labels for the axes, units for the axes, and scales for the axes in (a)
- ⑤ → 1 mark for correct answer in (b)

Note: Writing the word “calculator” is not sufficient to award mark ④.

-
- ⓔ③ → 0.5 mark deduction (if applicable) for not including one of the following on the graph: labels for the axes, units for the axes, or scales for the axes
 - ⓔ⑤ → 0.5 mark deduction (if applicable) for rounding too soon or rounding incorrectly

Exemplar 2

Question No. 5

Total: 5 marks

During a science experiment, Roger, who is on a platform, throws a ball toward the ground. He collects the following data:

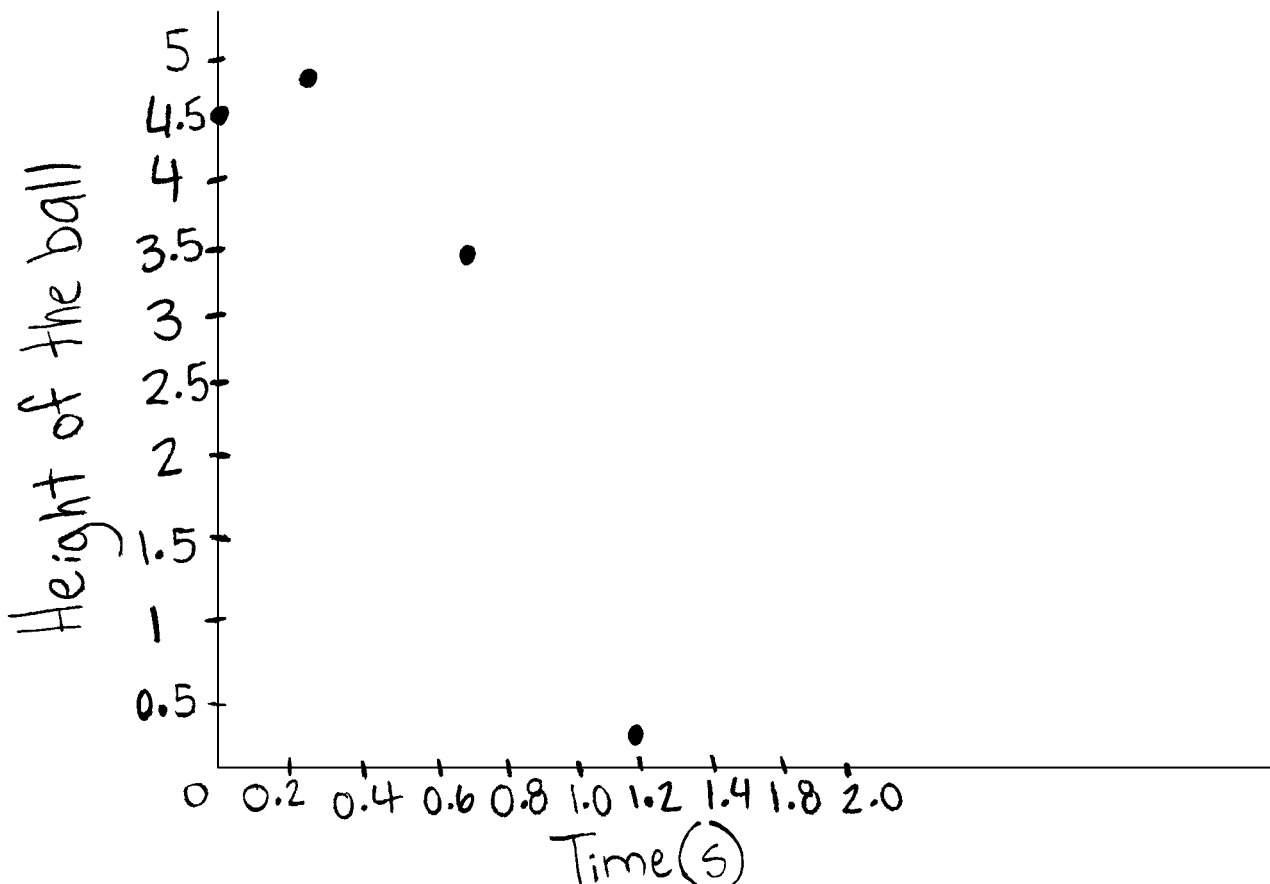
time (s)	0.0	0.4	0.8	1.2	1.6
height of the ball above the ground (m)	4.50	4.72	3.36	0.44	-5.984

\checkmark 1.36m \checkmark 2.92m \checkmark 6.424

- a) Determine the quadratic equation that best represents the data. Sketch a clearly labelled graph of the equation.

(3 marks)

quadratic equation: _____



Exemplar 2 (continued)

- b) How much time (to 2 decimal places) will it take for the ball to hit the ground? Show your work.

(2 marks)

0.0	0.4	0.8	1.2	1.6
4.50	4.72	3.36	0.44	-5.98

1.36 2.92 6.42

1.24

2 marks:

- ③ → 1 mark for including: labels for the axes, units for the axes, and scales for the axes in (a)
 - ⑤ → 1 mark for correct answer in (b)
-
- Ⓔ → 0.5 mark deduction (if applicable) for not including the units in the final answer
 - Ⓔ → 0.5 mark deduction (if applicable) for rounding too soon or rounding incorrectly

PROBABILITY

Learning Outcomes: 12A.P.3, 12A.P.4

Question Type: Short Answer

Question No. 6 and Answer

Total: 1 mark

A multiple-choice test has 3 questions. Each question has 4 possible answers. A student randomly selects an answer for each of the 3 questions. What is the probability that the student will select all the correct answers?

$$\begin{aligned} P(\text{all the correct answers}) &= \frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} \\ &= \frac{1}{64} \text{ or } 0.02 \text{ or } 1.56\% \end{aligned}$$

Marking Key	
1	1 mark for correct answer

Question No. 7 and Answer

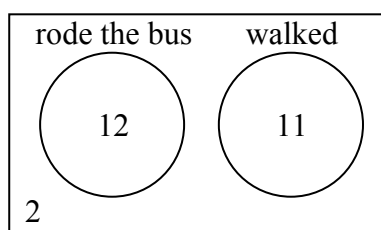
Total: 1 mark

Mr. Ramesh asked his 25 students how they got to school that day.

- 12 students said they rode the bus.
- 11 students said they walked.

Are these events mutually exclusive? Explain your reasoning.

- Yes. It is possible for the students who rode the bus and those who walked to be two distinct groups, given that the total is less than 25. These events are therefore mutually exclusive.



OR

- No. It is possible for students to walk to the bus stop. These events are therefore not mutually exclusive.

Other explanations are possible.

Marking Key**1***1 mark for correct explanation*

Question No. 8 and Answer**Total: 2 marks**

Describe a scenario that involves dependent events. Explain how you know that the events are dependent.

Given a bag of marbles where 3 marbles out of 5 marbles are red.
Picking 2 red marbles from the bag without replacement
would be a scenario involving dependent events.

The probability of picking a second red marble changes
since one red marble has already been removed from the bag.

Other answers are possible.

