Grade 12
Applied Mathematics
Achievement Test

Marking Guide

January 2020

Manitoba

Grade 12 applied mathematics achievement test.
Marking guide. January 2020

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Manitoba Education
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After the administration of this test, print copies of this resource will be available for purchase from the Manitoba Learning Resource Centre. Order online at www.manitobalrc.ca.

This resource will also be available on the Manitoba Education website at www.edu.gov.mb.ca/k12/assess/archives/index.html.

Websites are subject to change without notice.

Disponible en français.

While the department is committed to making its publications as accessible as possible, some parts of this document are not fully accessible at this time.

Available in alternate formats upon request.

Contents

General Marking Instructions

Please ensure that

- the student booklet number matches the number on the *Scoring Sheet*
- **only a pencil is used to complete the *Scoring Sheet***
- the final test mark is recorded on the *Scoring Sheet*
- the *Scoring Sheet* is complete and a copy has been made for school records

Do not make any marks in the student booklets. Booklets may be selected by Manitoba Education for sample marking.

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

Marking

Explanations for student errors for selected-response 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. Explanation or justification can be given through a labelled diagram, in words, by showing mathematical operations for answer verification, or by providing output from a technological tool. For this reason, appropriate flexibility is required when marking student responses.

Students are expected to round all final answers to two decimal places unless otherwise indicated in the question, or if the answer terminates to a whole number or one decimal place. More than two decimal places are acceptable if rounded correctly, except for monetary values or when the context of the question implies whole units be used (e.g., people, cans of paint).

Errors

Marks are deducted if conceptual or communication errors are committed. A 0.5 mark deduction will also apply each time a student makes one of the following errors:

- an arithmetic error
- a procedural error (not a conceptual error)
- a lack of clarity in the explanation, the description, or the justification

Conceptual 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.

Communication Errors

Communication errors are errors that are not related to the concepts and are tracked on the *Scoring Sheet* in a separate section. There is a 0.5 mark deduction for each type of communication error committed, with a maximum deduction of 3 marks from the total test mark. Each communication error can only be deducted once per test and committing a second error of the same type does not further affect a student's mark.

(E1) Final Answer

- does not include a percent sign
- does not identify the answer (e.g., TVM solver, Venn diagram)
- does not use the given contextual variables
- incorrectly states the final answer

(E2) Notation

- does not include braces when using set notation
- does not include a box when using a Venn diagram
- does not include one of the following in the equation: "$y =$", "sin", "ln", or "x", or writes parameters separately from the equation
- does not change "$y \sim$" to "$y =$" when writing an equation

(E3) Transcription/Transposition

- makes a transcription error (inaccurate transferring of information)
- makes a transposition error (changing order of digits)
- inaccurately plots one point on a scatter plot

(E4) Whole Units

- does not use whole units for materials purchased in design and measurement questions
- does not use whole units in contextual questions involving discrete data (e.g., people)

(E5) Units

- does not include the dollar sign for monetary values
- uses incorrect units of measure
- does not include the units in the final answer
- confuses square and cubic units (e.g., cm^2 instead of cm^3, or vice versa)
- does not include units with labels on a graph

(E6) Rounding

- rounds incorrectly
- rounds too soon
- does not express the answer to the appropriate number of decimal places, including monetary values to two decimal places

When a given response includes multiple types of communication errors, deductions are indicated in the order in which the errors occur in the response. No communication errors are recorded for work that has not been awarded marks. The total deduction may not exceed the marks awarded.

Scoring

The marks allocated to questions are 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.

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 one E1 error (0.5 mark deduction) and three E6 errors (0.5 mark deduction).

E1	E2	E3	E4	E5	E6
Final Answer	Notation	Transcription/ Transposition	Whole Units	Units	Rounding

$$\text{Preliminary Mark} - (\text{Number of error types} \times 0.5) = \text{Final Mark}$$

$$46 - (2 \times 0.5) = 45$$

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 B provides examples of such irregularities as well as procedures to follow to report irregularities.

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

Assistance

If any issue arises that cannot be resolved locally during marking, 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.

Yongfei Wu
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Grade 12 Applied Mathematics
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Marking Keys

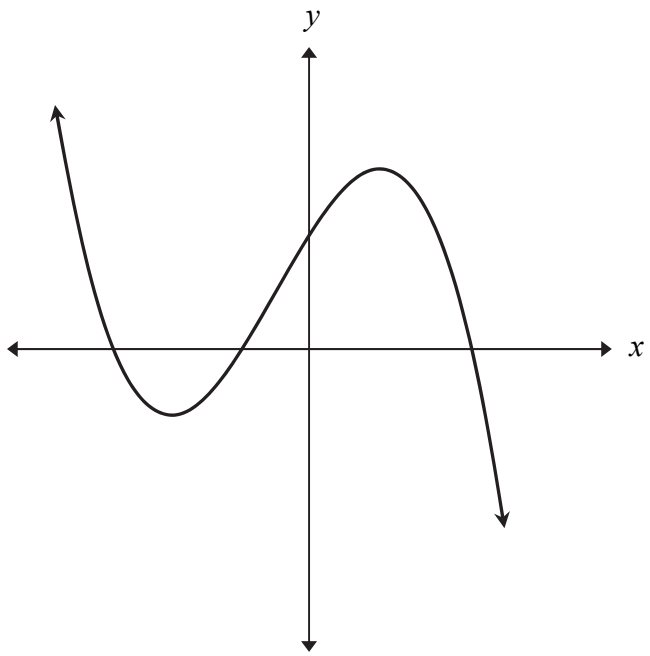
Please note that this *Marking Guide* contains
screen captures taken from a TI–84 Plus graphing calculator.

RELATIONS AND FUNCTIONS

Question 1 — Total: 1 mark

Learning Outcome: 12.A.R.1 — **Question Type: Selected Response**

Select the best answer.



Identify which equation the graph represents.

A) $y = 2x^3 - x^2 + 5x + 3$

B) $\boldsymbol{y = -2x^3 - x^2 + 5x + 3}$

C) $y = 2x^3 - x^2 + 5x - 3$

D) $y = -2x^3 - x^2 + 5x - 3$

Question 2 — Total: 1 mark

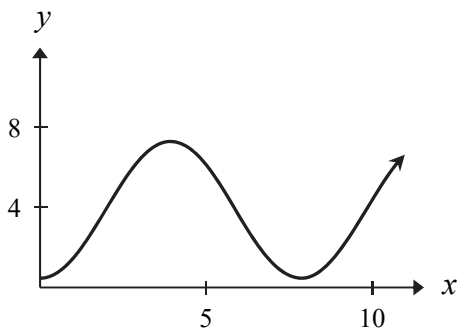
Learning Outcome: 12.A.R.3 — **Question Type: Selected Response**

Select the best answer.

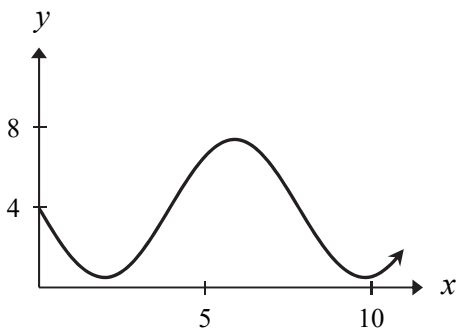
Identify the graph of the following function:

$$y = 3.5\sin\left(0.8x + 1.57\right) + 4$$

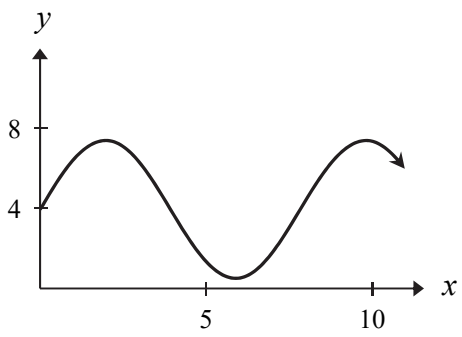
A)



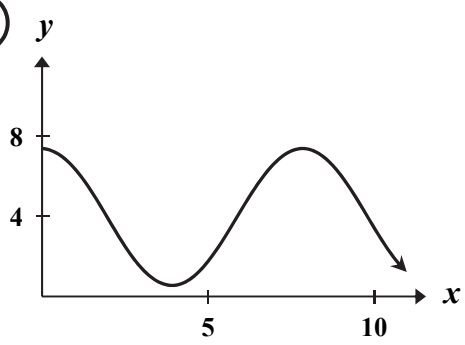
C)



B)



D)



Question 3 — Total: 3 marks

Learning Outcome: 12.A.R.1 — **Question Type: Constructed Response**

At the Manitoba provincial track and field meet, an athlete is competing in the javelin event. On the athlete's first attempt

- the javelin was thrown at a starting height of 1.6 m
- the javelin reached a height of 4 m at a horizontal distance of 7.2 m from the athlete
- the javelin hit the ground 38 m away from the athlete

a) Determine a quadratic regression equation that models the height of the javelin as a function of the horizontal distance from the athlete. Show your work.

(2 marks)

Horizontal Distance (m)	Height (m)
0	1.6
7.2	4
38	0

OR

Graphing Calculator:

$y = -0.01x^2 + 0.42x + 1.6$

Desmos:

$y_1 \sim ax_1^2 + bx_1 + c$

$y = -0.01x^2 + 0.42x + 1.6$

b) Determine the maximum height reached by the javelin.

(1 mark)

OR

Graphing Calculator:

CALC 4: maximum $(17.272..., 5.236...)$

$y = 5.24$

Desmos:

$(17.273, 5.237)$

The maximum height reached by the javelin is 5.24 m.

Marker Note(s):

→ *If a rounded value of "a" is used, a maximum height of 6.01 m is obtained.*

Marking Key	
❶	*1 mark for appropriate work in (a)*
❷	*1 mark for consistent equation in (a)*
❸	*1 mark for consistent answer in (b)*

Question 4 — Total: 4 marks

Learning Outcome: 12.A.R.2 — **Question Type: Constructed Response**

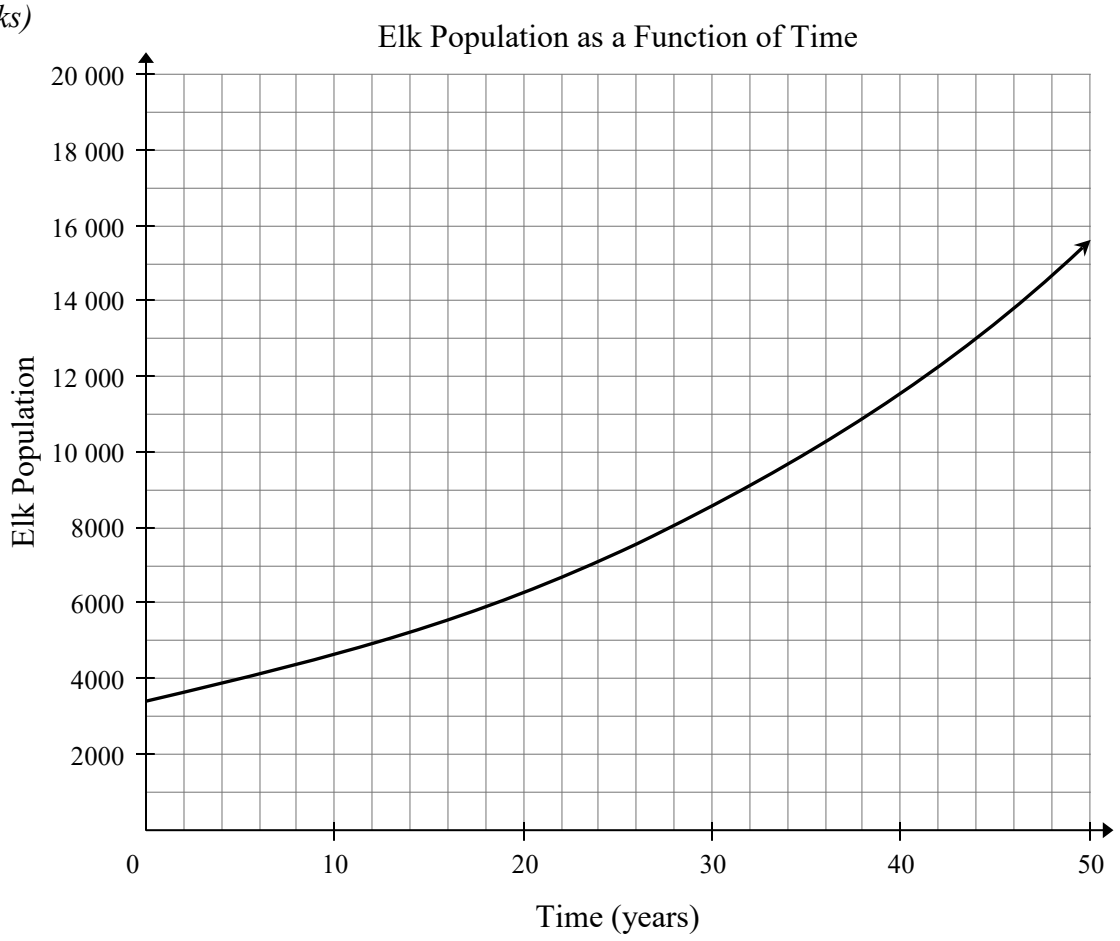
In 2020, the elk population in Riding Mountain National Park can be predicted by the following exponential equation:

$$P = 3500(1.03)^t$$

where P represents the elk population
and t represents the time (in years) starting in January 2020.

a) Create a clearly labelled graph of the predicted elk population over the next 50 years.

(3 marks)



b) Assume that Riding Mountain National Park can support a maximum population of 16 000 elk. Using the exponential equation, determine in what year the population will reach 16 000.

(1 mark)

$Y_2 = 16\ 000$

$\boxed{\text{CALC}}$ 5: intersect $(51.417..., 16\ 000)$

$x = 51.42$

$2020 + 51 = 2071$

The population will reach 16 000 in 2071.

Marker Note(s):

→ *Award marks ❹ and ❺ if only the correct year is shown in (b).*

Marking Key	
❶	*1 mark for communicating the context of the graph with appropriate title and/or labels in (a)*
❷	*1 mark for using an appropriate domain and range (i.e., window settings/grid range) for the context of the question in (a)*
❸	*1 mark for an appropriate shape that illustrates key characteristics of the function (e.g., maximum, minimum, asymptotes, intercepts) in (a)*
❹	*0.5 mark for correct x-value in (b)*
❺	*0.5 mark for consistent year in (b)*

Question 5 — Total: 4 marks

Learning Outcome: 12.A.R.3 — **Question Type: Constructed Response**

An observer collects data for the sea level in Churchill, Manitoba. The sea level rises and falls twice daily. The data is shown below:

Time (h)	Sea Level (m)
0	4.31
3	2.41
6	0.51
9	2.41
12	4.31

a) Determine a sinusoidal regression equation that models this data.

(1 mark)

Graphing Calculator:

$y = 1.9\sin\left(0.52x + 1.57\right) + 2.41$

OR

Desmos:

$y = -1.9\sin\left(0.52\left(x - 3\right)\right) + 2.41$

b) Determine the sea level at 5.5 hours.

(1 mark)

Graphing Calculator:

CALC 1: value $x = 5.5,\ y = 0.574\ 7$

The sea level is 0.57 m.

OR

Desmos:

$x = 5.5,\ y = 0.575$

The sea level is 0.58 m.

c) State the range and explain its meaning in this situation.

(2 marks)

$$\{0.51 \leq y \leq 4.31\}$$

The range represents the lowest to the highest sea levels, in metres, in Churchill.

OR

$$[0.51, 4.31]$$

The range represents the lowest to the highest sea levels, in metres, in Churchill.

Marker Note(s):

→ *Other values of "a" and "c" are possible in (a).*

→ *Award mark ❸ for 0.59 m in (b); answer reflects using rounded values from (a).*

Marking Key	
❶	*0.5 mark for two correct values in (a)*
❷	*0.5 mark for remaining two correct values in (a)*
❸	*1 mark for consistent answer in (b)*
❹	*0.5 mark for consistent upper and lower bounds of the range in (c)*
❺	*0.5 mark for inclusivity of both upper and lower bounds in (c)*
❻	*1 mark for correct explanation in (c)*

Question 6 — Total: 4 marks

Learning Outcome: 12.A.R.1 — **Question Type: Constructed Response/Selected Response**

A patient has his blood pressure monitored for 16 hours. During this period, his blood pressure can be modelled by the following cubic function:

$$P = -0.05t^3 + 1.28t^2 - 7.46t + 101$$

where P represents the blood pressure (in mm of mercury)
and t represents the amount of time his blood pressure is monitored (in hours).

a) Determine his lowest blood pressure during this period, in mm of mercury.

