Grade 12
Applied Mathematics
Achievement Test

Marking Guide

Use in conjunction with *Exemplars*

June 2025

Manitoba

Grade 12 Applied Mathematics Achievement Test:
Marking Guide (June 2025)

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This resource will be available on the Manitoba Education and Early Childhood Learning 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 and Early Childhood Learning for sample marking.

Once marking is completed, please forward the *Scoring Sheets* to Manitoba Education and Early Childhood Learning using the envelope provided. For more information, see the administration manual.

Marking

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 at least the nearest hundredth (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

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

$$\text{Communication Errors}$$

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

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 and Early Childhood Learning 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.

Youyi Sun
Assessment Consultant
Grade 12 Applied Mathematics
Telephone: 431-277-8337
Email: youyi.sun@gov.mb.ca

Marking Keys

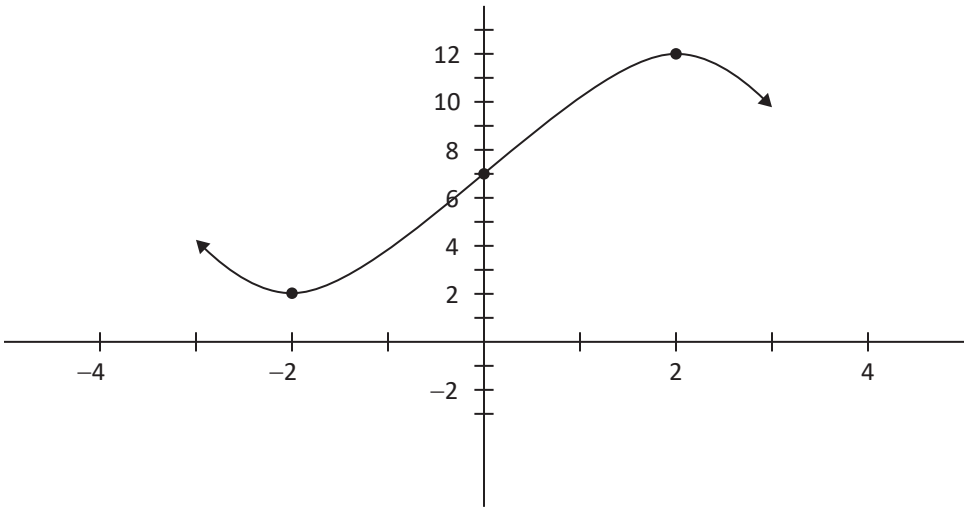
Please note that this *Marking Guide* contains
screen captures taken from a TI–84 Plus graphing calculator.

Relations and Functions

Question 1 — Total: 1 mark

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

Using the graph below, select the period of the sinusoidal function.



A) 4

B) 5

C) 8

D) 10

Marking Key

Correct answer: C

Question 2 — Total: 1 mark

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

Select the end behaviour of a quadratic function of the form $y = ax^2 + bx + c$ where $a > 0$.

The graph extends from:

A) quadrant I to quadrant III

B) quadrant II to quadrant I

C) quadrant II to quadrant IV

D) quadrant IV to quadrant III

Marking Key

Correct answer: B

Question 3 — Total: 3 marks

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

A rock is launched from the top of a cliff. It follows a parabolic path modelled by the following function:

$$H(t) = -3.85t^2 + 16.6t + 25$$

where $H(t)$ represents the height of the rock (in metres)
and t represents the time (in seconds).

a) Determine the maximum height reached by the rock. (*1 mark*)

CALC 4: maximum
$y = 42.89$

The rock reaches a maximum height of 42.89 m.

b) Determine the total amount of time the rock is in the air. (*1 mark*)

CALC 2: zero
$x = 5.49$

The rock is in the air for 5.49 s.

c) Determine at what time(s) the rock is 20 m above the ground. (*1 mark*)

$Y_2 = 20$
CALC 5: intersect
$x = 4.59$

The rock is 20 m above the ground at 4.59 s.