Marking Key

- | | |
|---|---|
| ① | <i>1 mark for scenario that involves dependent events</i> |
| ② | <i>1 mark for correct explanation</i> |

Exemplar 1

Question No. 8

Total: 2 marks

Describe a scenario that involves dependent events. Explain how you know that the events are dependent.

rolling two dice and getting an even number.

This scenario is dependent because after the first roll, it depends on what your second roll is, whether you get an even or an odd number.

1 mark:

② → 1 mark for correct explanation

Question No. 9 and Answer

Total: 2 marks

Twenty-five cards numbered from 1 to 25 are placed in a bag. What is the probability of selecting a card that is a multiple of 7 or an odd number? Show your work.

multiples of 7: {7, 14, 21}

$$n(\text{multiples of } 7) = 3$$

odd number, not a multiple of 7: {1, 3, 5, ~~7~~, 9, 11, 13, 15, 17, 19, ~~21~~, 23, 25}

$$n(\text{odd number, not a multiple of } 7) = 11$$

$$\begin{aligned} P(\text{multiple of } 7 \text{ or odd number}) &= \frac{3}{25} + \frac{11}{25} \\ &= \frac{14}{25} \text{ or } 0.56 \text{ or } 56\% \end{aligned}$$

OR

$P(\text{multiple of } 7 \text{ or odd number})$

$= P(\text{multiple of } 7) + P(\text{odd number}) - P(\text{multiple of } 7 \text{ and odd number})$

$$= \frac{3}{25} + \frac{13}{25} - \frac{2}{25}$$

$$= \frac{14}{25} \text{ or } 0.56 \text{ or } 56\%$$

Marking Key	
❶	<i>1 mark for appropriate work</i>
❷	<i>1 mark for correct answer</i>

Exemplar 1

Question No. 9

Total: 2 marks

Twenty-five cards numbered from 1 to 25 are placed in a bag. What is the probability of selecting a card that is a multiple of 7 or an odd number? Show your work.

^x multiple 7	^y Odd
7	1
14	3
21	5
	7
	9
	11
	13
	15
	17
	19
	21
	23
	25

$$\begin{aligned}P(x \text{ or } y) &= \left(\frac{3}{25}\right) + \left(\frac{13}{25}\right) \\ &= \frac{16}{25} \\ &= 0.64 \text{ or } 64\%\end{aligned}$$

1 mark:

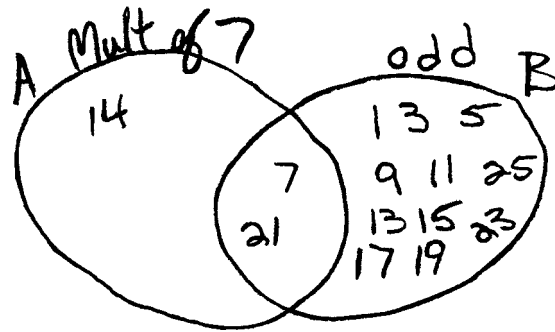
② → 1 mark for correct answer

Exemplar 2

Question No. 9

Total: 2 marks

Twenty-five cards numbered from 1 to 25 are placed in a bag. What is the probability of selecting a card that is a multiple of 7 or an odd number? Show your work.



$$P(\text{a mult. of 7 or odd number}) \\ = \frac{14}{25}$$

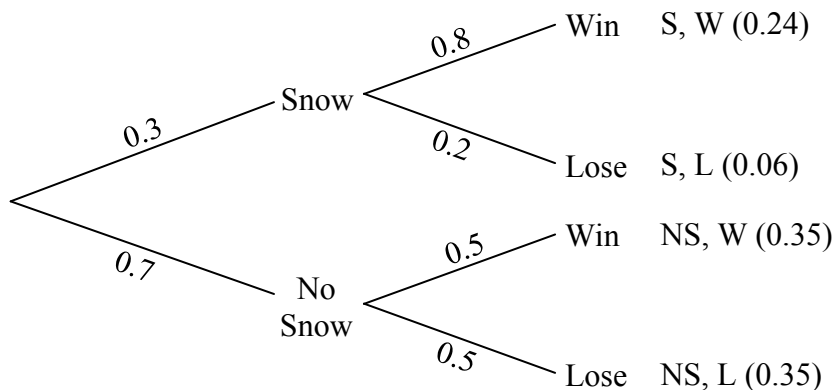
2 marks:

- ① → 1 mark for appropriate work
- ② → 1 mark for correct answer

Question No. 10 and Answer

Total: 2 marks

In October, the Leopards have a football game. If it snows, the probability that they will win is 0.8. If it does not snow, the probability that they will win is 0.5. The probability of snow is 0.3. Calculate the probability that the Leopards will win. Show your work.



$$\begin{aligned}
 P(\text{Win}) &= (0.3)(0.8) + (0.7)(0.5) \\
 &= 0.59 = 59\%
 \end{aligned}$$

Marker Note(s):

→ Award full marks even if a graphic organizer was not created.

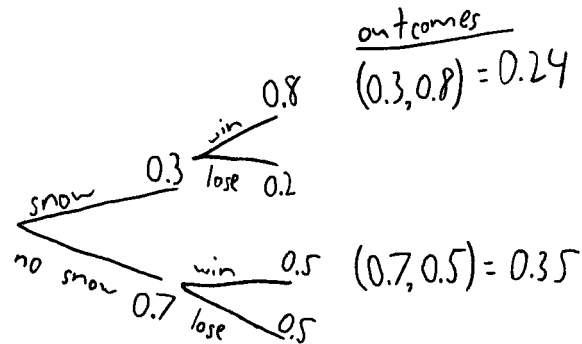
Marking Key	
1	<i>1 mark for appropriate work</i>
2	<i>1 mark for correct answer</i>

Exemplar 1

Question No. 10

Total: 2 marks

In October, the Leopards have a football game. If it snows, the probability that they will win is 0.8. If it does not snow, the probability that they will win is 0.5. The probability of snow is 0.3. Calculate the probability that the Leopards will win. Show your work.



$$P(\text{Leopards win}) = (0.24)(0.35) = 0.084$$

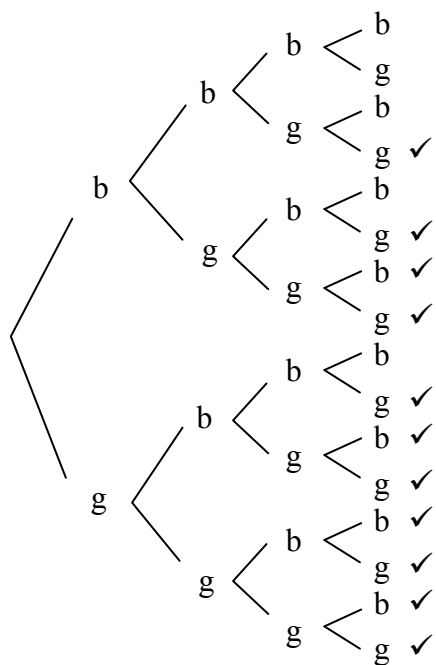
1 mark:

① → 1 mark for appropriate work

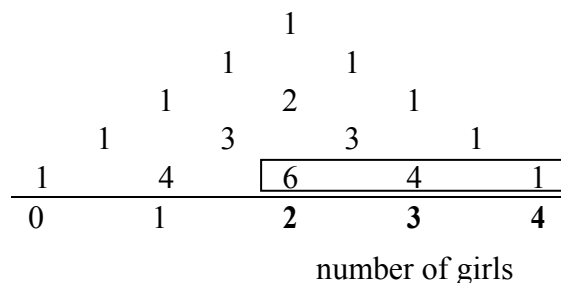
Question No. 11 and Answer

Total: 2 marks

A couple plans to have four children. The probability of a child being a girl is 50%. Determine the probability of the couple having at least 2 girls. Show your work using a graphic organizer. (A graphic organizer is a visual representation of information. Examples include a tree diagram, a chart, a list, a Venn diagram, a truth table, Pascal's triangle, etc.)