(1 mark)

Graphing Calculator:

CALC 3: minimum

$(3.728\,707\,1, 88.387\,955)$

OR

Desmos:

$(3.729, 88.388)$

88.39 mm of mercury

b) Determine how long his blood pressure is at 99 mm of mercury or below. Show your work.

(2 marks)

Graphing Calculator:

CALC 5: intersect

$Y_2 = 99$

$(0.281\,548\,1, 99)$

$(8.394\,913\,1, 99)$

time $= 8.394\,9 - 0.281\,5$

$= 8.113\,4$

OR

Desmos:

$y = 99$

$(0.282, 99)$ and $(8.395, 99)$

time $= 8.395 - 0.282$

$= 8.113$

His blood pressure is 99 mm of mercury or below for 8.11 hours.

c) Identify the domain of the equation in this situation.

(1 mark)

Select the best answer.

A) $\{\mathbf{0 \le t \le 16}\}$

B) $\{t \ge 0\}$

C) $\{t \in \mathbb{R}\}$

D) $\{t \le 16\}$

Marking Key	
❶	*1 mark for correct answer in (a)*
❷	*0.5 mark for correct first x-value in (b)*
❸	*0.5 mark for correct second x-value in (b)*
❹	*1 mark for consistent difference in (b)*
❺	*1 mark for correct answer in (c)*

PROBABILITY

Question 7 — Total: 1 mark

Learning Outcome: 12.A.P.1 — **Question Type: Selected Response**

Select the best answer.

At a marathon, there is a table with 27 cups filled with either a sports drink or water.
The probability that you grab a cup of sports drink as you run by the table is $\frac{19}{27}$.

Identify the odds in favour of grabbing a cup of sports drink.

A) $8:27$

B) $27:19$

C) $8:19$

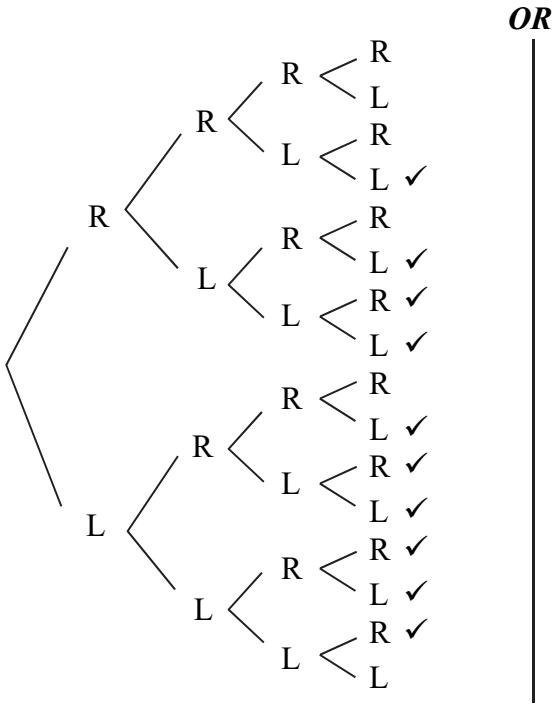
D) 19 : 8

Question 8 — Total: 2 marks

Learning Outcome: 12.A.P.4 — **Question Type: Constructed Response**

A student enters a maze and needs to make 4 turns. She must turn left or right at each intersection.

Determine how many different paths are possible if she makes either 1 or 2 right turns.
Use a graphic organizer to show your work.



OR

			1			
		1		1		
	1		2		1	
	1		3		3		1
1		**4**		**6**		4		1
R 0R		1R		2R		3R		4R
L 4L		3L		2L		1L		0L

There are 10 paths.

Marking Key	
❶	*1 mark for appropriate work*
❷	*1 mark for consistent answer*

Question 9 — Total: 2 marks

Learning Outcomes: 12.A.P.1, 12.A.P.2 — **Question Type: Constructed Response**

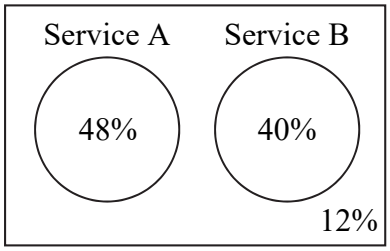
Students at a high school were surveyed about their use of online television services.

The survey results showed the following:

- 48% of students use Service A
- 40% of students use Service B
- the remaining students do not use any service
- no student uses both services

a) According to the survey results, is the use of online television services mutually exclusive? Justify your reasoning.

(1 mark)



Yes. The use of online television services is mutually exclusive because of the statement "no student uses both services".

b) According to the survey results, determine the odds against a student using an online television service.

(1 mark)

12 : 88

OR

3 : 22

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

Question 10 — Total: 2 marks

Learning Outcomes: 12.A.P.2, 12.A.L.1 — **Question Type: Constructed Response**

Twenty cards numbered 11 to 30 are placed in a box.

Determine the probability of selecting one card from the box that is a multiple of 3 or a multiple of 4. Show your work.

multiples of 3: $\{12, 15, 18, 21, 24, 27, 30\}$

multiples of 4: $\{12, 16, 20, 24, 28\}$

multiples of 3 or 4: $\{12, 15, 16, 18, 20, 21, 24, 27, 28, 30\}$

The probability is $\frac{10}{20} = \frac{1}{2}$, 0.5, or 50%.

OR

$$P(\text{multiples of 3 or 4}) = P(\text{multiples of 3}) + P(\text{multiples of 4}) - P(\text{multiples of 3 and 4})$$
$$= \frac{7}{20} + \frac{5}{20} - \frac{2}{20}$$
$$= \frac{10}{20}$$

The probability is $\frac{1}{2}$, 0.5, or 50%.

Marking Key	
❶	*0.5 mark for multiples of 3*
❷	*0.5 mark for multiples of 4*
❸	*0.5 mark for multiples of 3 and 4*
❹	*0.5 mark for consistent answer using 20 as the total number of outcomes*

Question 11 — Total: 3 marks

Learning Outcome: 12.A.P.6 — **Question Type: Constructed Response**

Your school requires a group of 4 actors for a play.

a) Determine how many ways the group of 4 actors can be chosen from 23 interested students.

(1 mark)

$$_{23}C_4 = 8855$$

There are 8855 ways.

b) You and your best friend are 2 of the 23 interested students. Determine the probability that you both are chosen. Show your work.

(2 marks)

$$\frac{_2C_2 \times {}_{21}C_2}{_{23}C_4} = \frac{1 \times 210}{8855}$$

$$= \frac{210}{8855}$$

The probability is $\frac{6}{253}$, 0.02, or 2.37%.

Marker Note(s):

→ *Award a maximum of 2 marks if student consistently uses permutations instead of combinations.*

Marking Key	
❶	*1 mark for correct answer in (a)*
❷	*1 mark for consistent number of favourable outcomes in (b)*
❸	*1 mark for consistent probability in (b)*

Question 12 — Total: 4 marks

Learning Outcome: 12.A.P.5 — **Question Type: Constructed Response**

A dance studio has 9 students: 4 students are ballet dancers and 5 students are hip-hop dancers. They are arranging themselves in a row for a year-end photo.

a) Determine how many ways the dancers can be arranged for the photo if they must alternate between their type of dance. Show your work.

(2 marks)

$$\frac{5}{\text{H}} \times \frac{4}{\text{B}} \times \frac{4}{\text{H}} \times \frac{3}{\text{B}} \times \frac{3}{\text{H}} \times \frac{2}{\text{B}} \times \frac{2}{\text{H}} \times \frac{1}{\text{B}} \times \frac{1}{\text{H}} = 2880$$

The dancers can be arranged in 2880 ways.

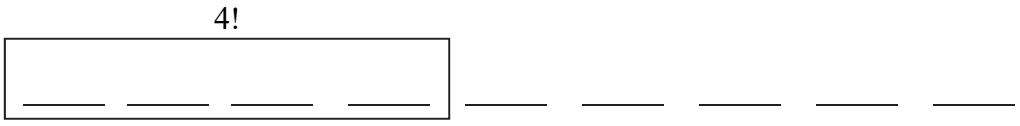
OR

$${}_5P_5 \times {}_4P_4 = 2880$$

The dancers can be arranged in 2880 ways.

b) Determine how many ways the dancers can be arranged for the photo if the ballet dancers must all stand together. Show your work.

(2 marks)



$$4!(6!) = 17\ 280$$

The dancers can be arranged in 17 280 ways.

Marker Note(s):
→ *Award a minimum of 0.5 mark for correctly arranging the dancers in (a).*

Marking Key	
❶	*0.5 mark for permutation of ballet dancers in (a)*
❷	*0.5 mark for permutation of hip-hop dancers in (a)*
❸	*1 mark for consistent product of the permutations in (a)*
❹	*0.5 mark for 4! in (b)*
❺	*0.5 mark for 6! in (b)*
❻	*1 mark for consistent product in (b)*

Question 13 — Total: 4 marks

Learning Outcomes: 12.A.P.3, 12.A.P.5 — **Question Type: Constructed Response**

Kyla wants to buy a cup of tea for \$2. She has the following coins in her pocket:

- 2 identical toonies (\$2 coin)
- 6 identical loonies (\$1 coin)
- 3 identical quarters (25¢ coin)

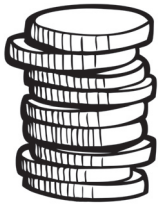
a) Determine the probability of randomly drawing 2 loonies, one after the other, if the first coin is not replaced in her pocket before drawing the second coin. Show your work.

(2 marks)

$$P(\text{loonie, loonie}) = \frac{6}{11} \times \frac{5}{10}$$
$$= \frac{30}{110}$$

The probability is $\frac{3}{11}$, 0.27, or 27.27%.

b) Once she has paid for her tea using the 2 loonies, Kyla decides to stack all of the remaining coins in a tower. Determine the number of different ways she can stack the coins. Show your work.



(2 marks)

11 coins − 2 loonies = 9 coins left

$$\frac{9!}{2!4!3!} = 1260$$

toonies loonies quarters

She can stack the coins 1260 different ways.

Marking Key	
❶	*0.5 mark for demonstrating the dependency of loonies in (a)*
❷	*0.5 mark for demonstrating the dependency of the total number of coins in (a)*
❸	*1 mark for consistent product in (a)*
❹	*0.5 mark for 9! in (b)*
❺	*0.5 mark for 4! in (b)*
❻	*0.5 mark for 2!3! in (b)*
❼	*0.5 mark for consistent quotient in (b)*

DESIGN AND MEASUREMENT

Question 14 — Total: 1 mark

Learning Outcome: 12.A.D.1 — **Question Type: Selected Response**

Select the best answer.

A frozen dessert is made of ice and syrup.
Shauna wants to estimate the amount of ice and syrup in her frozen dessert.

Identify the expression that will help her with her estimation.

A) $\frac{\pi r^2 h}{3} + \frac{4\pi r^3}{3}$

B) $\frac{\pi r^2 h}{3} + \frac{2\pi r^3}{3}$

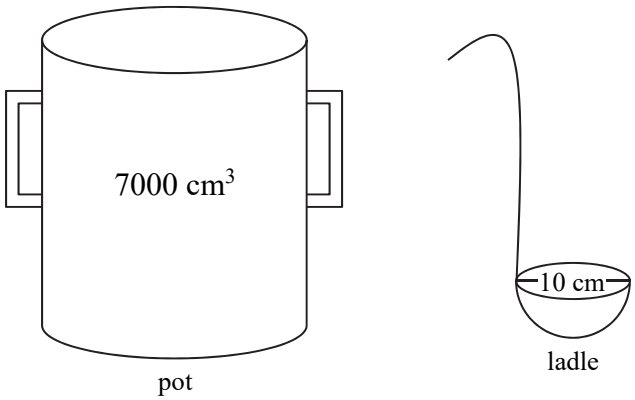
C) $\pi rs + 2\pi r^2$

D) $\pi rs + 4\pi r^2$

Question 15 — Total: 2 marks

Learning Outcome: 12.A.D.1 — **Question Type: Constructed Response**

Sarah has prepared 7000 cm^3 of soup in a pot. She uses a ladle, in the shape of a hemisphere, to serve the soup into bowls. The ladle has a diameter of 10 cm.



Determine the number of full ladles of soup that she can serve. Show your work.

$$\begin{aligned}\text{Volume of ladle} &= \left(\frac{4}{3}\pi r^3\right) \div 2 \\ &= \left(\frac{4}{3}\pi (5)^3\right) \div 2 \\ &= 261.80 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Number of ladles} &= \frac{\text{volume of pot}}{\text{volume of ladle}} \\ &= \frac{7000}{261.80} \\ &= 26.738 \\ &= 26 \text{ full ladles}\end{aligned}$$

She can serve 26 full ladles of soup.

Marker Note(s):
→ *Do not award marks ❶ and ❷ if using the wrong formula.*

Marking Key	
❶	*0.5 mark for correct substitution of radius in formula*
❷	*0.5 mark for consistent volume of ladle*
❸	*0.5 mark for dividing volume of pot by volume of ladle*
❹	*0.5 mark for consistent answer*

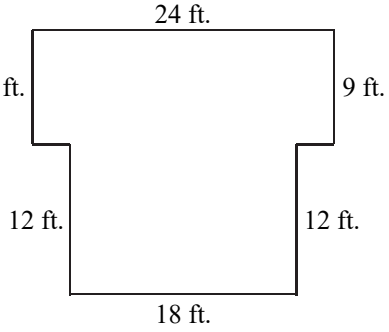
Question 16 — Total: 6 marks

Learning Outcomes: 12.A.D.1, 12.A.FM.1 — **Question Type: Constructed Response**

Nashida wants to build an outdoor kitchen.

She is going to place patio stones in the layout shown to the right. The patio stones

- are in the shape of a square with 18-inch sides
- cost $3.00 each



a) Determine the number of patio stones Nashida needs. Show your work.

(2 marks)

$$\text{Area of layout} = 24 \times 9 + 12 \times 18$$
$$= 216 + 216$$
$$= 432 \text{ ft}^2$$

$$\text{Area of one patio stone} = \left(\frac{18 \text{ in.}}{12 \text{ in./ft.}}\right)\left(\frac{18 \text{ in.}}{12 \text{ in./ft.}}\right)$$
$$= 2.25 \text{ ft}^2$$

$$\text{Number of patio stones} = \frac{432}{2.25}$$
$$= 192$$

Nashida needs 192 patio stones.

Nashida must buy a grill, a countertop, and a patio set for the outdoor kitchen. She has the following options:

Grill		Countertop		Patio Set	
Propane	$1400.00	Granite	$2700.00	Basic	$600.00
Pellet	$3000.00	Soapstone	$3600.00	Elegant	$1000.00

She also plans to buy **three** of the following items:

Side Burner		Fridge		Cabinet		Sink		Warming Drawer	
Single	$400.00	Small	$800.00	30-inch	$700.00	Single	$350.00	Small	$800.00
Double	$650.00	Large	$1100.00	42-inch	$1250.00	Double	$500.00	Large	$1300.00

b) Nashida can spend a maximum of $11 000.00, taxes included. Calculate the total cost, plus GST and PST, of the patio stones and components of the outdoor kitchen. Show your work. (Note: GST = 5%, PST = 7%)

(2 marks) **Sample Answer 1: (minimum)**

Patio stones: 192 × $3.00 = $576.00

Required components:

propane grill	$1400.00
granite countertop	$2700.00
basic patio set	$600.00

Optional components:

single sink	$350.00
single sink	$350.00
single sink	$350.00
subtotal	$6326.00
GST	$316.30
PST	$442.82
Total	$7085.12

The total cost is $7085.12.

OR

Sample Answer 2: (maximum)

Patio stones: 192 × $3.00 = $576.00

Required components:

pellet grill	$3000.00
soapstone countertop	$3600.00
elegant patio set	$1000.00

Optional components:

single side burner	$400.00
single side burner	$400.00
small fridge	$800.00
subtotal	$9776.00
GST	$488.80
PST	$684.32
Total	$10 949.12

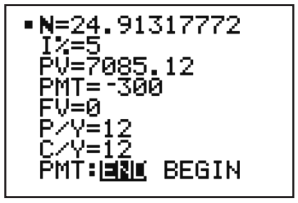
The total cost is $10 949.12.

Other answers are possible.