Marking Key

1. 0.5 mark for appropriate work in (a)
2. 0.5 mark for consistent answer in (a)
3. 0.5 mark for appropriate work in (b)
4. 0.5 mark for consistent answer in (b)
5. 0.5 mark for appropriate work in (c)
6. 0.5 mark for consistent answer in (c)

Question 4 — Total: 4.5 marks

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

The population of Bachstein is growing at a rate of approximately 4.5% per year. The population in 2016 was 15 829.

a) Determine the exponential regression equation that models the population growth, expressed to the nearest thousandth (three decimal places). You may use the table below. (*2 marks*)

Time (years since 2016)	Population
0	15 829
1	16 541
2	17 286
3	18 064

Regression equation: $y = 15\,829(1.045)^x$

b) Determine the population of Bachstein in 2026 using your equation in (a). (*1 mark*)

$x = 10$, $y = 24\,581.953$

The population in 2026 will be 24 581.

c) When the population reaches 30 000, Bachstein will build a new shopping mall. Determine in which year the population will reach 30 000. (*1.5 marks*)

$y = 30\,000$, $x = 14.525$

$2016 + 14.525 = 2030.525$

The population will reach 30 000 in the year 2030.

Marking Key

1. 1 mark for initial value in (a)
2. 1 mark for rate of growth in equation in (a)
3. 0.5 mark for appropriate work in (b)
4. 0.5 mark for consistent answer in (b)
5. 0.5 mark for appropriate work in (c)
6. 0.5 mark for consistent *x*-value in (c)
7. 0.5 mark for consistent year in (c)

Marker Notes:

→ If student used rounded values in the table in (a), accept consistent initial value.

→ Accept population of 24 582 in (b).

Question 5 — Total: 3 marks

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

The average monthly temperatures in Oslo, Norway were recorded every second month beginning in January (month 1 = January) as follows.

Time (months)	1	3	5	7	9	11
Temperature (°C)	0	5	17	23	16	4

a) State a possible sinusoidal regression equation that models the temperature as a function of time. (*1 mark*)

$$y = 11.52\sin\left(0.55x - 2.26\right) + 11.43$$

Other values for "c" are possible.

b) A tourist is planning to travel to Oslo and needs to know what type of clothing to pack. Determine the temperature they should expect in August. (*1 mark*)

$$x = 8$$
$$y = 20.90$$

The temperature they should expect in August is 20.90°C.

c) State the range of the situation using the regression curve from part (a). (*1 mark*)

Method A: [–0.10, 22.95] ***OR*** $\{-0.10 \le y \le 22.95\}$

OR

Method B: [–0.09, 22.95] ***OR*** $\{-0.09 \le y \le 22.95\}$

Marking Key

1. 0.5 mark for two values in (a)
2. 0.5 mark for remaining two values in (a)
3. 0.5 mark for appropriate work in (b)
4. 0.5 mark for consistent answer in (b)
5. 0.5 mark for consistent upper and lower bounds of the range in (c)
6. 0.5 mark for inclusivity of both upper and lower bounds in (c)

Marker Note:

→ If student used Desmos in degree mode, the value of *b* is 31.79 in (a).