OR



$$\frac{6 + 4 + 1}{1 + 4 + 6 + 4 + 1} = \frac{11}{16}$$

$$P(\text{at least 2 girls}) = \frac{11}{16} \text{ or } 0.69 \text{ or } 68.75\%$$

Marking Key

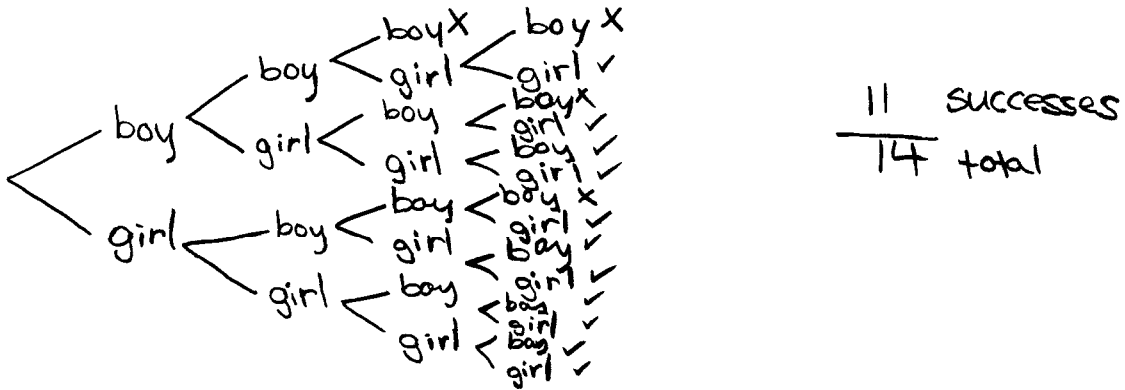
- | | |
|----------|--|
| 1 | <i>1 mark for appropriate work using a graphic organizer</i> |
| 2 | <i>1 mark for correct answer</i> |

Exemplar 1

Question No. 11

Total: 2 marks

A couple plans to have four children. The probability of a child being a girl is 50%. Determine the probability of the couple having at least 2 girls. Show your work using a graphic organizer. (A graphic organizer is a visual representation of information. Examples include a tree diagram, a chart, a list, a Venn diagram, a truth table, Pascal's triangle, etc.)



$$P(\text{having at least 2 girls}) = \frac{11}{14}$$

The probability of the couple having at least 2 girls is $\frac{11}{14}$.

1 mark:

① → 1 mark for appropriate work using a graphic organizer

Question No. 12 and Answer

Total: 2 marks

Four students were asked to determine how many four-digit numbers could be created using the digits 0, 1, 2, and 3, based on their assumptions. They gave the following answers:

- Aaron: 256
- Beth: 192
- Carol: 24
- David: 18

Choose one answer and show how it was calculated. Identify two assumptions made by the student.

Aaron

$$4 \times 4 \times 4 \times 4 = 256$$

- repetition allowed
- the number can start with 0

OR

Beth

$$3 \times 4 \times 4 \times 4 = 192$$

- repetition allowed
- the number can't start with 0

OR

Carol

$$4 \times 3 \times 2 \times 1 = 24$$

- no repetition allowed
- the number can start with 0

OR

David

$$3 \times 3 \times 2 \times 1 = 18$$

- no repetition allowed
- the number can't start with 0

Marking Key	
①	1 mark for correct calculation
②	1 mark for correct identification of two assumptions

Exemplar 1

Question No. 12

Total: 2 marks

Four students were asked to determine how many four-digit numbers could be created using the digits 0, 1, 2, and 3, based on their assumptions. They gave the following answers:

- Aaron: 256
- Beth: 192
- Carol: 24
- David: 18

Choose one answer and show how it was calculated. Identify two assumptions made by the student.

Carol 24
She punched in 4 nPr 4
She assumed that the #s could only be used once
in each # or that you must use all #s.
She also assumed that order did matter.

2 marks:

- ① → 1 mark for correct calculation
- ② → 1 mark for correct identification of two assumptions

Question No. 13 and Answer**Total: 2 marks**

A volleyball team consists of 8 players, a coach, and a manager. If the members of the team are asked to line up for a photograph, determine the number of ways that the members can line up

a) if there are no restrictions

(1 mark)

$$10! = 3\,628\,800$$

b) if the coach and the manager must stand beside each other

(1 mark)

$$9! \times 2! = 725\,760$$

Marking Key

① *1 mark for correct answer in (a)*

② *1 mark for correct answer in (b)*

Exemplar 1

Question No. 13**Total: 2 marks**

A volleyball team consists of 8 players, a coach, and a manager. If the members of the team are asked to line up for a photograph, determine the number of ways that the members can line up

- a) if there are no restrictions

(1 mark)

$$10! = 3628800$$

- b) if the coach and the manager must stand beside each other

(1 mark)

$$8! \times 2 = 80640$$

1 mark:

① → 1 mark for correct answer in (a)

Question No. 14 and Answer

Total: 4 marks

A group of 3 objects is selected from 8 objects.

- a) Describe a scenario in which the order of selection of the 3 objects is not important. Calculate the total possible outcomes for your scenario.

(2 marks)

Assuming that the objects are people and selecting a committee of 3 people from a group of 8. (ABC, ACB, BAC, BCA, CAB, and CBA are considered to be the same committee.)

$$\begin{array}{ccc} & \text{OR} & \\ \text{Combination: } {}_8C_3 = 56 & | & \frac{8 \times 7 \times 6}{3 \times 2 \times 1} = 56 \end{array}$$

There are 56 different committees.

Other answers are possible.

- b) Describe a scenario in which the order of selection of the 3 objects is important. Calculate the total possible outcomes for your scenario.

(2 marks)

Selecting a committee of 3 people from a group of 8, where the first person chosen is president, the second person is vice-president, and the third person is treasurer. (ABC, ACB, BAC, BCA, CAB, and CBA are considered to be different committees.)

$$\begin{array}{ccc} & \text{OR} & \\ \text{Permutation: } {}_8P_3 = 336 & | & 8 \times 7 \times 6 = 336 \end{array}$$

There are 336 different committees.

Other answers are possible.

Marking Key	
❶	<i>1 mark for appropriate scenario in (a)</i>
❷	<i>1 mark for correct answer in (a)</i>
❸	<i>1 mark for appropriate scenario in (b)</i>
❹	<i>1 mark for correct answer in (b)</i>

Exemplar 1

Question No. 14

Total: 4 marks

A group of 3 objects is selected from 8 objects.

- a) Describe a scenario in which the order of selection of the 3 objects is not important. Calculate the total possible outcomes for your scenario.