FINANCIAL MATHEMATICS

c) Nashida is financing the outdoor kitchen with a financial institution that gives her an interest rate of 5.00%, compounded monthly. She wants to make $300.00 monthly payments on the loan. Calculate how many payments it will take Nashida to pay off the loan. Show your work.

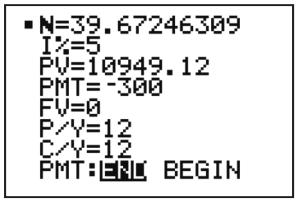
(2 marks) **Sample Answer 1: (minimum)**



It will take Nashida 25 payments to pay off the loan.

OR

Sample Answer 2: (maximum)



It will take Nashida 40 payments to pay off the loan.

Other answers are possible.

Marking Key	
❶	*0.5 mark for correct area of layout in (a)*
❷	*0.5 mark for correct area of one patio stone in (a)*
❸	*0.5 mark for correct unit conversion in (a)*
❹	*0.5 mark for consistent number of patio stones in (a)*
❺	*0.5 mark for indicating required components and costs in (b)*
❻	*0.5 mark for indicating three optional components and costs in (b)*
❼	*0.5 mark for consistent subtotal including all components in (b)*
❽	*0.5 mark for consistent total cost, including taxes, less than $11 000.00 in (b)*
❾	*1 mark for appropriate work in (c)*
❿	*1 mark for consistent answer in (c)*

Question 17 — Total: 1 mark

Learning Outcome: 12.A.FM.2 — **Question Type: Constructed Response**

Kazoo is looking for a house. He has the following options:

Option 1: He can buy a house with a monthly mortgage payment of $1150.00 amortized over 25 years.

Option 2: He can rent a similar house for $1150.00 per month.

State which option Kazoo should choose. Provide one reason for your choice.

Buying Reasons:

- build up equity
- personalize renovations

Renting Reasons:

- no down payment
- not responsible for maintenance and repair

Other reasons are possible.

Marking Key	
❶	*1 mark for appropriate reason*

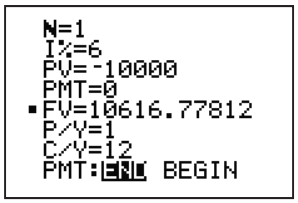
Question 18 — Total: 6 marks

Learning Outcome: 12.A.FM.3 — **Question Type: Constructed Response**

Ham and Sylvie each had $10 000.00 to invest.

a) Ham invested $10 000.00 in a mutual fund at an interest rate of 6.00%, compounded monthly. Determine the value of the mutual fund at the end of the first year. Show your work.

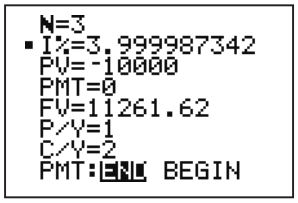
(2 marks)



The value of the mutual fund will be $10 616.78 at the end of the first year.

b) Sylvie invested $10 000.00 in a guaranteed investment certificate (GIC) with interest compounded semi-annually. The value of the GIC was $11 261.62 at the end of the third year. Determine the interest rate for the GIC. Show your work.

(2 marks)



The interest rate for the GIC is 4.00%.

c) Using the Rule of 72, determine approximately how much longer it will take for Sylvie's GIC to reach a value of $40 000.00 compared to Ham's mutual fund. Show your work.

(2 marks)

Mutual Fund	**GIC**
$t = \frac{72}{6}$	$t = \frac{72}{4}$
$= 12$	$= 18$
$12 \times 2 = 24$ years	$18 \times 2 = 36$ years

$$36 - 24 = 12$$

The GIC will reach a value of $40 000.00 12 years later than the mutual fund.

Marking Key	
❶	*1 mark for appropriate work in (a)*
❷	*1 mark for consistent answer in (a)*
❸	*1 mark for appropriate work in (b)*
❹	*1 mark for consistent answer in (b)*
❺	*0.5 mark for correctly using Rule of 72 on mutual fund in (c)*
❻	*0.5 mark for correctly using Rule of 72 on GIC in (c)*
❼	*0.5 mark for doubling twice in (c)*
❽	*0.5 mark for consistent subtraction in (c)*

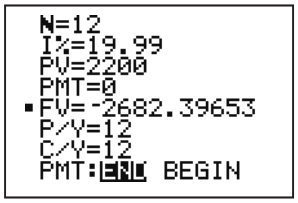
Question 19 — Total: 6 marks

Learning Outcome: 12.A.FM.1 — **Question Type: Constructed Response**

Simba wants to purchase a bed for $2200.00 (taxes included). The store offers him a promotion of 0% interest with no payments for one year. If Simba does not pay the amount in full within one year, interest will be charged from the date of purchase at an interest rate of 19.99%, compounded monthly.

a) If Simba does not make any payments during the first year, calculate the amount the store will bill him one year after the date of purchase. Show your work.

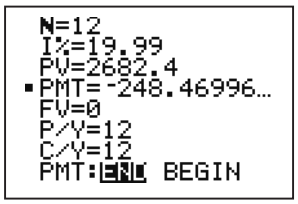
(2 marks)



The store will bill him $2682.40 one year after the date of purchase.

b) If Simba makes monthly payments over the second year to pay off the amount calculated in (a), determine his monthly payment. Show your work.

(2 marks)



His monthly payment will be $248.47.

c) Using your answer in (b), calculate the interest Simba would pay over the two-year period. Show your work.

(1.5 marks)

$$\$248.47 \times 12 - \$2200.00 = \$781.64$$

The interest Simba would pay over the two-year period is \$781.64.

OR

$$\sum \text{Int}(1, 12) = \$299.24$$
$$\$2682.40 - \$2200.00 = \$482.40$$
$$\$299.24 + \$482.40 = \$781.64$$

The interest Simba would pay over the two-year period is \$781.64.

d) Give one reason why Simba would buy his bed using the promotion.

(0.5 mark)

Simba could make interest-free payments for a year,
for which it is easier to budget.

Other reasons are possible.

Marking Key	
❶	*1 mark for appropriate work in (a)*
❷	*1 mark for consistent answer in (a)*
❸	*1 mark for appropriate work in (b)*
❹	*1 mark for consistent answer in (b)*
❺	*0.5 mark for the total amount paid during the second year in (c)*
❻	*0.5 mark for considering the initial cost of the bed in (c)*
❼	*0.5 mark for consistent answer in (c)*
❽	*0.5 mark for appropriate reason in (d)*

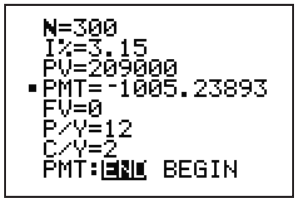
Question 20 — Total: 3 marks

Learning Outcome: 12.A.FM.2 — **Question Type: Constructed Response**

The Ramilo family moved to The Pas. They bought a house with a purchase price of $229 000.00 and made a down payment of $20 000.00. Their mortgage has an interest rate of 3.15%, compounded semi-annually, and is amortized over 25 years.

a) Calculate their monthly mortgage payment. Show your work.

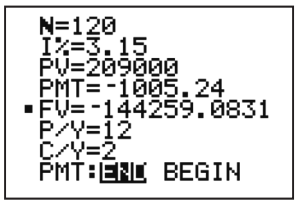
(2 marks)



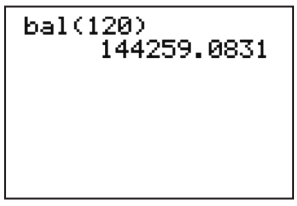
Their monthly mortgage payment is $1005.24.

b) Calculate the balance owing on the mortgage after 10 years if they have been making regular monthly payments.

(1 mark)



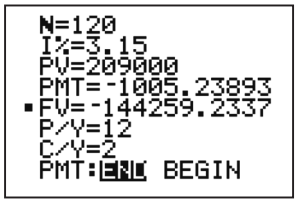
OR

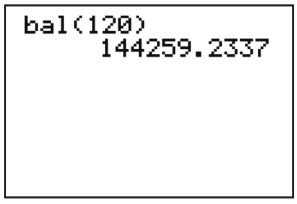


The balance owing on the mortgage after 10 years is $144 259.08.

OR

OR





If using a non-rounded payment, the balance owing on the mortgage after 10 years is $144 259.23.

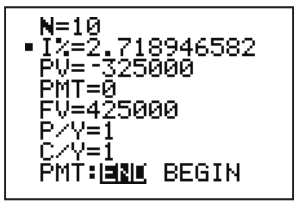
Marking Key	
❶	*1 mark for appropriate work in (a)*
❷	*1 mark for consistent answer in (a)*
❸	*1 mark for consistent answer in (b)*

Question 21 — Total: 2 marks

Learning Outcome: 12.A.FM.1 — **Question Type: Constructed Response**

In 2009, the value of a cottage was \$325 000.00. In 2019, the same cottage had a value of \$425 000.00.

Determine the average annual appreciation rate. Show your work.



The average annual appreciation rate is 2.72%.

OR

$$\$425\ 000.00 = \$325\ 000.00(x)^{10}$$

$$\frac{\$425\ 000.00}{\$325\ 000.00} = x^{10}$$

$$\sqrt[10]{\frac{\$425\ 000.00}{\$325\ 000.00}} = x$$

$x = 1.027\ 189\ 466$ rate = 2.72%

The average annual appreciation rate is 2.72%.

OR

$$y = 425\ 000$$

$$y = 325\ 000x^{10}$$

intersect at $x = 1.027\ 189\ 5$ rate = 2.72%

The average annual appreciation rate is 2.72%.

Marking Key	
❶	*1 mark for appropriate work*
❷	*1 mark for consistent answer*

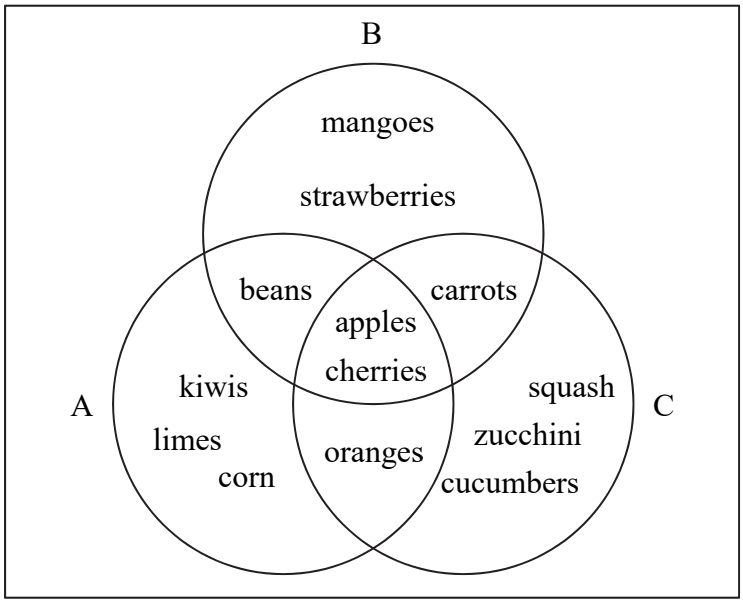
LOGICAL REASONING

Question 22 — Total: 1 mark

Learning Outcome: 12.A.L.2 — **Question Type: Selected Response**

Select the best answer.

Ari, Boba, and Cora are shopping at a farmer's market. The Venn diagram below represents the items found in their shopping baskets.



Identify which of the following statements is true.

A) $n(A) < n(C)$

B) $n(B') = n(A) + n(C)$

C) $\boldsymbol{n(C) > n(B)}$

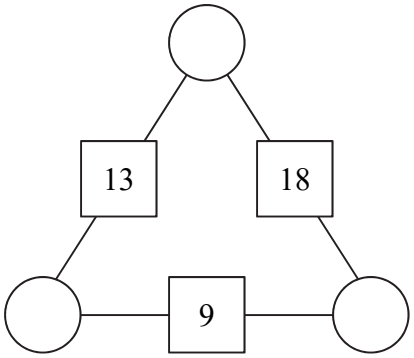
D) $n(C') = n(B) + n(A)$

Question 23 — Total: 1 mark

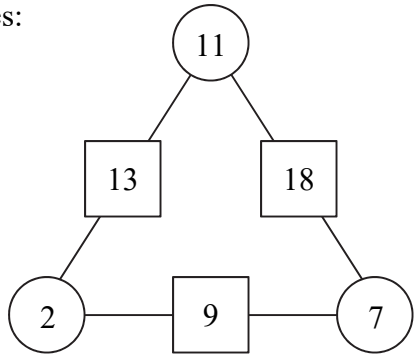
Learning Outcome: 12.A.L.1 — **Question Type: Constructed Response**

An arithmagon is a puzzle in which the number in each box is the sum of the two numbers in the circles adjacent to that box. Here is an example:

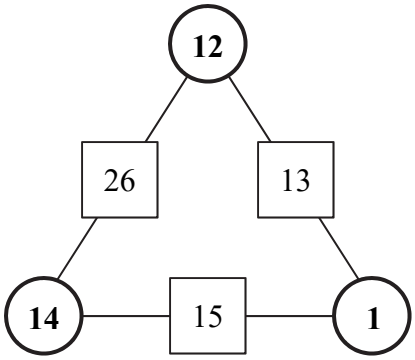
Given:



Becomes:



Therefore, given:



Fill in each circle above with an appropriate number.

Marking Key	
❶	*1 mark for correct answer*

Question 24 — Total: 2 marks

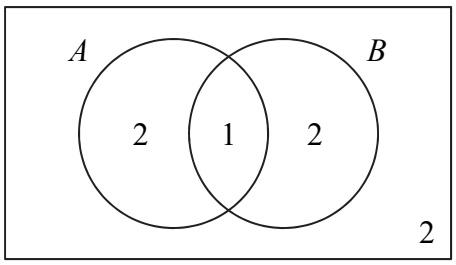
Learning Outcome: 12.A.L.2 — **Question Type: Constructed Response**

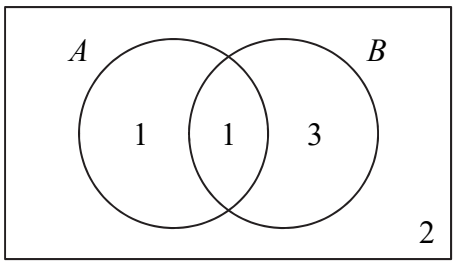
There are 7 students in Ms. Sanduk's class. She knows that some of her students have part-time jobs and some of her students participate in extra-curricular activities. However, 2 students neither have a part-time job nor participate in extra-curricular activities.

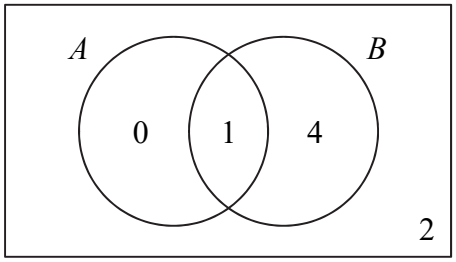
$$A = \{\text{students with part-time jobs}\}$$
$$B = \{\text{students who participate in extra-curricular activities}\}$$
$$n(A \cap B) = 1$$

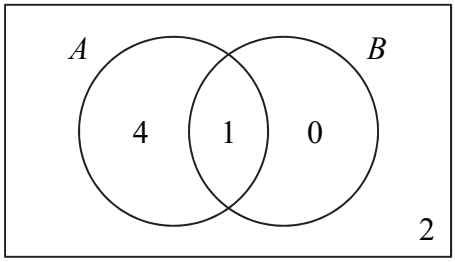
Fill in the blank diagrams below to show two possibilities in this situation.

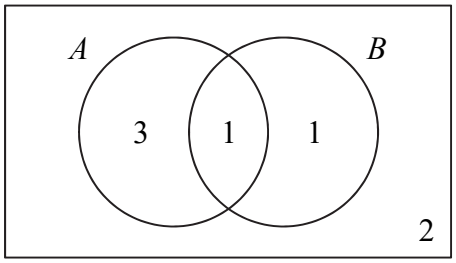
Two of the following five solutions:











Marking Key	
❶	*1 mark for first correct diagram*
❷	*1 mark for second correct diagram*

Question 25 — Total: 2 marks

Learning Outcomes: 12.A.L.2, 12.A.L.3 — **Question Type: Constructed Response**

Complete the truth table, including the missing symbol in the box, based on the following logical statement:

A number is even if and only if a number is a multiple of two.

p	q	p $\boxed{\leftrightarrow}$ q
True	True	**True**
True	False	**False**
False	True	**False**
False	False	**True**

Marker Note(s):
→ *Award a maximum of 1 mark for incorrect symbol with consistent values.*

Marking Key	
❶	*1 mark for correct biconditional symbol (↔)*
❷	*1 mark for consistent values in the third column*

Question 26 — Total: 2 marks

Learning Outcomes: 12.A.L.3, 12.A.P.6 — **Question Type: Constructed Response**

To form a group, 4 students are randomly chosen from 7 students. Jean writes the following conditional statement:

"If all 7 students have an equal chance of being chosen,
then there are 840 different groups that could be formed."

a) Write the contrapositive of the conditional statement.