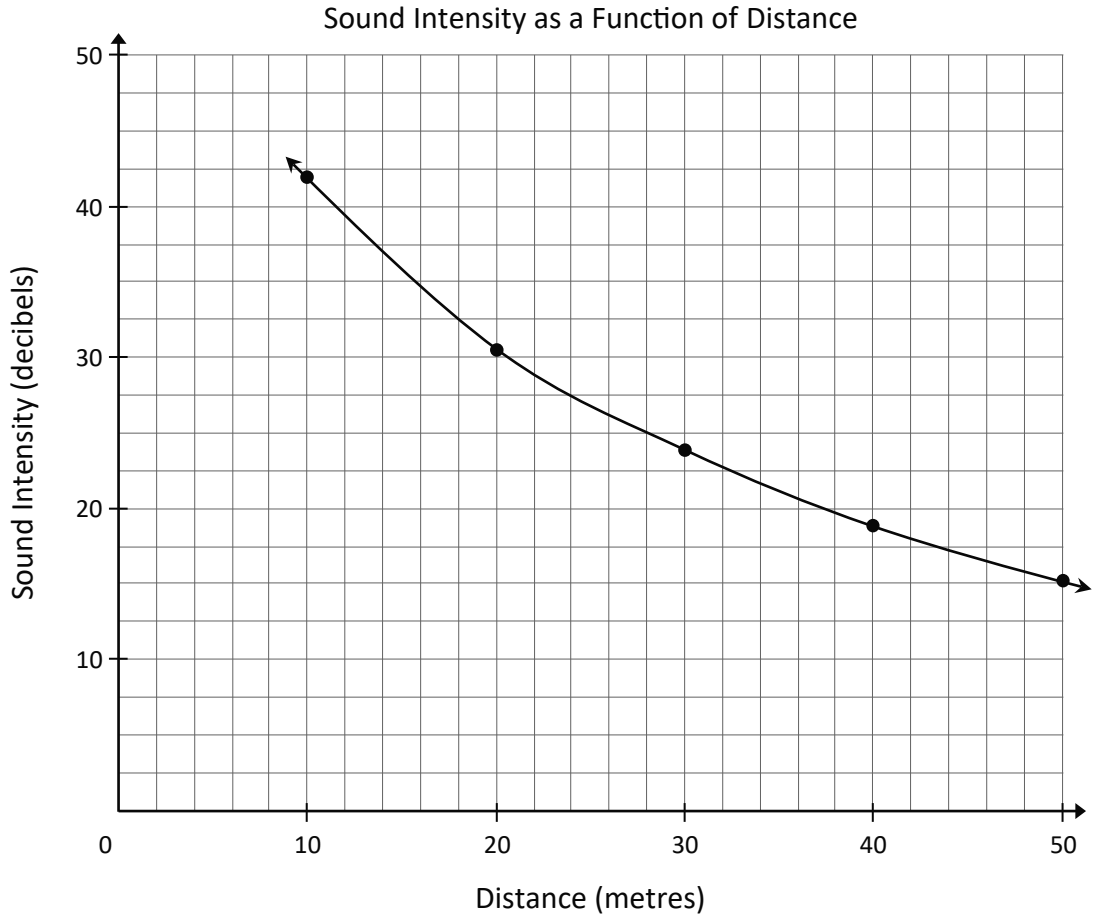
Question 6 — Total: 5 marks

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

The sound intensity decreases according to a logarithmic function as Peter moves away from an air conditioner.

Distance (metres)	10	20	30	40	50
Sound Intensity (decibels)	41.84	30.40	23.68	18.88	15.20

a) Create a clearly labelled graph by plotting the given data. Draw a curve of best fit. (*3 marks*)



b) State the logarithmic regression equation that models this situation. (*1 mark*)

$$y = 79.98 - 16.56\ln(x)$$

c) Determine Peter's distance from the air conditioner when the sound intensity is zero decibels. (*1 mark*)

CALC 2: zero

$x_1 = 125.24$

Peter will be 125.24 metres from the air conditioner.

Marking Key

1. 1 mark for communicating the context of the graph with appropriate title and/or labels in (a)
2. 0.5 mark for using an appropriate domain (i.e., window settings/grid range) for the context of the question in (a)
3. 0.5 mark for using an appropriate range (i.e., window settings/grid range) for the context of the question in (a)
4. 1 mark for plotting the data and appropriate logarithmic curve of best fit in (a)
5. 1 mark for answer in (b)
6. 0.5 mark for appropriate work in (c)
7. 0.5 mark for consistent distance in (c)

Marker Note:

→ Award mark 4 if arrowheads are not used in (a).

Probability

Question 7 — Total: 1 mark

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

The probability of rain during the picnic tomorrow is 35%.

Select the odds in favour of rain during the picnic tomorrow.

A) 7 : 20

B) 13 : 20

C) 7 : 13

D) 13 : 7

Marking Key

Correct answer: C

Question 8 — Total: 1 mark

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

Select the answer that best shows mutually exclusive events.

A) The set of positive integers from 1 to 8 and the set of even numbers from 1 to 12.

B) Rolling a 6 and an even number on a regular six-sided die.

C) The set of prime numbers from 1 to 10 and the set of multiples of 2 from 1 to 10.

D) Rolling a 5 and an even number on a regular six-sided die.