(2 marks)

56

If each Item is replaced while Selection is happening.

- b) Describe a scenario in which the order of selection of the 3 objects is important. Calculate the total possible outcomes for your scenario.

(2 marks)

336

if each item is removed as the selection is happening.

2 marks:

② → 1 mark for correct answer in (a)

④ → 1 mark for correct answer in (b)

Exemplar 2

Question No. 14

Total: 4 marks

A group of 3 objects is selected from 8 objects.

- a) Describe a scenario in which the order of selection of the 3 objects is not important. Calculate the total possible outcomes for your scenario.

(2 marks)

3 students are chosen from 8

$$\frac{8 \cdot 8 \cdot 8}{3 \cdot 2 \cdot 1} = 85$$

- b) Describe a scenario in which the order of selection of the 3 objects is important. Calculate the total possible outcomes for your scenario.

(2 marks)

8 people are taking a course, how many ways can you arrange for 1st, 2nd and 3rd?

$$8 \cdot 8 \cdot 8 = 512$$

2 marks:

③ → 1 mark for appropriate scenario in (b)

④ → 1 mark for correct answer in (b)

Note: Mark ④ was awarded based on student's work in (a).

FINANCIAL MATHEMATICS

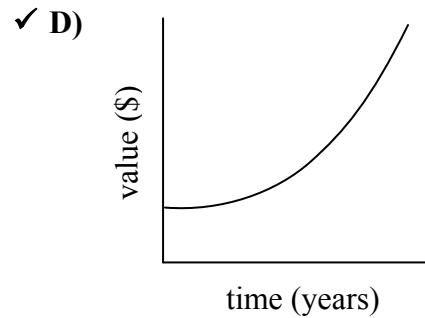
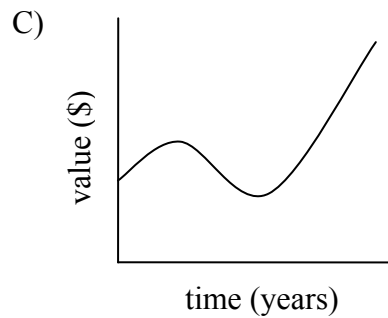
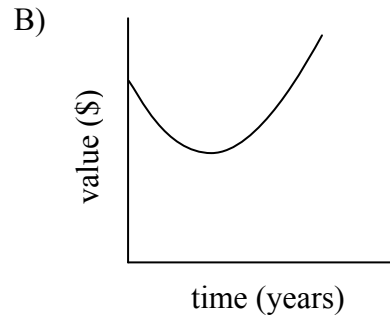
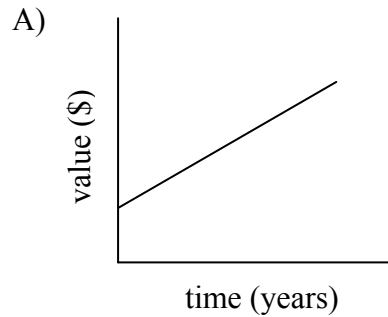
Learning Outcome: 12A.FM.1

Question Type: Multiple Choice

Question No. 15 and Answer

Total: 1 mark

Circle the graph below that best represents an investment earning compound interest over a period of years.



Common Errors

A: linear

B: quadratic

C: cubic

Question No. 16 and Answer**Total: 1 mark**

Diane invests \$100 and doubles her money in 8 years. Circle the operation below which illustrates the correct use of the Rule of 72 to estimate the annual interest rate.

- ✓ A) $72 \div 8$
- B) $8 \div 72 \times 100$
- C) $100 \div 8$
- D) $72 \div 100$

Question No. 17 and Answer**Total: 1 mark**

Identify an asset which is likely to appreciate in value. Justify your answer.

- A house usually increases in value over time.
- Cash in a savings account is secure and has guaranteed interest.

Other answers are possible.

Marking Key

1 | *1 mark for appropriate justification*

Exemplar 1

Question No. 17

Total: 1 mark

Identify an asset which is likely to appreciate in value. Justify your answer.

property

0 marks:
→ no criteria met

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Question No. 18 and Answer

Total: 4 marks

Amanda wants to invest \$15 000. She wonders which would be the better investment in terms of the amount of interest earned.

- a) **Option 1:** Buy a \$15 000 Canada Savings Bond that earns simple interest at an annual rate of 4.5%. Calculate the amount of interest earned after 5 years.

(1 mark)

$$\begin{aligned} I &= Prt \\ &= (15\,000)(0.045)(5) \\ &= \$3375 \end{aligned}$$

- b) **Option 2:** Buy a \$15 000 Guaranteed Investment Certificate that earns 4.5% compounded annually. Calculate the amount of interest earned after 5 years. Show your work.

(2 marks)

N=5
I%=4.5
PV=-15000
PMT=0
FV=18692.72906
P/Y=1
C/Y=1
PMT: <input type="checkbox"/> END <input checked="" type="checkbox"/> BEGIN

OR

$$\begin{aligned} A &= P \left(1 + \frac{r}{n} \right)^{nt} \\ &= 15\,000 \left(1 + \frac{0.045}{1} \right)^{(1)(5)} \\ &= \$18\,692.73 \end{aligned}$$

$$\begin{aligned} \text{amount of interest earned} &= \$18\,692.73 - \$15\,000 \\ &= \$3692.73 \end{aligned}$$

Question No. 18 continued

- c) Amanda's friend suggests that she should invest the \$15 000 in the stock market. Do you agree or disagree with her friend? Explain your answer.

(1 mark)

I disagree because stocks are a riskier investment and Amanda could lose a lot of money.

OR

I agree because, over a long period of time, the rate of return on stocks could be greater.

Marker Note(s):

→ A maximum of 1 error is allowed in the input values of a financial template in (b) (award the mark for appropriate work, but not the mark for correct answer).

Marking Key	
1	<i>1 mark for correct answer in (a)</i>
2	<i>1 mark for appropriate work in (b)</i>
3	<i>1 mark for correct answer in (b)</i>
4	<i>1 mark for appropriate explanation in (c)</i>

Exemplar 1

Question No. 18**Total: 4 marks**

Amanda wants to invest \$15 000. She wonders which would be the better investment in terms of the amount of interest earned.

- a) **Option 1:** Buy a \$15 000 Canada Savings Bond that earns simple interest at an annual rate of 4.5%. Calculate the amount of interest earned after 5 years.

(1 mark)

$$\text{Simple Interest } I = Prt$$

$$I = (15000)(0.045)(5)$$

$$I = \$3375$$

- b) **Option 2:** Buy a \$15 000 Guaranteed Investment Certificate that earns 4.5% compounded annually. Calculate the amount of interest earned after 5 years. Show your work.

(2 marks)

$$\text{Compound } A = P \left(1 + \frac{r}{n} \right)^{nt}$$

$$A = 15000 \left(1 + \frac{0.045}{1} \right)^{(1 \times 5)}$$

$$= 15000 (1.045)^5$$

$$= (15000)(1.25)$$

$$A = \$18692.73$$

Exemplar 1 (continued)

- c) Amanda's friend suggests that she should invest the \$15 000 in the stock market. Do you agree or disagree with her friend? Explain your answer.