(1 mark)

"If there are not 840 different groups that could be formed,
then all 7 students do not have an equal chance of being chosen."

b) Is the original conditional statement true? Justify your answer.

(1 mark)

No, the original conditional statement is not true since ${}_7C_4 = 35$ groups.

Other justifications are possible.

Marking Key	
❶	*0.5 mark for including "if" and "then" in (a)*
❷	*0.5 mark for correct contrapositive in (a)*
❸	*1 mark for correct justification in (b)*

Exemplars

Exemplars may contain screen captures
taken from software or Internet pages.

Exemplar 1

Question 3 — Total: 3 marks

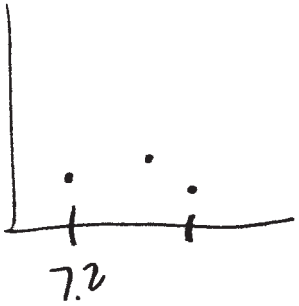
At the Manitoba provincial track and field meet, an athlete is competing in the javelin event. On the athlete's first attempt

- the javelin was thrown at a starting height of 1.6 m
- the javelin reached a height of 4 m at a horizontal distance of 7.2 m from the athlete
- the javelin hit the ground 38 m away from the athlete

a) Determine a quadratic regression equation that models the height of the javelin as a function of the horizontal distance from the athlete. Show your work.

(2 marks)

Horizontal Distance (m)	Height (m)
7.2m	1.6m
38m	4m
40m	3m



stat → edit
stat → calc → quad Reg

$y = -0.18x^2 + 0.87x - 3.78$

E3

b) Determine the maximum height reached by the javelin.

(1 mark)

2nd → trace → max

$x = 15.4$ m

$y = 47.00$ m

∴ the max height reached by the javelin is 47.00 m

1 mark:
❷ → 1 mark for consistent equation in (a)
E3 → makes a transcription error (inaccurate transferring of information)

Exemplar 2

Question 3 — Total: 3 marks

At the Manitoba provincial track and field meet, an athlete is competing in the javelin event. On the athlete's first attempt

- the javelin was thrown at a starting height of 1.6 m
- the javelin reached a height of 4 m at a horizontal distance of 7.2 m from the athlete
- the javelin hit the ground 38 m away from the athlete

a) Determine a quadratic regression equation that models the height of the javelin as a function of the horizontal distance from the athlete. Show your work.

(2 marks)

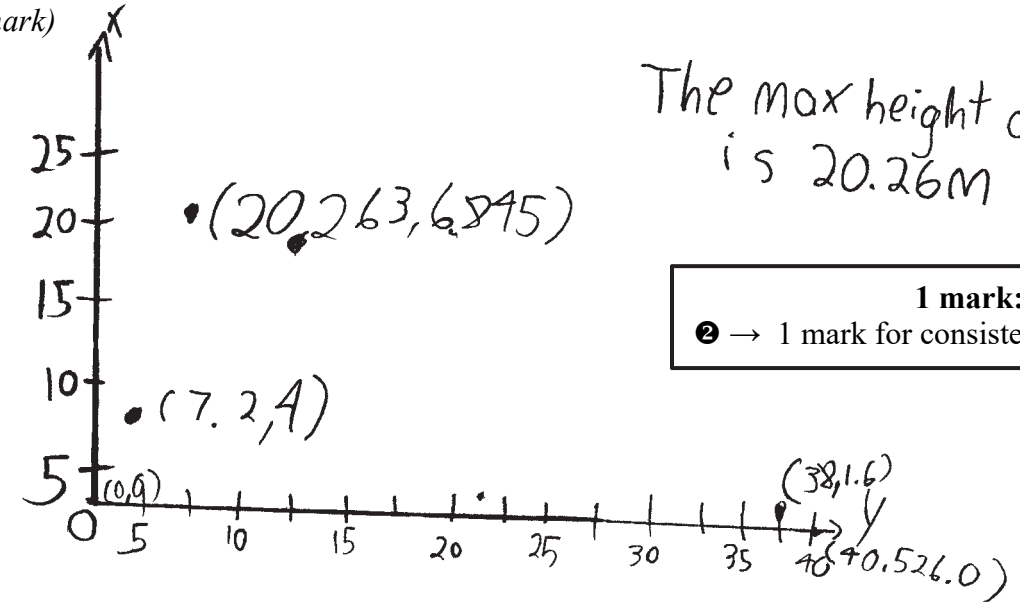
Horizontal Distance (m)	Height (m)
38	1.6
7.2	4
0	0

$y_1 \sim ax_1^2 + bx_1 + c$

$y = -0.0166705x^2 + 0.675583x + 0$

b) Determine the maximum height reached by the javelin.

(1 mark)



The max height of the javelin is 20.26m

1 mark:
❷ → 1 mark for consistent equation in (a)

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Exemplar 1

Question 4 — Total: 4 marks

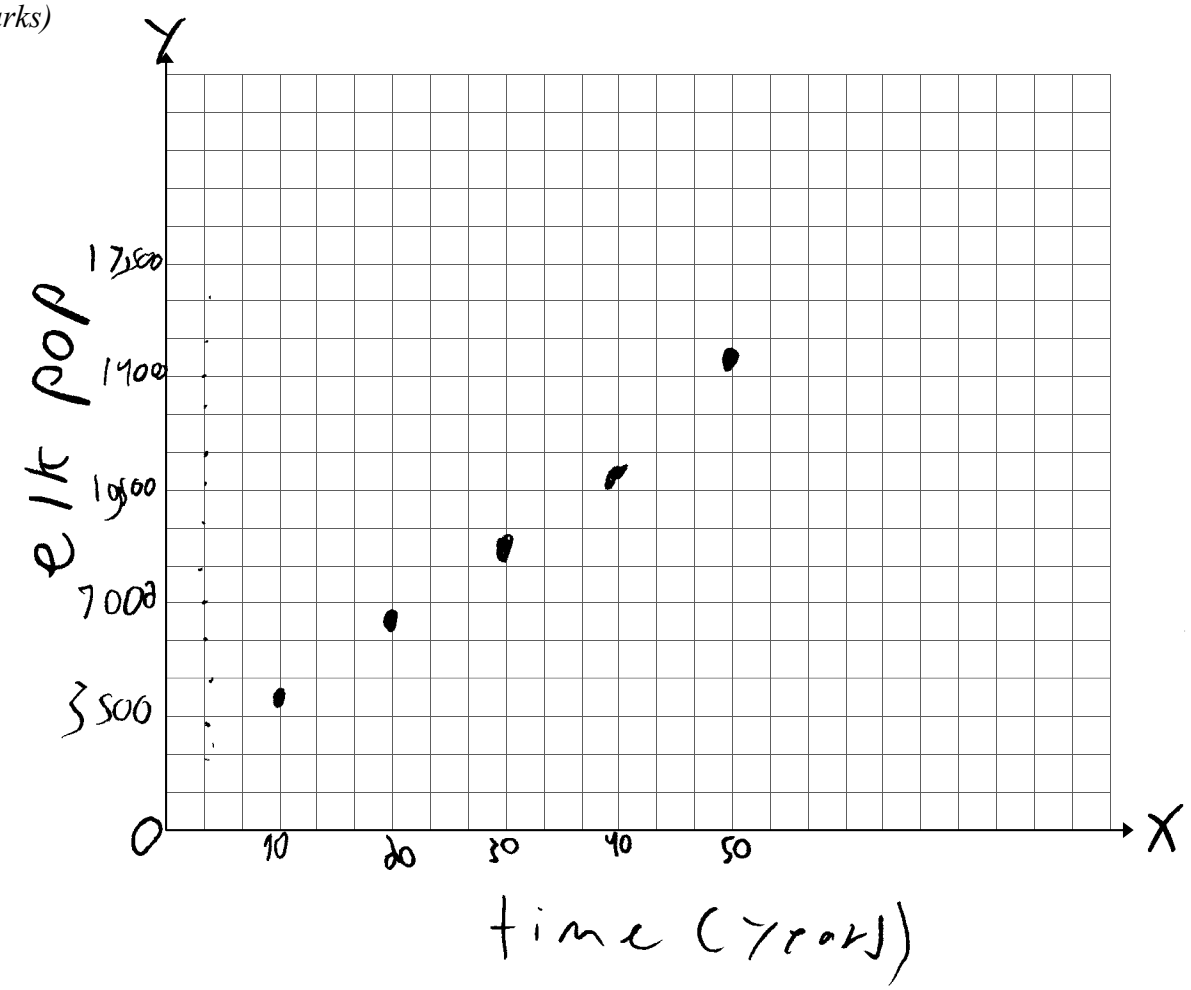
In 2020, the elk population in Riding Mountain National Park can be predicted by the following exponential equation:

$$P = 3500(1.03)^t$$

where P represents the elk population
and t represents the time (in years) starting in January 2020.

a) Create a clearly labelled graph of the predicted elk population over the next 50 years.

(3 marks)



Exemplar 1 (continued)

b) Assume that Riding Mountain National Park can support a maximum population of 16 000 elk. Using the exponential equation, determine in what year the population will reach 16 000.

(1 mark)

in year 2072 (E6)

3 marks:

❶ → 1 mark for communicating the context of the graph with appropriate title and/or labels in (a)
❷ → 1 mark for using an appropriate domain and range (i.e., window settings/grid range) for the context of the question in (a)
❹ → 0.5 mark for correct x-value in (b)
❺ → 0.5 mark for consistent year in (b)

Ⓔ6 → rounds incorrectly

Exemplar 2

Question 4 — Total: 4 marks

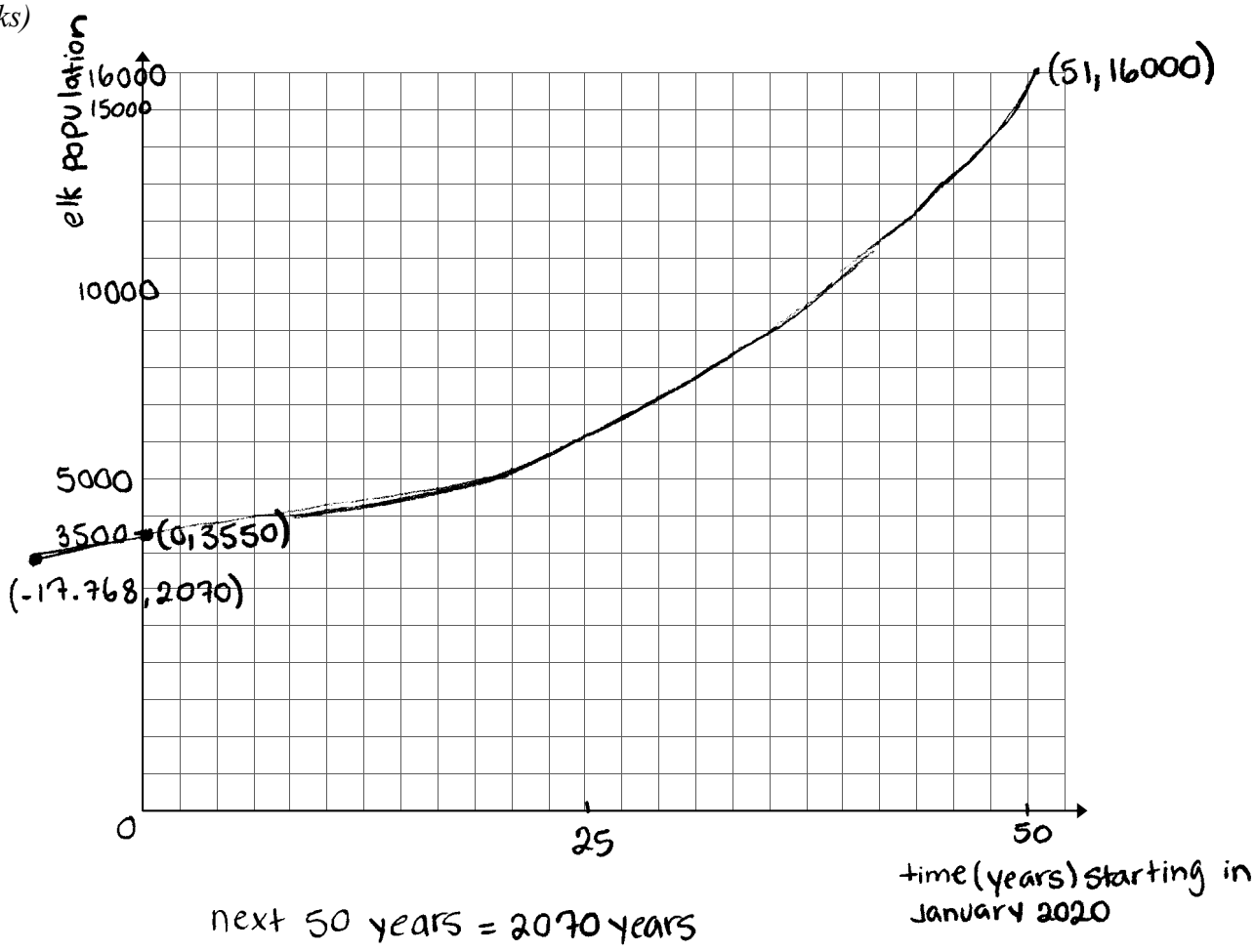
In 2020, the elk population in Riding Mountain National Park can be predicted by the following exponential equation:

$$P = 3500(1.03)^t$$

where P represents the elk population
and t represents the time (in years) starting in January 2020.

a) Create a clearly labelled graph of the predicted elk population over the next 50 years.

(3 marks)



Exemplar 2 (continued)

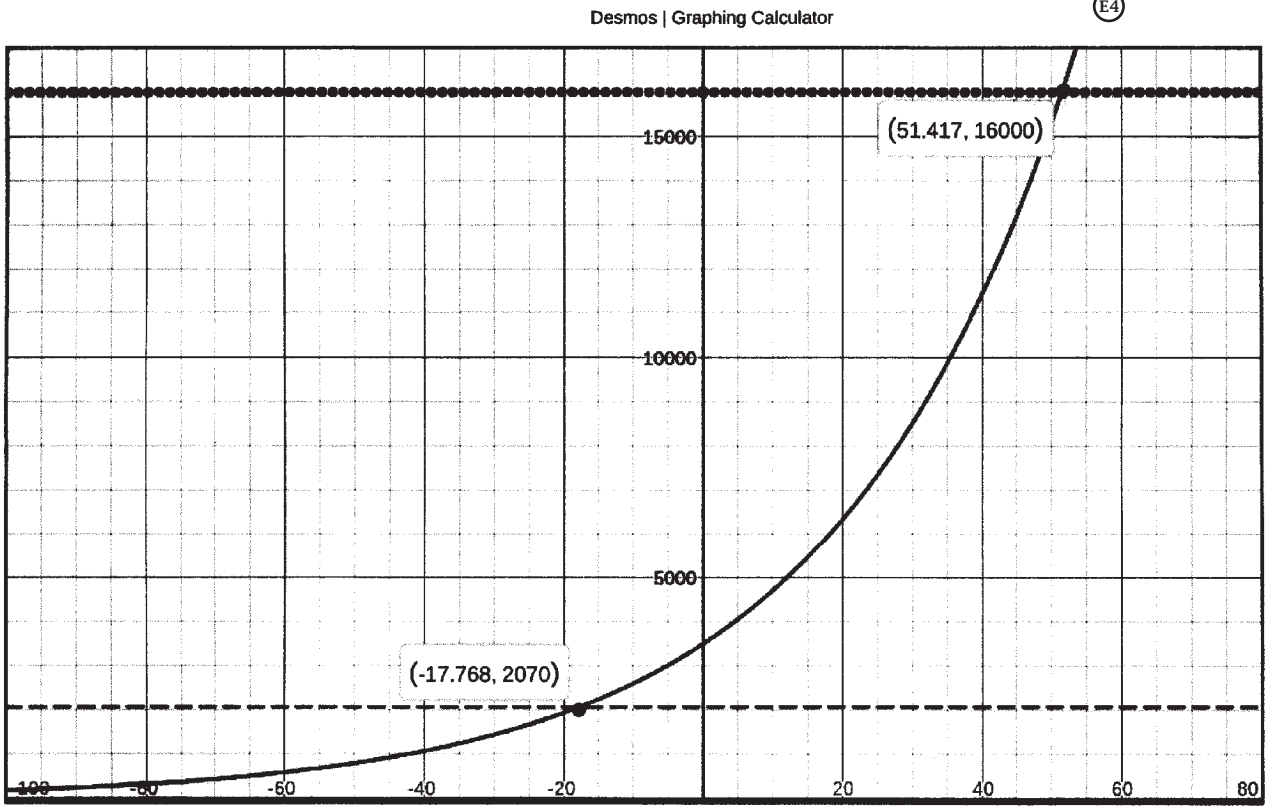
b) Assume that Riding Mountain National Park can support a maximum population of 16 000 elk. Using the exponential equation, determine in what year the population will reach 16 000.