Marking Key

Correct answer: D

Question 9 — Total: 4 marks

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

A parking lot has 3 different blue cars and 4 different white cars.

a) State the number of ways the cars can be parked in a row. (*1 mark*)

$${}_7P_7 = 5040 \quad \textbf{\textit{OR}} \quad 7! = 5040$$

There are 5040 ways.

b) Determine the number of ways the 7 cars can be parked if the 3 blue cars must be parked beside each other. (*2 marks*)

$${}_5P_5 \times {}_3P_3 = 720 \quad \textbf{\textit{OR}} \quad 5! \times 3! = 720$$

There are 720 ways.

c) State the probability that the 3 blue cars are parked beside each other. (*1 mark*)

$$\frac{720}{5040} = 0.142\,85\ldots$$

The probability is $\frac{720}{5040}$, 0.14, or 14.29%.

Marking Key

1. 1 mark for total number of ways in (a)
2. 0.5 mark for ${}_5P_5$ or 5! in (b)
3. 0.5 mark for ${}_3P_3$ or 3! in (b)
4. 1 mark for consistent product in (b)
5. 1 mark for consistent answer in (c)

Marker Note:

→ Award a maximum of 3 marks if combinations are consistently used instead of permutations.

Question 10 — Total: 2 marks

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

The probability of an event occurring can be shown on the line below.

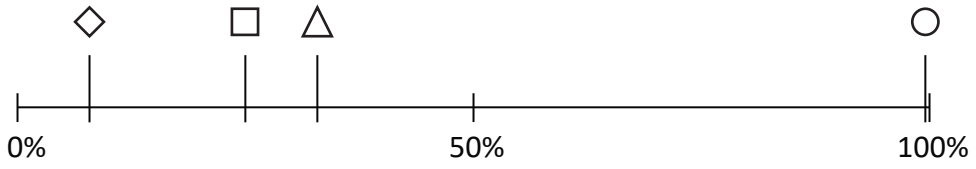
Draw the following symbols on the line.

◯: The probability that it will snow in Manitoba in the winter.

□: The probability of flipping two coins that both land on heads.

△: The probability of rolling a number greater than 4 on a regular six-sided die.

◇: The probability that a randomly-selected student has a birthday in June.



Marking Key

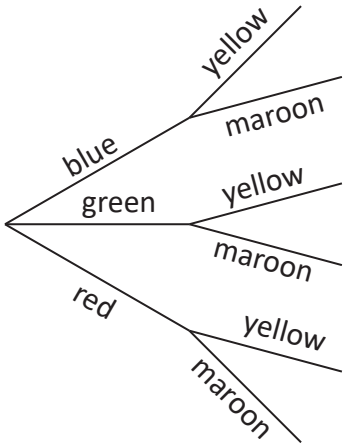
1. 0.5 mark for appropriate location of ◯
2. 0.5 mark for appropriate location of □
3. 0.5 mark for appropriate location of △
4. 0.5 mark for appropriate location of ◇

Question 11 — Total: 2 marks

Learning Outcomes: 12.A.P.1, 12.A.P.4 — **Question Type: Constructed Response**

Milo has 3 pairs of pants (blue, green, and red) and 2 sweaters (yellow and maroon) that are clean to wear for the dance on Friday.

a) Use a graphic organizer to show all possible outcomes for this situation. (*1 mark*)



OR

Possible outcomes:

- blue, yellow
- blue, maroon
- green, yellow
- green, maroon
- red, yellow
- red, maroon

Other graphic organizers are possible.

b) State the odds against Milo wearing the red pants and the maroon sweater. (*1 mark*)

5 : 1

Marking Key

1. 1 mark for appropriate graphic organizer in (a)
2. 1 mark for consistent odds against in (b)

Question 12 — Total: 3 marks

Learning Outcomes: 12.A.P.1, 12.A.P.3, 12.A.P.6 — **Question Type: Constructed Response**

A student council must consist of 7 members. There are 12 students and 5 teachers that volunteer. The student council must include 2 or 3 teachers.

a) Determine the number of ways that the student council can be formed. (*2 marks*)

Case 1: 3 teachers: $\left({}_{12}C_4 \times {}_5C_3\right) = 4950$

Case 2: 2 teachers: $\left({}_{12}C_5 \times {}_5C_2\right) = 7920$

$4950 + 7920 = 12\ 870$

There are 12 870 ways.

b) Determine the probability that the student council has exactly three teachers. (*1 mark*)

$$\frac{4950}{12\ 870}$$

The probability is $\frac{4950}{12\ 870}$, 0.38, or 38.46%.