(1 mark)

no

2 marks:

- ① → 1 mark for correct answer in (a)
② → 1 mark for appropriate work in (b)

Question No. 19 and Answer**Total: 5 marks**

A dealership advertises a sale price of \$45 899 (including taxes) for a new truck. The salesman offers Darrel two options:

Option 1: Lease

- down payment of \$5000
- monthly payments of \$577.50 (including taxes) for 4 years
- residual value of \$15 000 after 4 years
- allowable limit of 20 000 km/year and \$0.15 for each additional kilometre

Option 2: Purchase

- down payment of \$5000
- loan with monthly payments, compounded monthly for 4 years at an annual rate of 4.9%

- a) Darrel estimates that he will drive 30 000 km/year. If he chooses Option 1, how much will he pay in total if he returns the truck at the end of the lease? Show your work.

(2 marks)

$$(30\,000 \times 4) - (20\,000 \times 4) = 40\,000 \text{ km}$$

$$40\,000 \times \$0.15 = \$6000$$

$$\$6000 + \$5000 + (\$577.50 \times 12 \times 4) = \$38\,720$$

He will pay \$38 720.

Question No. 19 continued

- b) What will be the total price of the truck, including the down payment, if Darrel decides to purchase it according to Option 2? Show your work.

(3 marks)

N=48
I%=4.9
PV=40899
PMT=-940.02351...
FV=0
P/Y=12
C/Y=12
PMT: <input type="checkbox"/> END <input checked="" type="checkbox"/> BEGIN

$$\begin{array}{r}
 \$940.02 \times 12 \times 4 = \$45\,120.96 \\
 + \$5000.00 \\
 \hline
 \$50\,120.96
 \end{array}$$

The total price will be \$50 120.96.

Marker Note(s):

→ A maximum of 1 error is allowed in the input values of a financial template in (b) (award the mark for appropriate work, but not the mark for correct payment).

Marking Key	
1	<i>1 mark for appropriate work in (a)</i>
2	<i>1 mark for correct answer in (a)</i>
3	<i>1 mark for appropriate work in (b)</i>
4	<i>1 mark for correct payment in (b)</i>
5	<i>1 mark for correct answer in (b)</i>

Exemplar 1

Question No. 19

Total: 5 marks

A dealership advertises a sale price of \$45 899 (including taxes) for a new truck. The salesman offers Darrel two options:

Option 1: Lease

- down payment of \$5000
- monthly payments of \$577.50 (including taxes) for 4 years
- residual value of \$15 000 after 4 years
- allowable limit of 20 000 km/year and \$0.15 for each additional kilometre

Option 2: Purchase

- down payment of \$5000
- loan with monthly payments, compounded monthly for 4 years at an annual rate of 4.9%

- a) Darrel estimates that he will drive 30 000 km/year. If he chooses Option 1, how much will he pay in total if he returns the truck at the end of the lease? Show your work.

(2 marks)

$$\begin{aligned}\text{extra km} &= \$0.15/\text{km} \times 10\,000 \text{ km} \\ \text{extra km} &= \$1500.00\end{aligned}$$

$$\text{monthly} = \$577.50/\text{month} \times 48 \text{ months} = \$27\,720$$

$$\text{total paid} = \text{down payment} + \text{monthly payments} + \text{residual value} + \text{extra kms}$$

$$\text{total paid} = \$5000 + \$27\,720 + \$1500$$

$$\text{total paid} = \$34\,220$$

Exemplar 1 (continued)

- b) What will be the total price of the truck, including the down payment, if Darrel decides to purchase it according to Option 2? Show your work.

(3 marks)

$$\begin{aligned}n &= 12 \times 4 = 48 \\i\% &= 4.9 \\pv &= -45899 - 5000 \\pmt &= 0 \rightarrow 1169.86 \\fv &= 0 \\p/y &= 12 \\c/y &= 12 \\pmt &= \text{end}\end{aligned}$$

$$\$1169.86 \times 48 = \$56153.28$$

\$56153.28 is what Darrel would pay if he decides to purchase it with option 2.

2 marks:

- ① → 1 mark for appropriate work in (a)
- ② → 1 mark for appropriate work in (b)

Exemplar 2

Question No. 19

Total: 5 marks

A dealership advertises a sale price of \$45 899 (including taxes) for a new truck. The salesman offers Darrel two options:

Option 1: Lease

- down payment of \$5000
- monthly payments of \$577.50 (including taxes) for 4 years
- residual value of \$15 000 after 4 years
- allowable limit of 20 000 km/year and \$0.15 for each additional kilometre

Option 2: Purchase

- down payment of \$5000
- loan with monthly payments, compounded monthly for 4 years at an annual rate of 4.9%

- a) Darrel estimates that he will drive 30 000 km/year. If he chooses Option 1, how much will he pay in total if he returns the truck at the end of the lease? Show your work.

(2 marks)

Option 1 Lease

$$n = 12 \times 4 = 48$$

$$I = 0 \rightarrow 12.5$$

$$PV = -45\,899 + 5000$$

$$PMT = 577.50 \times 1.13 = 652.57$$

$$FV = 0$$

$$P/Y = 12$$

$$C/Y = 12$$

Purchase

$$n = 12 \times 4$$

$$I = 4.9$$

$$PV = -45\,899 - 5000$$

$$PMT = 0 \rightarrow 940.02$$

$$FV = 0$$

$$P/Y = 12$$

$$C/Y = 12$$

Darrel would pay 35 823.36 if he chooses option 1.

$$652.57 \times 48 = 31\,323.36$$

$$0.15 \times 30\,000 = 4500$$

Exemplar 2 (continued)

- b) What will be the total price of the truck, including the down payment, if Darrel decides to purchase it according to Option 2? Show your work.

(3 marks)

$$940.02 \times 48 = \$45\,120.96$$

2 marks:

③ → 1 mark for appropriate work in (b)

④ → 1 mark for correct payment in (b)

ⓔ2 → no 0.5 mark deduction since mark ② was not awarded

Question No. 20 and Answer**Total: 4 marks**

The Richards have a mortgage of \$200 000 at an interest rate of 6% compounded semi-annually and amortized over 25 years. The monthly mortgage payment is \$1279.61.

- a) If the Richards divide their monthly payment in half and make their payment every two weeks instead, how many payments will be required to pay off the mortgage?
Show your work.

(2 marks)

```
■ N=546.8028666
I%=6
PV=200000
PMT=-639.81
FV=0
P/Y=26
C/Y=2
PMT: [ ] BEGIN
```

547 payments will be required.

Question No. 20 continued

- b) If the Richards make their payment every two weeks, how much interest will they have saved by the end of the mortgage? Show your work.

(2 marks)

25 years, monthly payments: 21 years, bi-weekly payments

$$\Sigma \text{Int}(1, 300) = \$183\,885.23 \quad \Sigma \text{Int}(1, 547) = \$149\,850.06$$

$$\text{difference} = \$183\,885.23 - \$149\,850.06 = \$34\,035.17$$

The amount of interest saved will be \$34 035.17.

OR

$$(300)(1279.61) - (546.80)(639.81) = \$34\,034.89$$

The amount of interest saved will be \$34 034.89.