(1 mark)

2020
+51.417
2071.417

The population will reach 16000 elk in the year of 2071.42 years

E4



#4 x = time (years) starting in January 2020
y = elk population
$P = 3500(1.03)^t$
D→ [-17.77, 51]
R→ [2070, 16000]

3 marks:

❶ → 1 mark for communicating the context of the graph with appropriate title and/or labels in (a)

❸ → 1 mark for an appropriate shape that illustrates key characteristics of the function (e.g., maximum, minimum, asymptotes, intercepts) in (a)

❹ → 0.5 mark for correct *x*-value in (b)

❺ → 0.5 mark for consistent year in (b)

Ⓔ4 → does not use whole units in contextual questions involving discrete data

Exemplar 1

Question 5 — Total: 4 marks

An observer collects data for the sea level in Churchill, Manitoba. The sea level rises and falls twice daily. The data is shown below:

Time (h)	Sea Level (m)
0	4.31
3	2.41
6	0.51
9	2.41
12	4.31

a) Determine a sinusoidal regression equation that models this data.

(1 mark)

$y = a\sin(bx + c) + d$

$y = 1.9\sin(0.52x + 1.57) + 2.41$

b) Determine the sea level at 5.5 hours.

(1 mark)

2nd calc value 5.5

0.59 m

Exemplar 1 (continued)

c) State the range and explain its meaning in this situation.

(2 marks)

R : (4.31 , .51)

At high Tide the Sea level is at 4.31m and at low tide the Sea level is at .51 m.

3 marks:

❶ → 0.5 mark for two correct values in (a)
❷ → 0.5 mark for remaining two correct values in (a)
❸ → 1 mark for consistent answer in (b)
❻ → 1 mark for correct explanation in (c)

Exemplar 2

Question 5 — Total: 4 marks

An observer collects data for the sea level in Churchill, Manitoba. The sea level rises and falls twice daily. The data is shown below:

Window
x-min = 0
x-max = 15
y-min = 0
y-max = 5

Time (h) (x)	Sea Level (m) (y)
0	4.31
3	2.41
6	0.51
9	2.41
12	4.31

a) Determine a sinusoidal regression equation that models this data.

(1 mark)

stat → Edit → L_1 + L_2

stat → calc → SinReg

↳ $y = a \times \sin(bx + c) + d$

$y = 1.9 \times \sin(0.52x + 1.57) + 2.41$

vars → 5: statistics → EQ → 1: REGEQ → Graph

b) Determine the sea level at 5.5 hours.

(1 mark)

2nd trace → value → x = 5.5 hours

$y = 2.5574$

∴ the sea level after 5.5 hours will be **2.56m**

Exemplar 2 (continued)

c) State the range and explain its meaning in this situation.

(2 marks)

Range = [0, 4.31]

2 marks:

❶ → 0.5 mark for two correct values in (a)
❷ → 0.5 mark for remaining two correct values in (a)
❸ → 1 mark for consistent answer in (b)
❺ → 0.5 mark for inclusivity of both upper and lower bounds in (c)
PE → 0.5 mark deduction for procedural error

Exemplar 1

Question 6 — Total: 4 marks

A patient has his blood pressure monitored for 16 hours. During this period, his blood pressure can be modelled by the following cubic function:

$$P = -0.05t^3 + 1.28t^2 - 7.46t + 101$$

where P represents the blood pressure (in mm of mercury)
and t represents the amount of time his blood pressure is monitored (in hours).

a) Determine his lowest blood pressure during this period, in mm of mercury.

(1 mark)

3.73h = 88.388 mm

b) Determine how long his blood pressure is at 99 mm of mercury or below. Show your work.

(2 marks)

0.28h - 8.395h

2 marks:
❶ → 1 mark for correct answer in (a)
❷ → 0.5 mark for correct first x-value in (b)
❸ → 0.5 mark for correct second x-value in (b)

Exemplar 2

Question 6 — Total: 4 marks

A patient has his blood pressure monitored for 16 hours. During this period, his blood pressure can be modelled by the following cubic function:

$$P = -0.05t^3 + 1.28t^2 - 7.46t + 101$$

where P represents the blood pressure (in mm of mercury)
and t represents the amount of time his blood pressure is monitored (in hours).

a) Determine his lowest blood pressure during this period, in mm of mercury.

(1 mark)

lowest = 2nd → calc → 3: minimum

minimum =
x = 3.73
y = 88.39

∴ his lowest blood pressure was 88.39 mm

b) Determine how long his blood pressure is at 99 mm of mercury or below. Show your work.

(2 marks)

$y_2 = 99$ → 2nd → trace → intersection

x = 0.28 hours

∴ his pressure was at 99 mm for 0.28 hours

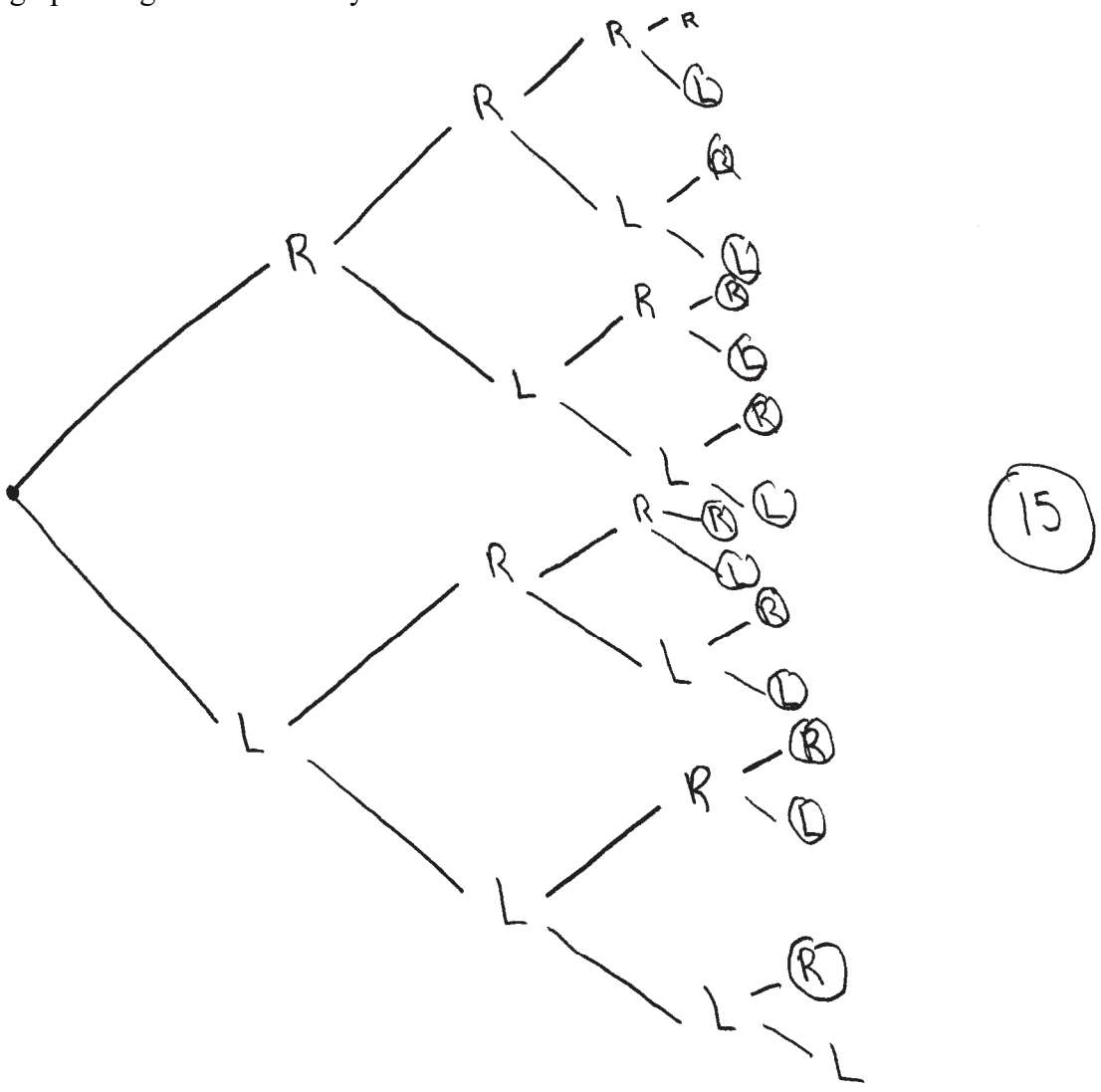
1.5 marks:
❶ → 1 mark for correct answer in (a)
❷ → 0.5 mark for correct first x-value in (b)

Exemplar 1

Question 8 — Total: 2 marks

A student enters a maze and needs to make 4 turns. She must turn left or right at each intersection.

Determine how many different paths are possible if she makes either 1 or 2 right turns.
Use a graphic organizer to show your work.



She could take 15 paths

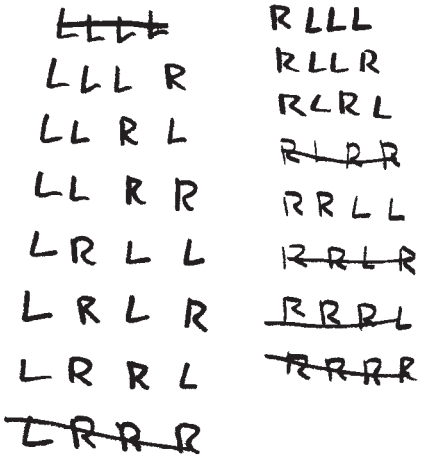
1 mark:
❶ → 1 mark for appropriate work

Exemplar 2

Question 8 — Total: 2 marks

A student enters a maze and needs to make 4 turns. She must turn left or right at each intersection.

Determine how many different paths are possible if she makes either 1 or 2 right turns.
Use a graphic organizer to show your work.



10/16 ← (E1)

2 marks:
❶ → 1 mark for appropriate work ❷ → 1 mark for consistent answer
(E1) → incorrectly states the final answer

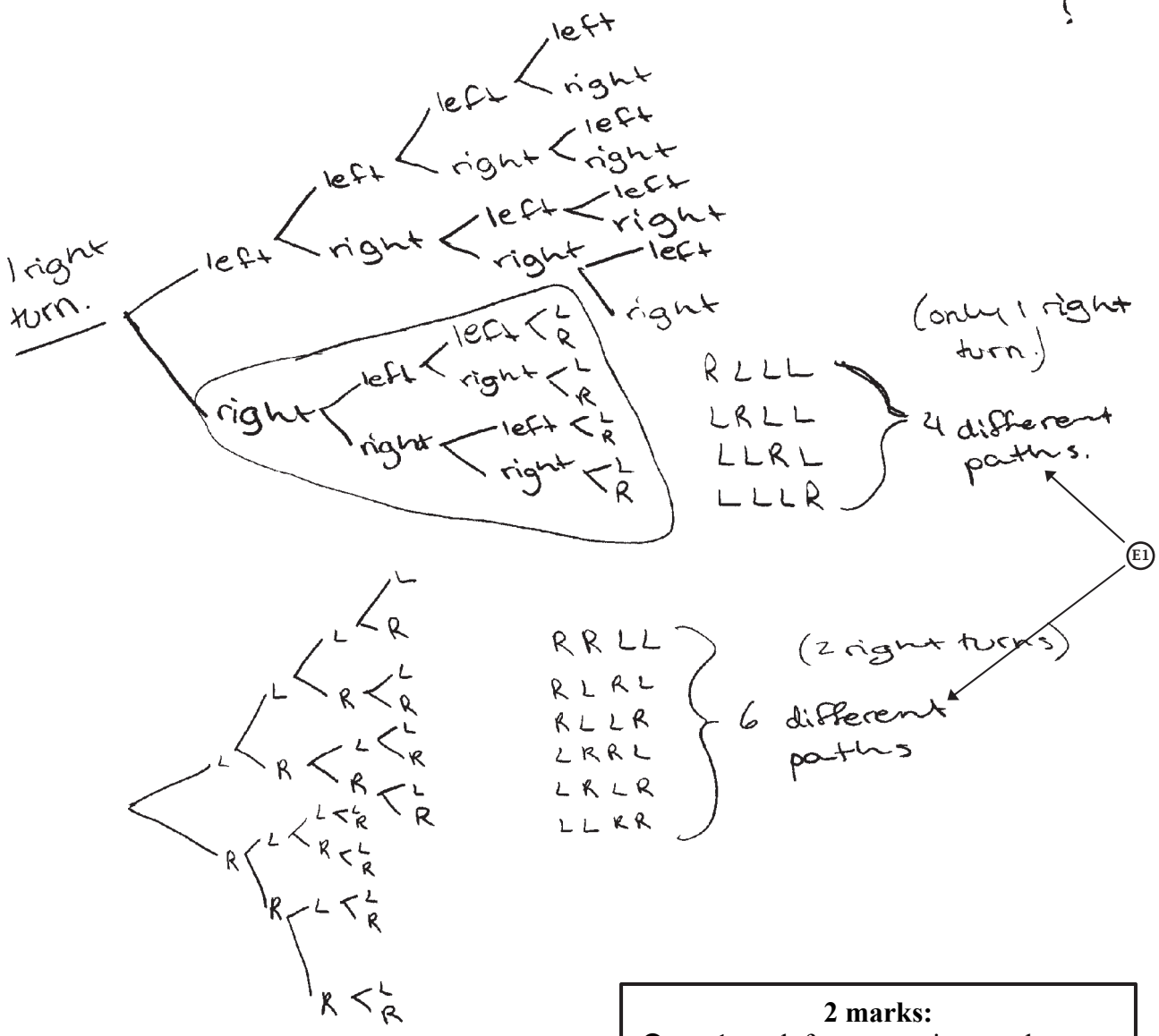
Exemplar 3

Question 8 — Total: 2 marks

A student enters a maze and needs to make 4 turns. She must turn left or right at each intersection.

Determine how many different paths are possible if she makes either 1 or 2 right turns.
Use a graphic organizer to show your work.

only 1 or 2 in total ?



2 marks:
- ❶ → 1 mark for appropriate work
- ❷ → 1 mark for consistent answer

Ⓔ1 → incorrectly states the final answer

Exemplar 1

Question 9 — Total: 2 marks

Students at a high school were surveyed about their use of online television services.

The survey results showed the following:

- 48% of students use Service A
- 40% of students use Service B
- the remaining students do not use any service
- no student uses both services

a) According to the survey results, is the use of online television services mutually exclusive? Justify your reasoning.

(1 mark)

LC yes because both answer do not overlap they are completly opposite things

b) According to the survey results, determine the odds against a student using an online television service.

(1 mark)

40
+ 48
88

12:88 are the odds in percentage

1.5 marks:
❶ → 1 mark for correct justification in (a)
❷ → 1 mark for correct answer in (b)
LC → 0.5 mark deduction for lack of clarity

Exemplar 2

Question 9 — Total: 2 marks

Students at a high school were surveyed about their use of online television services.

The survey results showed the following:

- 48% of students use Service A
- 40% of students use Service B
- the remaining students do not use any service
- no student uses both services

a) According to the survey results, is the use of online television services mutually exclusive? Justify your reasoning.

(1 mark)

Yes the students' choices are mutually exclusive because that means that they don't occur at the same time and no students' used both at the same time,

b) According to the survey results, determine the odds against a student using an online television service.