Marking Key

1. 0.5 mark for ${}_{12}C_4 \times {}_5C_3$ in (a)
2. 0.5 mark for ${}_{12}C_5 \times {}_5C_2$ in (a)
3. 1 mark for consistent sum in (a)
4. 0.5 mark for consistent numerator in (b)
5. 0.5 mark for consistent denominator in (b)

Marker Note:

→ Award a maximum of 2 marks if permutations are consistently used instead of combinations.

Question 13 — Total: 1 mark

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

There are five pairs of socks: red, purple, blue, green, and yellow.

Determine the number of ways the 10 socks can be arranged.

$$\frac{10!}{2!2!2!2!2!} = 113\,400$$

There are 113 400 ways.

Marking Key

1. 0.5 mark for 2!2!2!2!2! in the denominator
2. 0.5 mark for consistent quotient

Question 14 — Total: 2 marks

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

Your school is drawing tickets for three prizes. There are 100 tickets sold.

You have purchased 5 tickets. Determine the probability that you win all three prizes if the tickets are not replaced.

$$\left(\frac{5}{100}\right)\left(\frac{4}{99}\right)\left(\frac{3}{98}\right)=\frac{60}{970\,200}$$

The probability is $\frac{60}{970\,200}$, 0.000 061 8…, 0.006 18%, or 0.01%.

Marking Key

1. 0.5 mark for considering dependency in the numerator
2. 0.5 mark for considering dependency in the denominator
3. 1 mark for consistent product

Financial Mathematics

Question 15 — Total: 1 mark

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

The table below shows the value of a savings account earning simple interest.

Year	Value
0	$6500.00
1	$6633.25
3	$6899.75

Select the annual simple interest rate earned by this account.

A) 1.54%

B) 2.00%

C) 2.01%

D) 2.05%

Marking Key

Correct answer: D

Question 16 — Total: 1 mark

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

Nadia invests $10 000.00 in stocks.

Using the Rule of 72, select the estimated interest rate that would double their investment in 24 years.

A) 3%

B) 6%

C) 9%

D) 12%

Marking Key

Correct answer: A

Question 17 — Total: 7 marks

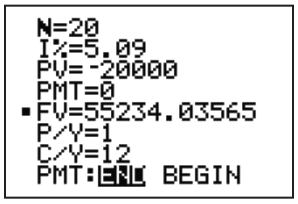
Learning Outcomes: 12.A.FM.1, 12.A.FM.3 — **Question Type: Constructed Response**

Tess has $20 000.00 saved and is considering investing her money for a time period of 20 years. She has the following two options:

Option 1: She invests the entire sum of $20 000.00 in an account that earns 5.09%, compounded monthly.

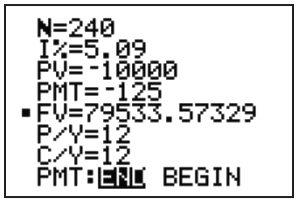
Option 2: She spends half the money on a trip to Costa Rica. She invests the remaining $10 000.00 and deposits an additional $125.00 per month into an account that earns 5.09%, compounded monthly.

a) Determine the value of Tess's investment after 20 years if she chooses Option 1. (*2 marks*)



The future value of Tess's investment is $55 234.04 with Option 1.

b) Determine the value of Tess's investment after 20 years if she chooses Option 2. (*2 marks*)



The future value of Tess's investment is $79 533.57 with Option 2.

c) Calculate Tess's rate of return if she chooses Option 1. (*1 mark*)

$$\text{Rate of return} = \frac{\left(\$55\ 234.04 - \$20\ 000.00\right)}{\$20\ 000.00} \times 100$$

$$= 176.17\%$$

Tess's rate of return is 176.17% with Option 1.

d) Calculate Tess's rate of return if she chooses Option 2. (*1.5 marks*)

$$P = \$10\ 000.00 + 240\left(\$125.00\right)$$

$$= \$40\ 000.00$$

$$\text{Rate of return} = \frac{\left(\$79\ 533.57 - \$40\ 000.00\right)}{\$40\ 000.00} \times 100$$

$$= 98.83\%$$

Tess's rate of return is 98.83% with Option 2.

e) Justify which option Tess should choose. (*0.5 mark*)

Tess should choose Option 1 since it has a greater rate of return.