OR

$$(1279.61)(12)(25) - (639.81)(26)\left(\frac{546.80}{26}\right) = \$34\,034.89$$

The amount of interest saved will be \$34 034.89.

Marker Note(s):

- A maximum of 1 error is allowed in the input values of a financial template in (a) (award the mark for appropriate work, but not the mark for correct answer).
→ The answer in (b) may vary as a result of rounding.

Marking Key	
①	1 mark for appropriate work in (a)
②	1 mark for correct answer in (a)
③	1 mark for appropriate work in (b)
④	1 mark for correct answer in (b)

Exemplar 1

Question No. 20

Total: 4 marks

The Richards have a mortgage of \$200 000 at an interest rate of 6% compounded semi-annually and amortized over 25 years. The monthly mortgage payment is \$1279.61.

- a) If the Richards divide their monthly payment in half and make their payment every two weeks instead, how many payments will be required to pay off the mortgage? Show your work.

(2 marks)

bi weekly pmnts ~ 639.81

26 payments per year

TVM solver

555 payments $\frac{555}{26} = 21.35 \text{ yrs}$

21 years to pay off instead of 25

- b) If the Richards make their payment every two weeks, how much interest will they have saved by the end of the mortgage? Show your work.

(2 marks)

$$\begin{array}{r}
 1279.61 \times 12 \times 25 = \$383\,883 \\
 639.81 \times 26 \times 21 = \$349\,336.26 \\
 \hline
 \text{they save } \$34\,546.74
 \end{array}$$

2 marks:

③ → 1 mark for appropriate work in (b)
 ④ → 1 mark for correct answer in (b)

Ⓔ⑤ → 0.5 mark deduction (if applicable) for rounding too soon or rounding incorrectly

DESIGN AND MEASUREMENT

Learning Outcome: 12A.D.1

Question Type: Short Answer

Question No. 21 and Answer

Total: 2 marks

The Bertrands want to empty their circular swimming pool. There is 3 feet of water left in the pool which has a diameter of 16 feet. Using a pump which can remove 400 ft³ of water per hour, how many hours will it take to remove all the water?

$$\begin{aligned}\text{Volume} &= \pi r^2 h \\ &= \pi(8)^2(3) \\ &= 603.19 \text{ ft}^3\end{aligned}$$

$$\frac{603.19 \text{ ft}^3}{400 \text{ ft}^3/\text{hour}} = 1.51 \text{ hours}$$

It will take 1.51 hours.

Marking Key

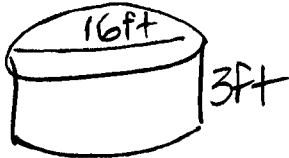
- | | |
|---|---|
| ① | <i>1 mark for correct volume of water</i> |
| ② | <i>1 mark for correct number of hours</i> |

Exemplar 1

Question No. 21

Total: 2 marks

The Bertrands want to empty their circular swimming pool. There is 3 feet of water left in the pool which has a diameter of 16 feet. Using a pump which can remove 400 ft^3 of water per hour, how many hours will it take to remove all the water?



$$V = \pi r^2 h$$

$$V = \pi (16)^2 (3) = \frac{2412.74}{400} = 6.0319$$

1 mark:

② → 1 mark for correct number of hours

ⓔ2 → 0.5 mark deduction (if applicable) for not including the units in the final answer

ⓔ5 → no 0.5 mark deduction since student correctly rounded the answer to more than two decimal places

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Question No. 22 and Answer**Total: 4 marks**

You have been asked to install floor tiles and paint your aunt's bathroom based on the following information:

- The floor measures 5 ft. \times 7 ft.
 - The walls are 8 ft. high.
 - The door measures 80 in. \times 30 in.
 - The window measures 24 in. \times 30 in.
- a) You must cover the entire bathroom floor with tiles. Each tile measures 1 ft. \times 1 ft. You will need an extra 5% of tiles to account for waste. How many tiles will you need to purchase for the project?

(1 mark)

$$5 \text{ ft.} \times 7 \text{ ft.} = 35 \text{ ft}^2$$

$$35 \text{ ft}^2 \times 1.05 = 36.75$$

You will need to purchase 37 tiles.

Question No. 22 continued

- b) You must apply two coats of paint to the walls of the bathroom. The door and the window will not be painted. Determine the total area to be painted. How many cans of paint will you need to purchase if one can covers 100 ft^2 ? Show your work.

(3 marks)

Area of walls (with door and window)

$$2(5 \text{ ft.} \times 8 \text{ ft.}) + 2(7 \text{ ft.} \times 8 \text{ ft.}) \\ = 192 \text{ ft}^2$$

Area to be painted (without door and window)

$$192 - (6.6 \text{ ft.} \times 2.5 \text{ ft.}) - (2 \text{ ft.} \times 2.5 \text{ ft.}) \\ = 170.33 \text{ ft}^2$$

Number of cans of paint

$$170.33 \text{ ft}^2/\text{coat} \times 2 \text{ coats} = 340.66 \text{ ft}^2 \\ 340.66 \text{ ft}^2 \times \frac{1 \text{ can}}{100 \text{ ft}^2} = 3.41 \text{ cans}$$

You will need to purchase 4 cans of paint.

Marking Key	
①	1 mark for correct number of tiles in (a)
②	1 mark for correct area of walls (with door and window) in (b)
③	1 mark for correct area to be painted (without door and window) in (b)
④	1 mark for correct number of cans of paint in (b)

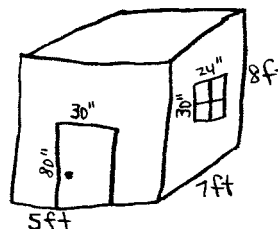
Exemplar 1

Question No. 22

Total: 4 marks

You have been asked to install floor tiles and paint your aunt's bathroom based on the following information:

- The floor measures 5 ft. \times 7 ft.
- The walls are 8 ft. high.
- The door measures 80 in. \times 30 in.
- The window measures 24 in. \times 30 in.



- a) You must cover the entire bathroom floor with tiles. Each tile measures 1 ft. \times 1 ft. You will need an extra 5% of tiles to account for waste. How many tiles will you need to purchase for the project?

(1 mark)

ceiling	wall	back	5×7 $= 35\text{ft}^2$	5×7 $= 35\text{ft}^2$	8×7 $= 56\text{ft}^2$	5×8 $= 40\text{ft}^2$	7×8 $= 56\text{ft}^2 - 5\text{ft}^2$ $= 51\text{ft}^2$	
floor	wall with window	front with door	5×8 $= 40\text{ft}^2 - 16.67\text{ft}^2$ $= 23.33\text{ft}^2$	Total ft $= 240.33$				240.33×1.05 $= 252.35 = 253 \text{ tiles}$

Exemplar 1 (continued)

- b) You must apply two coats of paint to the walls of the bathroom. The door and the window will not be painted. Determine the total area to be painted. How many cans of paint will you need to purchase if one can covers 100 ft^2 ? Show your work.