(1 mark)

$48 + 40 = 88 = 0.88$

$100 - 88 = 12 = 0.12$

$0.12 : 0.88$

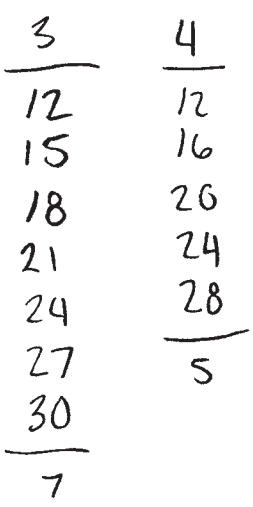
2 marks:
❶ → 1 mark for correct justification in (a)
❷ → 1 mark for correct answer in (b)

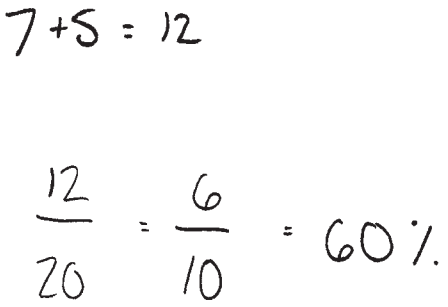
Exemplar 1

Question 10 — Total: 2 marks

Twenty cards numbered 11 to 30 are placed in a box.

Determine the probability of selecting one card from the box that is a multiple of 3 or a multiple of 4. Show your work.





1.5 marks:
- ❶ → 0.5 mark for multiples of 3
- ❷ → 0.5 mark for multiples of 4
- ❹ → 0.5 mark for consistent answer using 20 as the total number of outcomes

Exemplar 2

Question 10 — Total: 2 marks

Twenty cards numbered 11 to 30 are placed in a box.

Determine the probability of selecting one card from the box that is a multiple of 3 or a multiple of 4. Show your work.

$P(\text{mul. of 3 or 4}) = \frac{10}{30} = \boxed{\frac{1}{3}}$

12, 15, 16, 18, 20, 21, 24, 28, 27, 30

1.5 marks:
❶ → 0.5 mark for multiples of 3
❷ → 0.5 mark for multiples of 4
❸ → 0.5 mark for multiples of 3 and 4

Exemplar 1

Question 11 — Total: 3 marks

Your school requires a group of 4 actors for a play.

a) Determine how many ways the group of 4 actors can be chosen from 23 interested students.

(1 mark)

23 nCr 4

8855 different ways

b) You and your best friend are 2 of the 23 interested students. Determine the probability that you both are chosen. Show your work.

(2 marks)

23nCr 2 = 253

23nCr 4 = 8855

$\frac{253}{8855}$

2 marks:

❶ → 1 mark for correct answer in (a)

❸ → 1 mark for consistent probability in (b)

Exemplar 2

Question 11 **Total: 3 marks**

Your school requires a group of 4 actors for a play.

a) Determine how many ways the group of 4 actors can be chosen from 23 interested students.

(1 mark)

$_{23}P_4 = 212\ 520$

212 520 ways

b) You and your best friend are 2 of the 23 interested students. Determine the probability that you both are chosen. Show your work.

(2 marks)

$\underset{\text{you or friend}}{2} \times {}_{21}P_2 \times \underset{\text{you or friend only}}{1} = 840$ ways

4-2 = 2 spots

23-2 = 21 students

840/ 212 520

2 marks:
❷ → 1 mark for consistent number of favourable outcomes in (b)
❸ → 1 mark for consistent probability in (b)

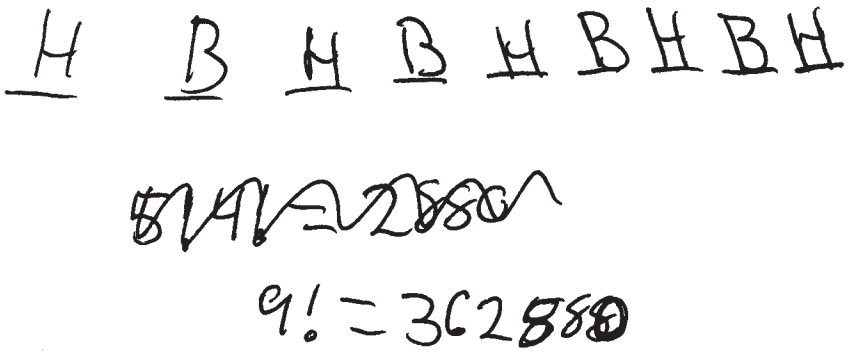
Exemplar 1

Question 12 — Total: 4 marks

A dance studio has 9 students: 4 students are ballet dancers and 5 students are hip-hop dancers. They are arranging themselves in a row for a year-end photo.

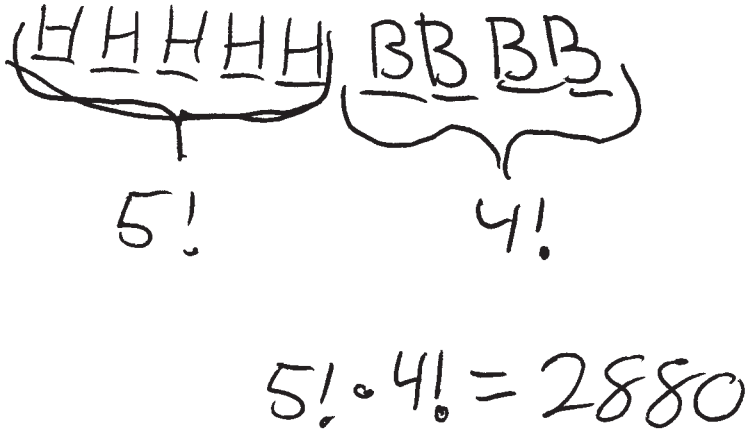
a) Determine how many ways the dancers can be arranged for the photo if they must alternate between their type of dance. Show your work.

(2 marks)



b) Determine how many ways the dancers can be arranged for the photo if the ballet dancers must all stand together. Show your work.

(2 marks)



2 marks:
- → 0.5 mark for correctly arranging the dancers in (a) as per marker note
- ❹ → 0.5 mark for 4! in (b)
- ❻ → 1 mark for consistent product in (b)

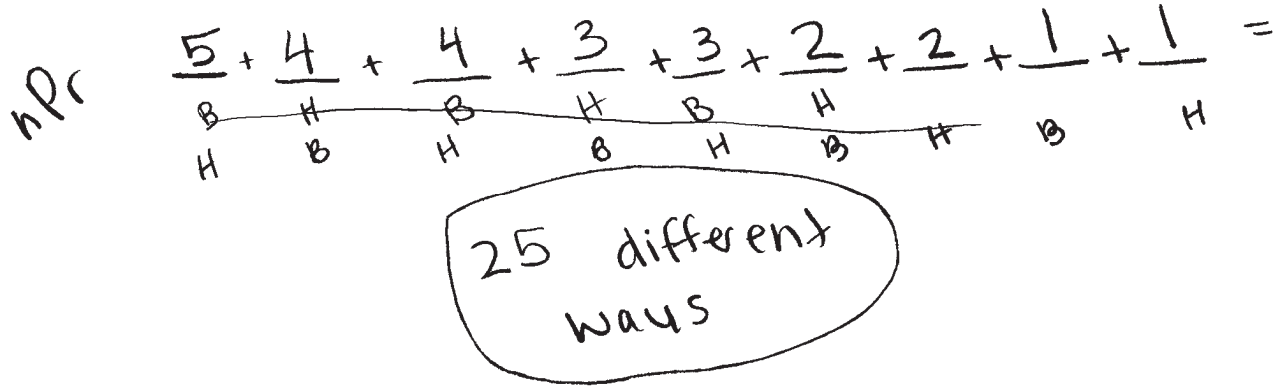
Exemplar 2

Question 12 — Total: 4 marks

A dance studio has 9 students: 4 students are ballet dancers and 5 students are hip-hop dancers. They are arranging themselves in a row for a year-end photo.

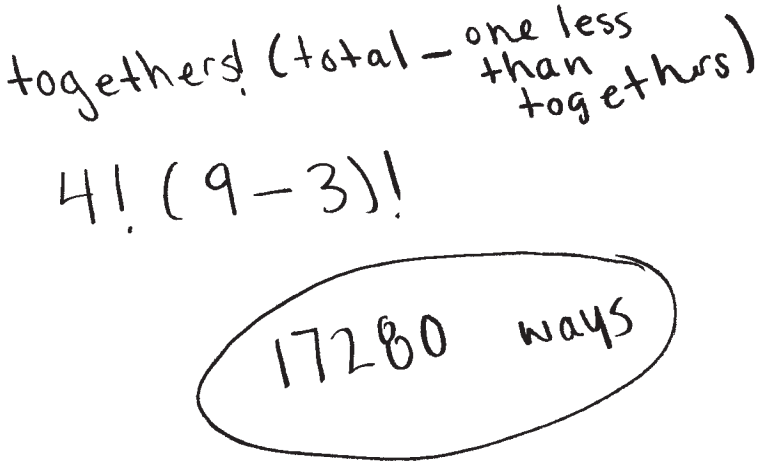
a) Determine how many ways the dancers can be arranged for the photo if they must alternate between their type of dance. Show your work.

(2 marks)



b) Determine how many ways the dancers can be arranged for the photo if the ballet dancers must all stand together. Show your work.

(2 marks)



3 marks:
- ❶ → 0.5 mark for permutation of ballet dancers in (a)
- ❷ → 0.5 mark for permutation of hip-hop dancers in (a)
- ❹ → 0.5 mark for 4! in (b)
- ❺ → 0.5 mark for 6! in (b)
- ❻ → 1 mark for consistent product in (b)

Exemplar 1

Question 13 — Total: 4 marks

Kyla wants to buy a cup of tea for $2. She has the following coins in her pocket:

- 2 identical toonies ($2 coin)
- 6 identical loonies ($1 coin)
- 3 identical quarters (25¢ coin)

11 coins

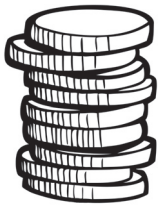
a) Determine the probability of randomly drawing 2 loonies, one after the other, if the first coin is not replaced in her pocket before drawing the second coin. Show your work.

(2 marks)

$\frac{2}{11}$ and $\frac{1}{10} = \frac{2}{110}$

b) Once she has paid for her tea using the 2 loonies, Kyla decides to stack all of the remaining coins in a tower. Determine the number of different ways she can stack the coins. Show your work.

(2 marks)



9 8 7 6 5 4 3 2 1

362880 different stacks

2 marks:

❷ → 0.5 mark for demonstrating the dependency of the total number of coins in (a)
❸ → 1 mark for consistent product in (a)
❹ → 0.5 mark for 9! in (b)

Exemplar 2

Question 13 — Total: 4 marks

Kyla wants to buy a cup of tea for $2. She has the following coins in her pocket:

- 2 identical toonies ($2 coin)
- 6 identical loonies ($1 coin)
- 3 identical quarters (25¢ coin)

a) Determine the probability of randomly drawing 2 loonies, one after the other, if the first coin is not replaced in her pocket before drawing the second coin. Show your work.

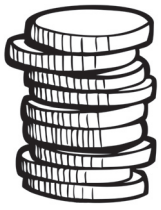
(2 marks)

$\frac{4}{11}$

$1/22$

b) Once she has paid for her tea using the 2 loonies, Kyla decides to stack all of the remaining coins in a tower. Determine the number of different ways she can stack the coins. Show your work.

(2 marks)



$9! \div 4!2!3! = 181440$

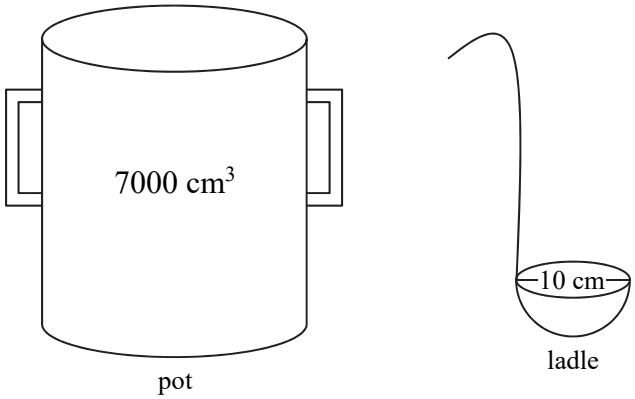
❹ ❺ ❻ ❼ PE

1.5 marks:
- ❹ → 0.5 mark for 9! in (b)
- ❺ → 0.5 mark for 4! in (b)
- ❻ → 0.5 mark for 2!3! in (b)
- ❼ → 0.5 mark for consistent quotient in (b)
- PE → 0.5 mark deduction for procedural error

Exemplar 1

Question 15 — Total: 2 marks

Sarah has prepared 7000 cm^3 of soup in a pot. She uses a ladle, in the shape of a hemisphere, to serve the soup into bowls. The ladle has a diameter of 10 cm.



Determine the number of full ladles of soup that she can serve. Show your work.

ladle volume

$\frac{4}{3}\pi 5^3 = 523.59\,cm^3$

$\frac{7000\,cm^3}{523.59\,cm^3} = 13.36 \uparrow 14$ (E6) (E6)

∴ she can serve 14 servings

1.5 marks:

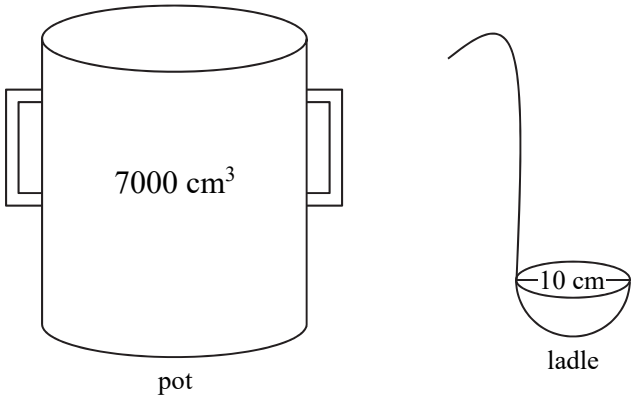
❶ → 0.5 mark for correct substitution of radius in formula
❸ → 0.5 mark for dividing volume of pot by volume of ladle
❹ → 0.5 mark for consistent answer

(E6) → rounds incorrectly

Exemplar 2

Question 15 — Total: 2 marks

Sarah has prepared 7000 cm^3 of soup in a pot. She uses a ladle, in the shape of a hemisphere, to serve the soup into bowls. The ladle has a diameter of 10 cm.



Determine the number of full ladles of soup that she can serve. Show your work.

$4\pi 5^2 = 314.159 \div 2 = 157.08\ cm^2$

$7000 \div 157.08 = 44.56$

45 full ladles of soup

E6

1 mark:
❸ → 0.5 mark for dividing volume of pot by volume of ladle ❹ → 0.5 mark for consistent answer
Ⓔ6 → rounds incorrectly

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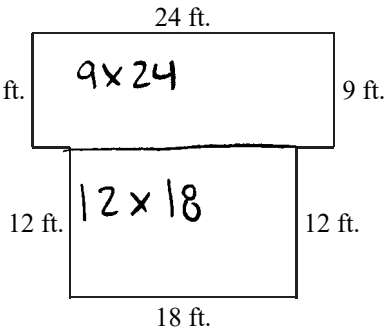
Exemplar 1

Question 16 — Total: 6 marks

Nashida wants to build an outdoor kitchen.

She is going to place patio stones in the layout shown to the right. The patio stones

- are in the shape of a square with 18-inch sides
- cost $3.00 each



1ft = 12in (×12)

a) Determine the number of patio stones Nashida needs. Show your work.

(2 marks)

9x24 = 216ft

(E3) → 15x18 = 270ft

= 486ft → (×12) 5822in ÷ 324 = 18 patio stones

18x18 = 324

Nashida must buy a grill, a countertop, and a patio set for the outdoor kitchen. She has the following options:

Grill		Countertop		Patio Set	
Propane	$1400.00	Granite	$2700.00	Basic	$600.00
Pellet	$3000.00	Soapstone	$3600.00	Elegant	$1000.00

She also plans to buy **three** of the following items:

Side Burner		Fridge		Cabinet		Sink		Warming Drawer	
Single	$400.00	Small	$800.00	30-inch	$700.00	Single	$350.00	Small	$800.00
Double	$650.00	Large	$1100.00	42-inch	$1250.00	Double	$500.00	Large	$1300.00

Exemplar 1 (continued)

b) Nashida can spend a maximum of $11 000.00, taxes included. Calculate the total cost, plus GST and PST, of the patio stones and components of the outdoor kitchen. Show your work. (Note: GST = 5%, PST = 7%)

(2 marks)

18 patio stones × $3.00 = $54

$1400.00 + $2700.00 + $1000.00 = $5100.00

propane grill ↑ granite counter top ↑ elegant patio set ↑

$5164.00 × 1.12 = $5772.48

c) Nashida is financing the outdoor kitchen with a financial institution that gives her an ~~interest rate of 5.00%, compounded monthly~~. She wants to make ~~$300.00 monthly payments~~ on the loan. Calculate how many payments it will take Nashida to pay off the loan. Show your work.