OR

Tess should choose Option 2 since it has a greater future value.

Other justifications are possible.

Marking Key

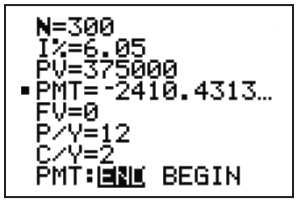
1. 1 mark for appropriate work in (a)
2. 1 mark for consistent answer in (a)
3. 1 mark for appropriate work in (b)
4. 1 mark for consistent answer in (b)
5. 1 mark for consistent rate of return in (c)
6. 0.5 mark for amount of principal in (d)
7. 1 mark for consistent rate of return in (d)
8. 0.5 mark for justification in (e)

Question 18 — Total: 4 marks

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

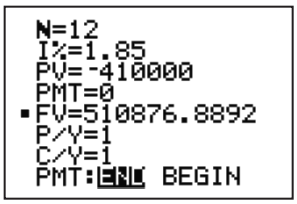
Xavier and Pierce buy a house valued at $410 000.00 and have $35 000.00 saved for a down payment. The bank offers a mortgage at an interest rate of 6.05%, compounded semi-annually with an amortization period of 25 years.

a) Determine their monthly mortgage payment. (*2 marks*)



Their monthly mortgage payment is $2410.43.

b) Determine the value of their house after 12 years if the house appreciates in value by 1.85% annually. (*2 marks*)



OR

$$A = \$410\,000.00(1.018\,5)^{12}$$

$$= \$510\,876.889\,2$$

The value of their house after 12 years will be $510 876.89.

Marking Key

1. 1 mark for appropriate work in (a)
2. 1 mark for consistent answer in (a)
3. 1 mark for appropriate work in (b)
4. 1 mark for consistent answer in (b)

Question 19 — Total: 3 marks

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

Lori is a farmer in Rivers, Manitoba and is buying a new tractor. Lori is applying for a bank loan and has the following financial situation:

- Her farm (land and equipment) is valued at $820 000.00.
- She owes $45 000.00 on the equipment.
- Her house is valued at $535 000.00 with a mortgage of $454 000.00.
- She has $12 000.00 in a savings account.
- She owes a total of $85 000.00 on a line of credit.

a) Calculate her net worth. (*1 mark*)

Assets:	Liabilities:	Net worth:
$820 000.00	$45 000.00	
$535 000.00	$454 000.00	$1 367 000.00
+ $12 000.00	+ $85 000.00	− $584 000.00
$1 367 000.00	$584 000.00	$783 000.00

Her net worth is $783 000.00.

b) Calculate her debt-to-equity ratio. (*1 mark*)

$$\text{Debt-to-equity ratio (\%)} = \frac{(\text{Total liabilities} - \text{Mortgage})}{\text{Net worth}} \times 100$$

$$= \frac{(\$584\,000.00 - \$454\,000.00)}{\$783\,000.00} \times 100$$

$$= 16.602\,8\ldots$$

Her debt-to-equity ratio is 16.60%.

c) Explain if the bank would lend her money based on her debt-to-equity ratio. (*1 mark*)

Yes, the bank would lend her money because her debt-to-equity ratio is below 50%.

Marking Key

1. 0.5 mark for assets and liabilities in (a)
2. 0.5 mark for consistent net worth in (a)
3. 0.5 mark for consistent total liabilities − mortgage in (b)
4. 0.5 mark for consistent debt-to-equity ratio in (b)
5. 1 mark for explanation with reference to 50% in (c)

Question 20 — Total: 1 mark

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

Sylke buys an electric bike to commute to university in the fall.

- The bike costs $3358.88, taxes included.
- She uses store financing which includes regular payments with the option to pay the bike off sooner.
- The bike is financed at a rate of 19.9%, compounded daily.

Explain a strategy Sylke could use to pay the least amount of interest possible on this bike.