(3 marks)

look at calculation in (a)

$$\begin{aligned} &\text{Total ft} \\ &= 240.33 \text{ ft}^2 \end{aligned}$$

You will need 3 cans
of paint.

$$\begin{aligned} &240.33 \text{ ft}^2 \div 100 \text{ ft}^2 \\ &= 2.40 \text{ cans of paint} \end{aligned}$$

1 mark:

⑤ → 1 mark for correct area to be painted (without door and window) in (b)

Exemplar 2

Question No. 22

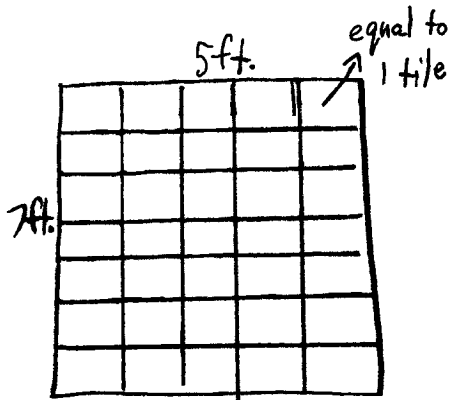
Total: 4 marks

You have been asked to install floor tiles and paint your aunt's bathroom based on the following information:

- The floor measures 5 ft. \times 7 ft.
- The walls are 8 ft. high. ~~6.7ft.~~ = 2.5ft.
- The door measures 80 in. \times 30 in.
- The window measures 24 in. \times 30 in. = 2ft. = 2.5ft.

- a) You must cover the entire bathroom floor with tiles. Each tile measures 1 ft. \times 1 ft. You will need an extra 5% of tiles to account for waste. How many tiles will you need to purchase for the project?

(1 mark)



$$5 \times 7 = 35$$

You will need 35 tiles for the project.

Exemplar 2 (continued)

- b) You must apply two coats of paint to the walls of the bathroom. The door and the window will not be painted. Determine the total area to be painted. How many cans of paint will you need to purchase if one can covers 100 ft²? Show your work.

(3 marks)

$$= 50 \text{ ft.}$$

$$5 + 5 + 7 + 7 = 24 \times 8 = 192 \text{ ft.}$$

$$192 - (6.7 \times 2.5 = 16.75) - (2 \times 2.5 = 5) = 170.25$$

Need 4 cans for one coat $50 \times 4 = 200 \times 2$ for 2 coats = 400 ft.
8 cans.

You need 8 cans of paint for the entire bathroom with its 2 coats.

2 marks:

- ② → 1 mark for correct area of walls (with door and window) in (b)
- ③ → 1 mark for correct area to be painted (without door and window) in (b)

-
- ⓔ2 → 0.5 mark deduction (if applicable) for not including the units in the final answer
 - ⓔ5 → 0.5 mark deduction (if applicable) for rounding too soon or rounding incorrectly

LOGICAL REASONING

Learning Outcome: 12A.L.3

Question Type: Multiple Choice

Question No. 23 and Answer

Total: 1 mark

Circle the statement below which has the same meaning as: “If a quadrilateral is a square, then it is a rectangle.”

- A) If a quadrilateral is not a square, then it is not a rectangle.
- B) If a quadrilateral is a rectangle, then it is a square.
- ✓ C) **If a quadrilateral is not a rectangle, then it is not a square.**
- D) If it is not a square or a rectangle, then it is not a quadrilateral.

Given the statement: “Multiples of 6 are always multiples of 3.”

a) Write the converse statement.

(1 mark)

Multiples of 3 are always multiples of 6.

b) Provide a counter-example that shows the converse statement is false.

(1 mark)

Justification: 9 is a multiple of 3, but it is not a multiple of 6.

Other answers are possible.

Marking Key	
①	1 mark for writing the converse statement in (a)
②	1 mark for appropriate counter-example in (b)

Exemplar 1

Question No. 24

Total: 2 marks

Given the statement: "Multiples of 6 are always multiples of 3."

a) Write the converse statement.

(1 mark)

If multiple of 6 then a multiple of 3.

b) Provide a counter-example that shows the converse statement is false.

(1 mark)

The converse is false because 15 is a multiple of 3 such that 15 is not a multiple of 6.

1 mark:

② → 1 mark for appropriate counter-example in (b)

Exemplar 2

Question No. 24

Total: 2 marks

Given the statement: "Multiples of 6 are always multiples of 3."

a) Write the converse statement.

(1 mark)

Multiples of 3 aren't always multiples of 6.

b) Provide a counter-example that shows the converse statement is false.

(1 mark)

Multiples of 3 up to 30 = 3, ~~6~~, 9, ~~12~~, 15, ~~18~~, 21,
~~24~~, 27, ~~30~~

Multiples of 6 up to 30 = 6, 12, 18, 24, 30

There are 5 differences between the two which are:
3, 9, 15, 21, and 27

0 marks:

→ no criteria met

Question No. 25 and Answer

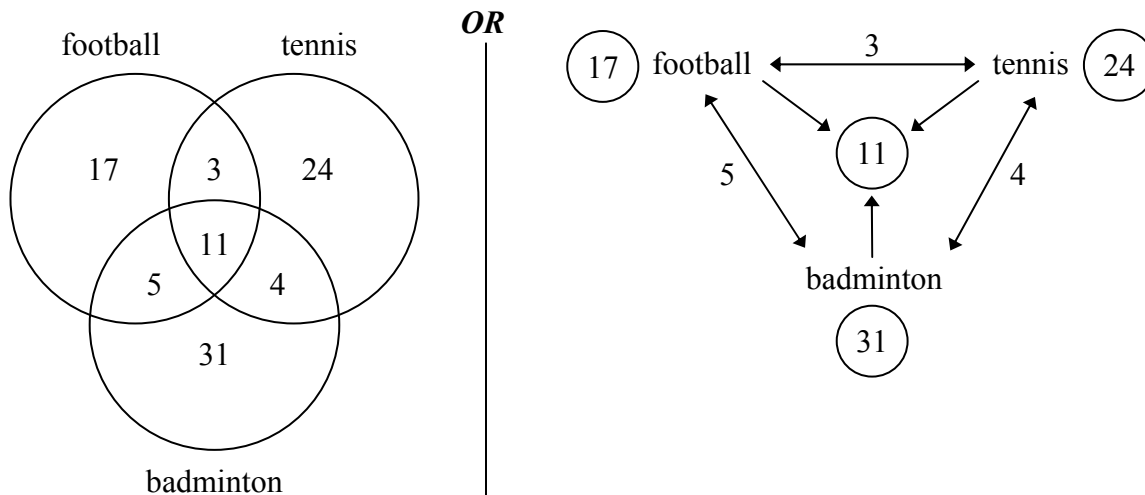
Total: 3 marks

A sports club noted that its members participated in at least one of the following sports: football, tennis, or badminton.

- 36 played football
- 42 played tennis
- 51 played badminton
- 14 played football and tennis
- 16 played football and badminton
- 15 played tennis and badminton
- 11 participated in all three sports

a) Use a graphic organizer to illustrate this situation. (A graphic organizer is a visual representation of information. Examples include a tree diagram, a chart, a list, a Venn diagram, a truth table, Pascal’s triangle, etc.)

(1 mark)



Other graphic organizers could be used.

b) How many members only played badminton?

(1 mark)

31 members

c) How many members played football or tennis?