(2 marks)

→N: SOLVE: 20.098...

I: 5%

PV: $5772.48

PMT: -300.00

FV: 0

P/Y: 12

C/Y: 12

E6

= nashida will have to make 20 payments to pay off the loan

5 marks:

❶ → 0.5 mark for correct area of layout in (a)
❷ → 0.5 mark for correct area of one patio stone in (a)
❹ → 0.5 mark for consistent number of patio stones in (a)
❺ → 0.5 mark for indicating required components and costs in (b)
❼ → 0.5 mark for consistent subtotal including all components in (b)
❽ → 0.5 mark for consistent total cost, including taxes, less than $11 000.00 in (b)
❾ → 1 mark for appropriate work in (c)
❿ → 1 mark for consistent answer in (c)

E3 → makes a transcription error (inaccurate transferring of information)
E6 → rounds incorrectly

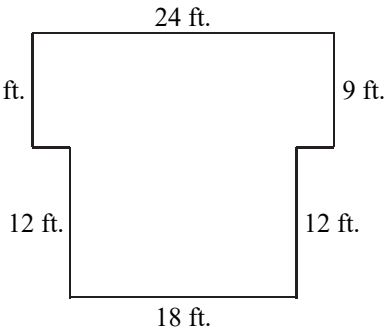
Exemplar 2

Question 16 — Total: 6 marks

Nashida wants to build an outdoor kitchen.

She is going to place patio stones in the layout shown to the right. The patio stones

- are in the shape of a square with 18-inch sides
- cost $3.00 each



$\frac{18}{12} = 1.5\text{ft}$

a) Determine the number of patio stones Nashida needs. Show your work.

(2 marks)

80ft
1.5ft
= 53.33
= 54 stones

24
9
+ 3
12
12
18
3
9
80

Nashida must buy a grill, a countertop, and a patio set for the outdoor kitchen. She has the following options:

Grill		Countertop		Patio Set	
Propane	$1400.00	Granite	$2700.00	Basic	$600.00
Pellet	$3000.00	Soapstone	$3600.00	Elegant	$1000.00

She also plans to buy **three** of the following items:

Side Burner		Fridge		Cabinet		Sink		Warming Drawer	
Single	$400.00	Small	$800.00	30-inch	$700.00	Single	$350.00	Small	$800.00
Double	$650.00	Large	$1100.00	42-inch	$1250.00	Double	$500.00	Large	$1300.00

Exemplar 2 (continued)

b) Nashida can spend a maximum of $11 000.00, taxes included. Calculate the total cost, plus GST and PST, of the patio stones and components of the outdoor kitchen. Show your work. (Note: GST = 5%, PST = 7%)

(2 marks)

(propane) Grill = $1400
(Granite) Countertop = $2700
(Basic) Patio set = $600
(small) Fridge = $800
(Double) Side burner = $6500 ← E3
(single) Sink = $350

12350
+ 162
12512

54 x 3 = 162

12512 x 1.12
= $14013.44

c) Nashida is financing the outdoor kitchen with a financial institution that gives her an interest rate of 5.00%, compounded monthly. She wants to make $300.00 monthly payments on the loan. Calculate how many payments it will take Nashida to pay off the loan. Show your work.

(2 marks)

N 24
I% 5
PV 300
PMT ? 13 payments
FV 0
P/Y 12
C/Y 12

2.5 marks:

❸ → 0.5 mark for correct unit conversion in (a)
❹ → 0.5 mark for consistent number of patio stones in (a)
❺ → 0.5 mark for indicating required components and costs in (b)
❻ → 0.5 mark for indicating three optional components and costs in (b)
❼ → 0.5 mark for consistent subtotal including all components in (b)

E3 → makes a transcription error (inaccurate transferring of information)

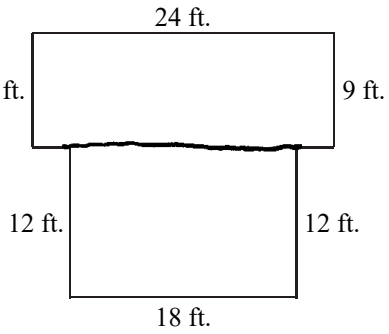
Exemplar 3

Question 16 — Total: 6 marks

Nashida wants to build an outdoor kitchen.

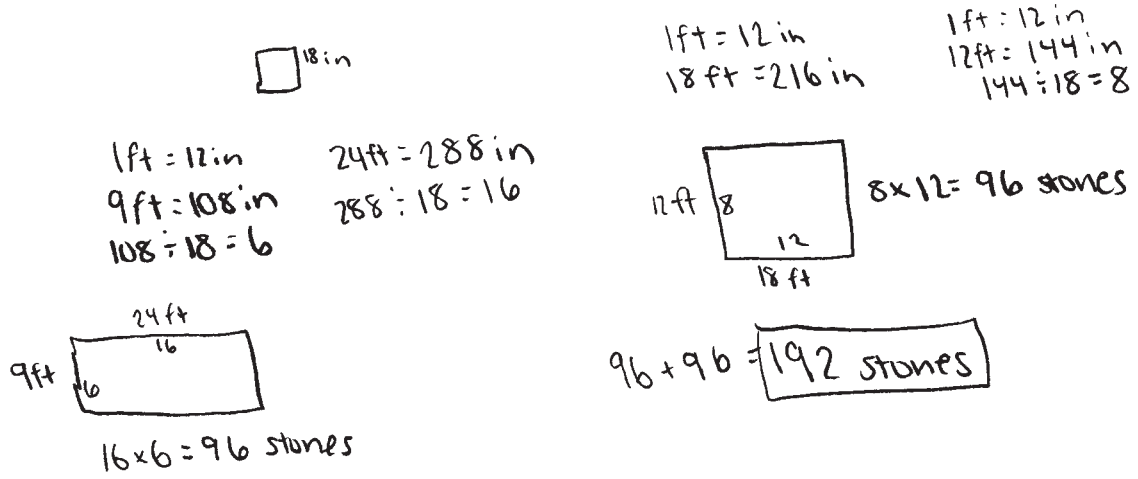
She is going to place patio stones in the layout shown to the right. The patio stones

- are in the shape of a square with 18-inch sides
- cost $3.00 each



a) Determine the number of patio stones Nashida needs. Show your work.

(2 marks)



Nashida must buy a grill, a countertop, and a patio set for the outdoor kitchen. She has the following options:

Grill		Countertop		Patio Set	
Propane	$1400.00	Granite	$2700.00	Basic	$600.00
Pellet	$3000.00	Soapstone	$3600.00	Elegant	$1000.00

She also plans to buy **three** of the following items:

Side Burner		Fridge		Cabinet		Sink		Warming Drawer	
Single	$400.00	Small	$800.00	30-inch	$700.00	Single	$350.00	Small	$800.00
Double	$650.00	Large	$1100.00	42-inch	$1250.00	Double	$500.00	Large	$1300.00

Exemplar 3 (continued)

b) Nashida can spend a maximum of $11 000.00, taxes included. Calculate the total cost, plus GST and PST, of the patio stones and components of the outdoor kitchen. Show your work. (Note: GST = 5%, PST = 7%)

(2 marks)

192 x 3 = $576 ← Patio stones

Propane Grill: $1400.00
Granite countertop $2700.00
Basic Patio Set: $600.00
Double Side burner: $650.00
Fridge: $800.00
Cabinet (30in): $700.00
Single Sink: $350

576 + 1400 + 2700 + 600 + 650 + 800 + 700 + 350 = $7776

$7776.00 x 1.12 = $8709.12

c) Nashida is financing the outdoor kitchen with a financial institution that gives her an interest rate of 5.00%, compounded monthly. She wants to make $300.00 monthly payments on the loan. Calculate how many payments it will take Nashida to pay off the loan. Show your work.

(2 marks)

N = ?
I = 5
PV = 8709.12
PMT = -300
FV = 0
P/Y = 12
C/Y = 12

N = 31.006

It will take just over 31 or 32 payments

5.5 marks:

❶ → 0.5 mark for correct area of layout in (a)
❷ → 0.5 mark for correct area of one patio stone in (a)
❸ → 0.5 mark for correct unit conversion in (a)
❹ → 0.5 mark for consistent number of patio stones in (a)
❺ → 0.5 mark for indicating required components and costs in (b)
❼ → 0.5 mark for consistent subtotal including all components in (b)
❽ → 0.5 mark for consistent total cost, including taxes, less than $11 000.00 in (b)
❾ → 1 mark for appropriate work in (c)
❿ → 1 mark for consistent answer in (c)

Exemplar 1

Question 17 — Total: 1 mark

Kazoo is looking for a house. He has the following options:

Option 1: He can buy a house with a monthly mortgage payment of $1150.00 amortized over 25 years.

Option 2: He can rent a similar house for $1150.00 per month.

State which option Kazoo should choose. Provide one reason for your choice.

Kazoo should choose option 1

- buying a house is more benefital

0 marks:
→ no criteria met

Exemplar 2

Question 17 — Total: 1 mark

Kazoo is looking for a house. He has the following options:

Option 1: He can buy a house with a monthly mortgage payment of $1150.00 amortized over 25 years.

Option 2: He can rent a similar house for $1150.00 per month.

State which option Kazoo should choose. Provide one reason for your choice.

Kazoo should choose option 1

→ house goes up in value if he wants to sell later

→ more privacy

→ counts towards assets.

0.5 mark:
❶ → 1 mark for appropriate reason
LC → 0.5 mark deduction for lack of clarity

Exemplar 1

Question 18 — Total: 6 marks

Ham and Sylvie each had $10 000.00 to invest.

a) Ham invested $10 000.00 in a mutual fund at an interest rate of 6.00%, compounded monthly. Determine the value of the mutual fund at the end of the first year. Show your work.

(2 marks)

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

$= 10\,000(1 + \frac{0.06}{12})^{12 \cdot 1}$

$A = \$10\,616.78$

b) Sylvie invested $10 000.00 in a guaranteed investment certificate (GIC) with interest compounded semi-annually. The value of the GIC was $11 261.62 at the end of the third year. Determine the interest rate for the GIC. Show your work.

(2 marks)

$I = Prt$

$\frac{1261.62}{3} = \frac{10\,000r(3)}{3}$

$\frac{420.54}{10\,000} = \frac{10\,000r}{10\,000}$

$= 0.04205 \times 100$

$r = 4.21\%$

c) Using the Rule of 72, determine approximately how much longer it will take for Sylvie's GIC to reach a value of $40 000.00 compared to Ham's mutual fund. Show your work.

(2 marks)

S

$\frac{72}{4.21} = 17.10$ yrs

$\times 2$

34.20 years

H

$\frac{72}{6} = 12$

$\times 2$

24 years

4.5 marks:

❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent answer in (a)
❹ → 1 mark for consistent answer in (b)
❺ → 0.5 mark for correctly using Rule of 72 on mutual fund in (c)
❻ → 0.5 mark for correctly using Rule of 72 on GIC in (c)
❼ → 0.5 mark for doubling twice in (c)

Exemplar 2

Question 18 — Total: 6 marks

Ham and Sylvie each had $10 000.00 to invest.

a) Ham invested $10 000.00 in a mutual fund at an interest rate of 6.00%, compounded monthly. Determine the value of the mutual fund at the end of the first year. Show your work.

(2 marks)

Ham

N = 12
I = 6%
PV = 10 000
PMT = 0
FV = 0
P/Y = 12
C/Y

= $10 616.78

b) Sylvie invested $10 000.00 in a guaranteed investment certificate (GIC) with interest compounded semi-annually. The value of the GIC was $11 261.62 at the end of the third year. Determine the interest rate for the GIC. Show your work.

(2 marks)

N = 3
I = ? = 4% ← E6
PV = 10000
PMT = 0
FV = -11261.62
P/Y = 1
C/Y = 2

c) Using the Rule of 72, determine approximately how much longer it will take for Sylvie's GIC to reach a value of $40 000.00 compared to Ham's mutual fund. Show your work.

(2 marks)

Sylvie $\frac{72}{4}$ = 18 years

Ham $\frac{72}{6}$ = 12 years

5 marks:

❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent answer in (a)
❸ → 1 mark for appropriate work in (b)
❹ → 1 mark for consistent answer in (b)
❺ → 0.5 mark for correctly using Rule of 72 on mutual fund in (c)
❻ → 0.5 mark for correctly using Rule of 72 on GIC in (c)

E6 → does not express the answer to the appropriate number of decimal places

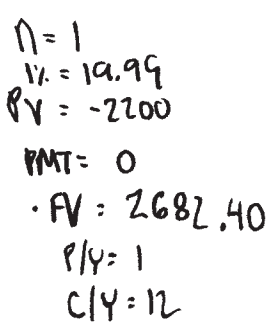
Exemplar 1

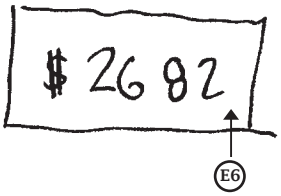
Question 19 — Total: 6 marks

Simba wants to purchase a bed for $2200.00 (taxes included). The store offers him a promotion of 0% interest with no payments for one year. If Simba does not pay the amount in full within one year, interest will be charged from the date of purchase at an interest rate of 19.99%, compounded monthly.

a) If Simba does not make any payments during the first year, calculate the amount the store will bill him one year after the date of purchase. Show your work.

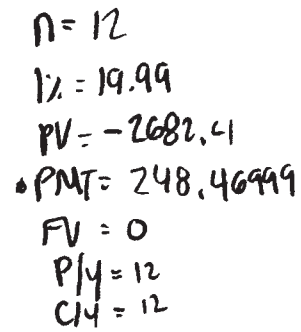
(2 marks)

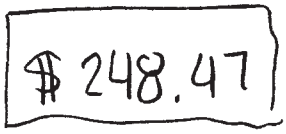




b) If Simba makes monthly payments over the second year to pay off the amount calculated in (a), determine his monthly payment. Show your work.

(2 marks)





c) Using your answer in (b), calculate the interest Simba would pay over the two-year period. Show your work.

(1.5 marks)

$int(1,12) = \boxed{\$299.24}$

d) Give one reason why Simba would buy his bed using the promotion.

(0.5 mark)

Likely he liked the idea of 0% interest for a year.

4.5 marks:

❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent answer in (a)
❸ → 1 mark for appropriate work in (b)
❹ → 1 mark for consistent answer in (b)
❺ → 0.5 mark for the total amount paid during the second year in (c)

Ⓔ6 → does not express the answer to the appropriate number of decimal places, including monetary values to two decimal places

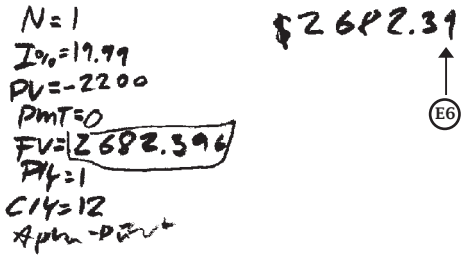
Exemplar 2

Question 19 — Total: 6 marks

Simba wants to purchase a bed for $2200.00 (taxes included). The store offers him a promotion of 0% interest with no payments for one year. If Simba does not pay the amount in full within one year, interest will be charged from the date of purchase at an interest rate of 19.99%, compounded monthly.

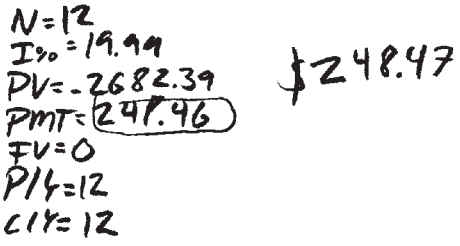
a) If Simba does not make any payments during the first year, calculate the amount the store will bill him one year after the date of purchase. Show your work.

(2 marks)



b) If Simba makes monthly payments over the second year to pay off the amount calculated in (a), determine his monthly payment. Show your work.

(2 marks)



c) Using your answer in (b), calculate the interest Simba would pay over the two-year period. Show your work.

(1.5 marks)

2682.39-2200 = 482.39

APPS→Fin→6 Int(1,12) = 299.23+482.39

$781.62 in interest

d) Give one reason why Simba would buy his bed using the promotion.