- make a down payment
- increase payment frequency
- make additional payments
- make larger payments over a shorter time period

Other explanations are possible.

Marking Key

1 1 mark for appropriate strategy

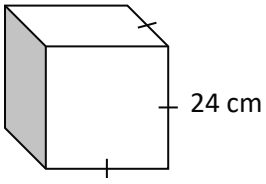
Design and Measurement

Question 21 — Total: 1 mark

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

Daniel is wrapping a present.

- The wrapping paper costs \$0.000 3/cm^2.
- The present is a cube with a side length of 24 cm.



Select the cost of wrapping the present.

A) \$0.86

B) \$1.04

C) \$4.15

D) \$10.37

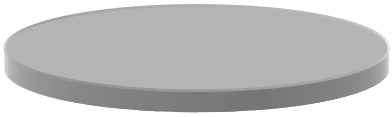
Marking Key

Correct answer: B

Question 22 — Total: 1 mark

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

The volume of a pizza crust is 30 in^3.



Select the equation that could be used to find the height of the crust.

A) $h = 30 - r$

B) $h = 30\pi r^2$

C) $h = \dfrac{30}{\pi r^2}$

D) $h = \dfrac{30 - 2\pi r^2}{2\pi r}$

Marking Key

Correct answer: C

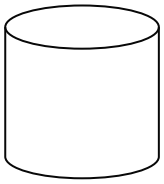
Question 23 — Total: 3.5 marks

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

Taylor has two fish tanks for goldfish.

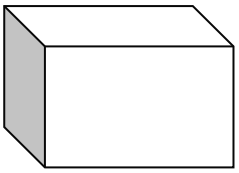
Tank 1

- The height is 45 cm.
- The diameter is 40 cm.



Tank 2

- The length is 40 cm.
- The width is 32 cm.
- The height is 42 cm.



a) Determine the volume of Tank 1. (*1 mark*)

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

$$= \pi (20)^2 (45)$$

$$= 56\,548.67 \text{ cm}^3$$

The volume is 56 548.67 cm^3.

b) State the volume of Tank 2. (*1 mark*)

$$V = lwh$$

$$= (40)(32)(42)$$

$$= 53\,760 \text{ cm}^3$$

The volume is 53 760 cm^3.

c) Calculate the number of goldfish Taylor can put into each tank if each goldfish requires 15 000 cm^3 of fresh water. (*1.5 marks*)

Tank 1

$$\frac{56\,548.67}{15\,000} = 3.77$$

$$= 3 \text{ goldfish}$$

Tank 2

$$\frac{53\,760}{15\,000} = 3.58$$

$$= 3 \text{ goldfish}$$

Taylor can put 3 goldfish into each tank.

Marking Key

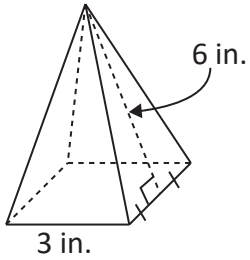
1. 0.5 mark for appropriate work in (a)
2. 0.5 mark for consistent answer in (a)
3. 1 mark for volume in (b)
4. 0.5 mark for appropriate work in (c)
5. 0.5 mark for consistent number of goldfish for Tank 1 in (c)
6. 0.5 mark for consistent number of goldfish for Tank 2 in (c)

Question 24 — Total: 4 marks

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

A school needs 75 trophies for their awards night.

Each trophy is in the shape of a square-based pyramid and is covered in gold foil.



a) Determine the amount of gold foil needed to cover one trophy including the bottom. (*1 mark*)

$$\begin{aligned}\text{Surface area} &= b^2 + 2bs \\ &= (3)^2 + 2(3)(6) \\ &= 9 + 36 \\ &= 45 \text{ in}^2\end{aligned}$$

The amount of gold foil needed to cover one trophy is 45 in^2.

b) Gold foil is sold by the roll. The roll measures 12.5 inches by 10 feet. Calculate the number of rolls needed to cover the 75 trophies. (*2 marks*)

$$\text{Area of one roll} = 12.5 \text{ in.} \times 10 \text{ ft.} \times \frac{12 \text{ in.}}{1 \text{ ft.}}$$

$$= 1500 \text{ in}^2$$

$$\text{Area of 75 trophies: } 45 \times 75 = 3375 \text{ in}^2$$

$$\frac{3375}{1500} = 2.25 \text{ rolls}$$

There are 3 rolls needed to cover the 75 trophies.