(1 mark)

$$36 + 42 - 14 = 64 \text{ members}$$

OR

$$17 + 5 + 11 + 3 + 4 + 24 = 64 \text{ members}$$

Marking Key	
1	<i>1 mark for correct distribution of players in (a)</i>
2	<i>1 mark for correct answer in (b) consistent with distribution in (a)</i>
3	<i>1 mark for correct answer in (c) consistent with distribution in (a)</i>

Exemplar 1

Question No. 25

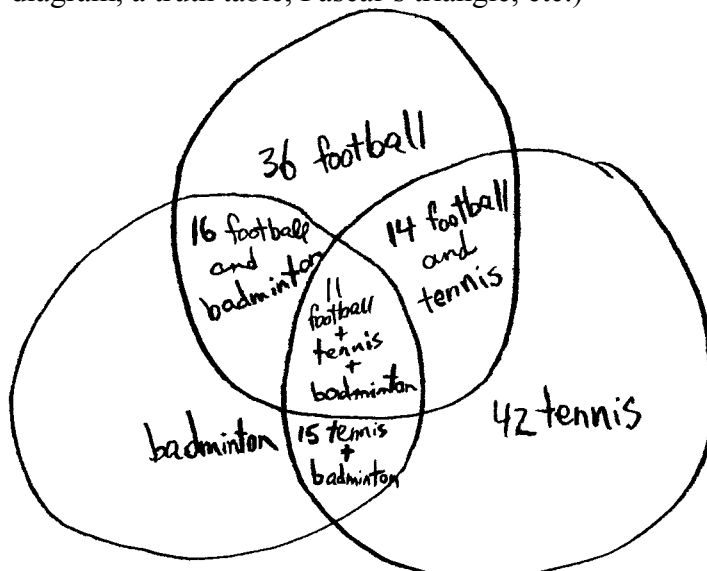
Total: 3 marks

A sports club noted that its members participated in at least one of the following sports: football, tennis, or badminton.

- 36 played football
- 42 played tennis
- 51 played badminton
- 14 played football and tennis
- 16 played football and badminton
- 15 played tennis and badminton
- 11 participated in all three sports

- a) Use a graphic organizer to illustrate this situation. (A graphic organizer is a visual representation of information. Examples include a tree diagram, a chart, a list, a Venn diagram, a truth table, Pascal's triangle, etc.)

(1 mark)



- b) How many members only played badminton?

(1 mark)

$$51 - 16 - 15 - 11 \\ = 9 \text{ only played badminton}$$

- c) How many members played football or tennis?

(1 mark)

$$11 + 15 + 16 + 14 \\ = 56 \text{ played} \\ \text{football or tennis}$$

1 mark:

② → 1 mark for correct answer in (b) consistent with distribution in (a)

Appendices

Appendix A: Table of Questions by Unit and Learning Outcome

Unit	Question	Type	Learning Outcome	Mark
A	1	MC	12A.R.3	1
A	2	SA	12A.R.3	2
A	3	LA	12A.R.2	3
A	4	LA	12A.R.2	3
A	5	LA	12A.R.1	5
Total = 14				
B	6	SA	12A.P.3, 12A.P.4	1
B	7	SA	12A.P.2	1
B	8	SA	12A.P.3	2
B	9	SA	12A.P.2	2
B	10	SA	12A.P.3	2
B	11	SA	12A.P.4	2
B	12	SA	12A.P.4	2
B	13	SA	12A.P.5	2
B	14	LA	12A.P.5, 12A.P.6	4
Total = 18				
C	15	MC	12A.FM.1	1
C	16	MC	12A.FM.3	1
C	17	SA	12A.FM.2	1
C	18	LA	12A.FM.1	4
C	19	LA	12A.FM.1, 12A.FM.2	5
C	20	LA	12A.FM.1, 12A.FM.2	4
Total = 16				
D	21	SA	12A.D.1	2
D	22	LA	12A.D.1	4
Total = 6				
E	23	MC	12A.L.3	1
E	24	SA	12A.L.3	2
E	25	LA	12A.L.2	3
Total = 6				

Legend for Units:

A: Relations and Functions
 B: Probability
 C: Financial Mathematics
 D: Design and Measurement
 E: Logical Reasoning

Legend for Question Types:

MC: Multiple Choice
 SA: Short Answer
 LA: Long Answer

Appendix B: Table of Questions by Type and Learning Outcome

Type	Question	Unit	Learning Outcome	Mark
MC	1	A	12A.R.3	1
MC	15	C	12A.FM.1	1
MC	16	C	12A.FM.3	1
MC	23	E	12A.L.3	1
Total = 4				
SA	2	A	12A.R.3	2
SA	6	B	12A.P.3, 12A.P.4	1
SA	7	B	12A.P.2	1
SA	8	B	12A.P.3	2
SA	9	B	12A.P.2	2
SA	10	B	12A.P.3	2
SA	11	B	12A.P.4	2
SA	12	B	12A.P.4	2
SA	13	B	12A.P.5	2
SA	17	C	12A.FM.2	1
SA	21	D	12A.D.1	2
SA	24	E	12A.L.3	2
Total = 21				
LA	3	A	12A.R.2	3
LA	4	A	12A.R.2	3
LA	5	A	12A.R.1	5
LA	14	B	12A.P.5, 12A.P.6	4
LA	18	C	12A.FM.1	4
LA	19	C	12A.FM.1, 12A.FM.2	5
LA	20	C	12A.FM.1, 12A.FM.2	4
LA	22	D	12A.D.1	4
LA	25	E	12A.L.2	3
Total = 35				

Legend for Question Types:

MC: Multiple Choice
SA: Short Answer
LA: Long Answer

Legend for Units:

A: Relations and Functions
B: Probability
C: Financial Mathematics
D: Design and Measurement
E: Logical Reasoning

Appendix C: Irregularities in Provincial Tests

A Guide for Local Marking

During the marking of provincial tests, irregularities are occasionally encountered in test booklets. The following list provides examples of irregularities for which an *Irregular Test Booklet Report* should be completed and sent to the Department:

- completely different penmanship in the same test booklet
- incoherent work with correct answers
- notes from a teacher indicating how he or she has assisted a student during test administration
- student offering that he or she received assistance on a question from a teacher
- student submitting work on unauthorized paper
- evidence of cheating or plagiarism
- disturbing or offensive content
- no responses provided by the student (all “NR”) or only incorrect responses (“0”)

Student comments or responses indicating that the student may be at personal risk of being harmed or of harming others are personal safety issues. This type of student response requires an immediate and appropriate follow-up at the school level. In this case, please ensure the Department is made aware that follow-up has taken place by completing an *Irregular Test Booklet Report*.

Except in the case of cheating or plagiarism where the result is a provincial test mark of 0%, it is the responsibility of the division or the school to determine how they will proceed with irregularities. Once an irregularity has been confirmed, the marker prepares an *Irregular Test Booklet Report* documenting the situation, the people contacted, and the follow-up. The original copy of this report is to be retained by the local jurisdiction and a copy is to be sent to the Department along with the test materials.

Irregular Test Booklet Report

Test: _____

Date marked: _____

Booklet No.: _____

Problem(s) noted: _____

Question(s) affected: _____

Action taken or rationale for assigning marks: _____

Follow-up: _____

Decision: _____

Marker's Signature: _____

Principal's Signature: _____

For Department Use Only—After Marking Complete

Consultant: _____

Date: _____