(0.5 mark)

So he wouldn't have to pay the extra interest of 781.68 dollars

5.5 marks:

❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent answer in (a)
❸ → 1 mark for appropriate work in (b)
❹ → 1 mark for consistent answer in (b)
❺ → 0.5 mark for the total amount paid during the second year in (c)
❻ → 0.5 mark for considering the initial cost of the bed in (c)
❼ → 0.5 mark for consistent answer in (c)

Ⓔ6 → rounds incorrectly

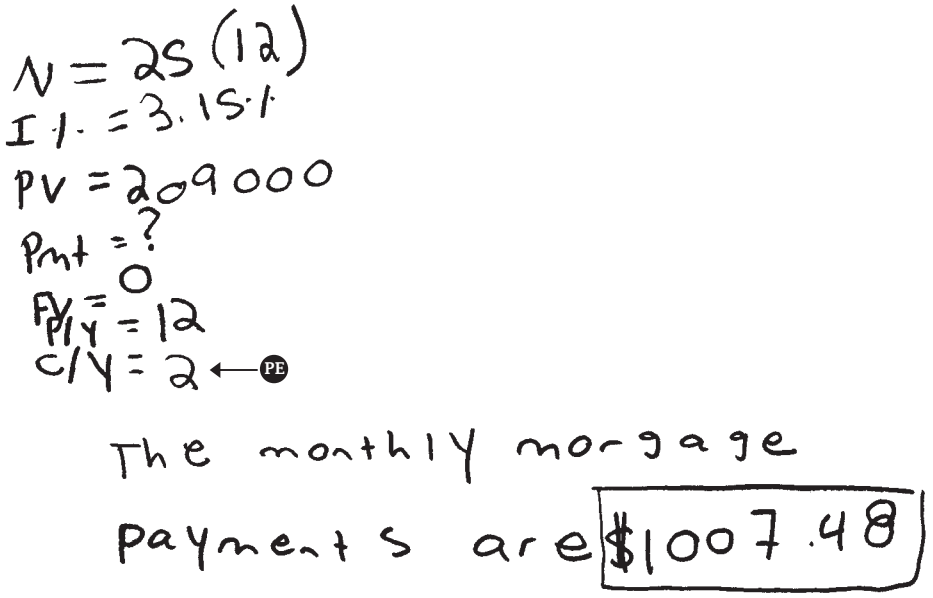
Exemplar 1

Question 20 **Total: 3 marks**

The Ramilo family moved to The Pas. They bought a house with a purchase price of $229 000.00 and made a down payment of $20 000.00. Their mortgage has an interest rate of 3.15%, compounded semi-annually, and is amortized over 25 years.

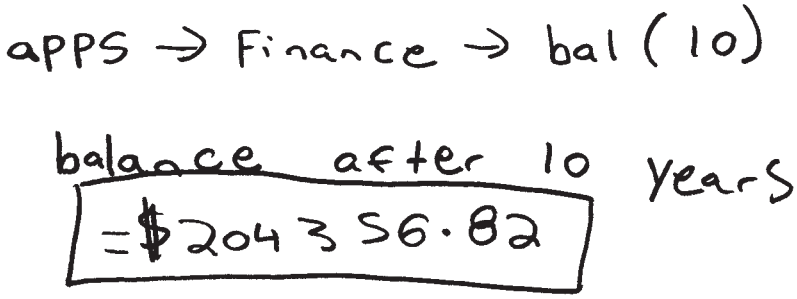
a) Calculate their monthly mortgage payment. Show your work.

(2 marks)



b) Calculate the balance owing on the mortgage after 10 years if they have been making regular monthly payments.

(1 mark)



1.5 marks:
❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent answer in (a)
PE → 0.5 mark deduction for procedural error

Exemplar 2

Question 20 — Total: 3 marks

The Ramilo family moved to The Pas. They bought a house with a purchase price of $229 000.00 and made a down payment of $20 000.00. Their mortgage has an interest rate of 3.15%, compounded semi-annually, and is amortized over 25 years.

a) Calculate their monthly mortgage payment. Show your work.

(2 marks)

229 000
- 20 000
209 000

N = 300
I% = 3.15
PV = 209 000
PMT = ?
FV = 0
P/Y = 12
C/Y = 2

PMT = $1005.24

b) Calculate the balance owing on the mortgage after 10 years if they have been making regular monthly payments.

(1 mark)

N = 120
I% = 3.15
PV = ?
PMT = -1005.24
FV = 0
P/Y = 12
C/Y = 2

$103 462.45

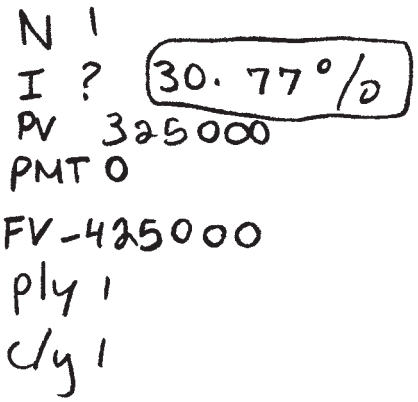
2 marks:
❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent answer in (a)

Exemplar 1

Question 21 — Total: 2 marks

In 2009, the value of a cottage was $325 000.00. In 2019, the same cottage had a value of $425 000.00.

Determine the average annual appreciation rate. Show your work.



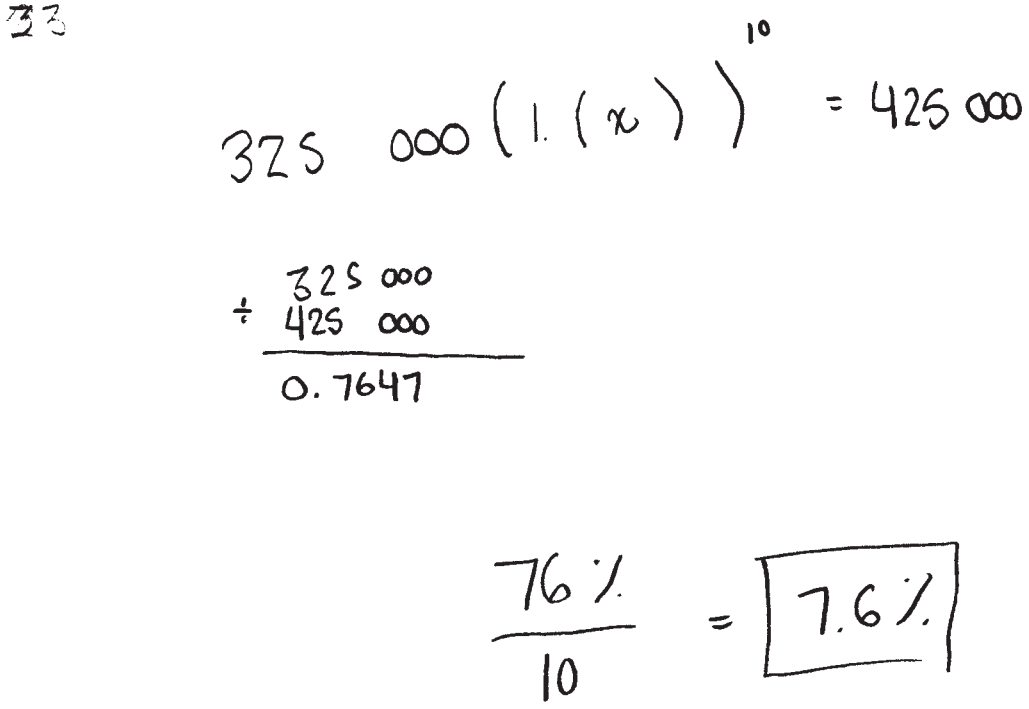
1 mark:
❷ → 1 mark for consistent answer

Exemplar 2

Question 21 — Total: 2 marks

In 2009, the value of a cottage was $325 000.00. In 2019, the same cottage had a value of $425 000.00.

Determine the average annual appreciation rate. Show your work.



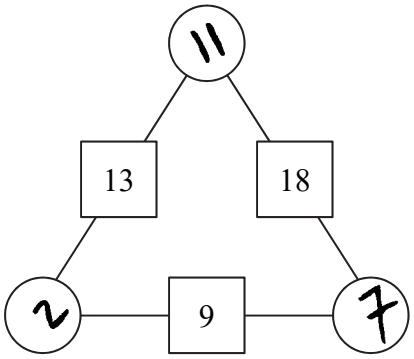
0 marks:
→ no criteria met

Exemplar 1

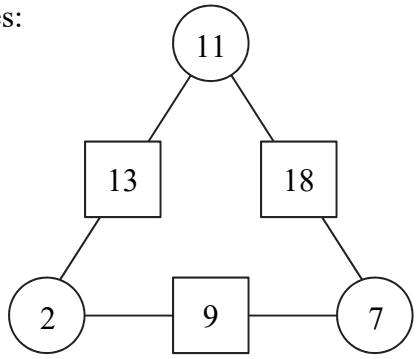
Question 23 — Total: 1 mark

An arithmagon is a puzzle in which the number in each box is the sum of the two numbers in the circles adjacent to that box. Here is an example:

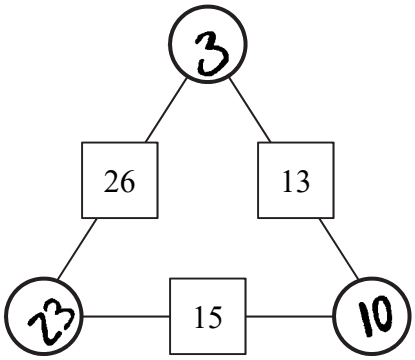
Given:



Becomes:



Therefore, given:



Fill in each circle above with an appropriate number.

0 marks:
→ no criteria met

Exemplar 1

Question 24 — Total: 2 marks

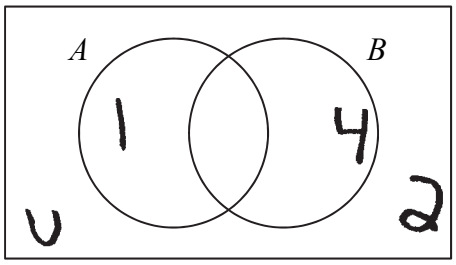
There are 7 students in Ms. Sanduk's class. She knows that some of her students have part-time jobs and some of her students participate in extra-curricular activities. However, 2 students neither have a part-time job nor participate in extra-curricular activities.

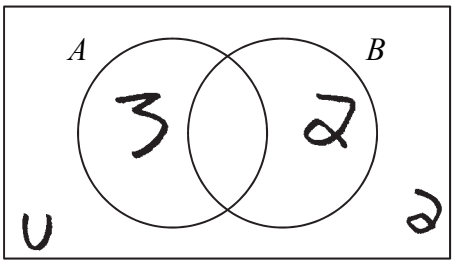
$A = \{\text{students with part-time jobs}\}$

$B = \{\text{students who participate in extra-curricular activities}\}$

$n(A \cap B) = 1$

Fill in the blank diagrams below to show two possibilities in this situation.





0 marks:
→ no criteria met

Exemplar 2

Question 24 — Total: 2 marks

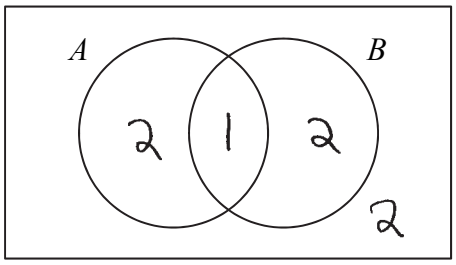
There are 7 students in Ms. Sanduk's class. She knows that some of her students have part-time jobs and some of her students participate in extra-curricular activities. However, 2 students neither have a part-time job nor participate in extra-curricular activities.

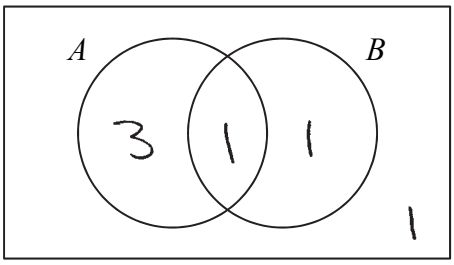
$A = \{\text{students with part-time jobs}\}$

$B = \{\text{students who participate in extra-curricular activities}\}$

$n(A \cap B) = 1$

Fill in the blank diagrams below to show two possibilities in this situation.





1 mark:
❶ → 1 mark for first correct diagram

Exemplar 1

Question 25 — Total: 2 marks

Complete the truth table, including the missing symbol in the box, based on the following logical statement:

A number is even if and only if a number is a multiple of two.

p	q	p ⟷ q
True	True	F
True	False	T
False	True	T
False	False	F

1 mark:
❶ → 1 mark for correct biconditional symbol (↔)

Exemplar 2

Question 25 — Total: 2 marks

Complete the truth table, including the missing symbol in the box, based on the following logical statement:

A number is even if and only if a number is a multiple of two.

p	q	p $\boxed{\Rightarrow}$ q
True	True	T
True	False	F
False	True	T
False	False	T

1 mark:
❷ → 1 mark for consistent values in the third column

Exemplar 1

Question 26 — Total: 2 marks

To form a group, 4 students are randomly chosen from 7 students. Jean writes the following conditional statement:

"If all 7 students have an equal chance of being chosen,
then there are 840 different groups that could be formed."

a) Write the contrapositive of the conditional statement.

(1 mark)

If 840 groups aren't formed, then 7 students don't have an equal chance.

b) Is the original conditional statement true? Justify your answer.

(1 mark)

No because it didn't make sense.

1 mark:
❶ → 0.5 mark for including "if" and "then" in (a)
❷ → 0.5 mark for correct contrapositive in (a)

Exemplar 2

Question 26 — Total: 2 marks

To form a group, 4 students are randomly chosen from 7 students. Jean writes the following conditional statement:

"If all 7 students have an equal chance of being chosen,
then there are 840 different groups that could be formed."

a) Write the contrapositive of the conditional statement.

(1 mark)

Flie are not

"if 840 groups are formed then 7 students have an equal chance of ~~not~~ being chosen"

b) Is the original conditional statement true? Justify your answer.

(1 mark)

yes because

$7 \times 6 \times 5 \times 4 = 840$

0.5 mark:
❶ → 0.5 mark for including "if" and "then" in (a)

Exemplar 3

Question 26 **Total: 2 marks**

To form a group, 4 students are randomly chosen from 7 students. Jean writes the following conditional statement:

"If all 7 students have an equal chance of being chosen,
then there are 840 different groups that could be formed."

a) Write the contrapositive of the conditional statement.

(1 mark)

If there are 840 different groups that could be formed then all 7 students have an equal chance of being chosen

b) Is the original conditional statement true? Justify your answer.

(1 mark)

It is only true if each member of the group has a distinct role so the nP_r would be applicable.

1.5 marks:
❶ → 0.5 mark for including "if" and "then" in (a)
❸ → 1 mark for correct justification in (b)

Appendices

Appendix A:
Table of Questions by Unit and Learning Outcome

RELATIONS AND FUNCTIONS		
Question	**Learning Outcome**	**Mark**
1	12.A.R.1	1
2	12.A.R.3	1
3	12.A.R.1	3
4	12.A.R.2	4
5	12.A.R.3	4
6	12.A.R.1	4
		Total = 17
PROBABILITY		
Question	**Learning Outcome**	**Mark**
7	12.A.P.1	1
8	12.A.P.4	2
9	12.A.P.1, 12.A.P.2	2
10	12.A.P.2, 12.A.L.1	2
11	12.A.P.6	3
12	12.A.P.5	4
13	12.A.P.3, 12.A.P.5	4
		Total = 18
DESIGN AND MEASUREMENT		
Question	**Learning Outcome**	**Mark**
14	12.A.D.1	1
15	12.A.D.1	2
16 a)	12.A.D.1	2
16 b)	12.A.D.1	2
		Total = 7
FINANCIAL MATHEMATICS		
Question	**Learning Outcome**	**Mark**
16 c)	12.A.FM.1	2
17	12.A.FM.2	1
18	12.A.FM.3	6
19	12.A.FM.1	6
20	12.A.FM.2	3
21	12.A.FM.1	2
		Total = 20
LOGICAL REASONING		
Question	**Learning Outcome**	**Mark**
22	12.A.L.2	1
23	12.A.L.1	1
24	12.A.L.2	2
25	12.A.L.2, 12.A.L.3	2
26	12.A.L.3, 12.A.P.6	2
		Total = 8

Appendix B:
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 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: _____

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Question(s) affected: _____

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Action taken or rationale for assigning marks: _____

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Follow-up: _____

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Decision: _____

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Marker's Signature: _____

Principal's Signature: _____

For Department Use Only—After Marking Complete

Consultant: _____

Date: _____