OR

$$\text{Area of one roll} = 12.5 \text{ in.} \times 10 \text{ ft.} \times \frac{12 \text{ in.}}{1 \text{ ft.}}$$

$$= 1500 \text{ in}^2$$

$$\frac{1500}{45} = 33.33\ldots$$

One roll covers 33 trophies.

$$\frac{75}{33} = 2.27$$

There are 3 rolls needed to cover the 75 trophies.

c) Each roll costs $15.25, taxes included. Calculate the cost per trophy. (*1 mark*)

$$\$15.25 \times 3 = \$45.75$$

$$\frac{\$45.75}{75} = \$0.61 \text{ per trophy}$$

The cost per trophy is $0.61 including the excess.

OR

$$\frac{1500}{45} = \frac{\$15.25}{x}$$

$$x = \$0.457\,5$$

The cost per trophy is $0.46 not including the excess.

Marking Key

1. 0.5 mark for appropriate work in (a)
2. 0.5 mark for consistent area in (a)
3. 0.5 mark for appropriate work calculating area of one roll in (b)
4. 0.5 mark for consistent area of all trophies in (b)
5. 1 mark for consistent number of rolls in (b)
6. 0.5 mark for appropriate work in (c)
7. 0.5 mark for consistent cost per trophy in (c)

Logical Reasoning

Question 25 — Total: 2 marks

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

Consider the following conditional statement:

"If I'm in Sagkeeng First Nation, then I'm in Manitoba."

a) State the converse of the statement. (*1 mark*)

"If I'm in Manitoba, then I'm in Sagkeeng First Nation."

b) State the contrapositive of the statement. (*1 mark*)

"If I'm not in Manitoba, then I'm not in Sagkeeng First Nation."

Marking Key

1. 1 mark for converse of the statement in (a)
2. 1 mark for contrapositive of the statement in (b)

Marker Note:

→ Award a maximum of 0.5 mark if "if" or "then" is missing.

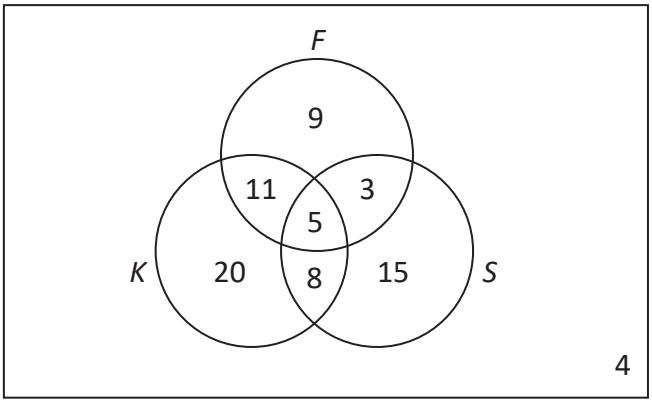
Question 26 — Total: 4 marks

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

The 75 students attending a school camping trip were asked which of the following three activities they enjoy.

- 28 students enjoy fishing (*F*)
- 44 students enjoy kayaking (*K*)
- 31 students enjoy swimming (*S*)
- 16 students enjoy fishing and kayaking
- 13 students enjoy kayaking and swimming
- 3 students enjoy fishing and swimming but not kayaking
- 5 students enjoy all three activities

a) Create a Venn diagram to represent this situation. (*3 marks*)



b) State how many students only enjoy fishing. (*1 mark*)

There are 9 students who only enjoy fishing.

Marking Key

1. 0.5 mark for $n\left(\left(K \cap F\right) \setminus S\right) = 11$ in (a)
2. 0.5 mark for $n\left(\left(K \cap S\right) \setminus F\right) = 8$ in (a)
3. 1 mark for consistent number of students who enjoy only one activity in (a)
4. 1 mark for consistent number of students who do not enjoy any of the three activities in (a)
5. 1 mark for consistent answer in (b)

Question 27 — Total: 2 marks

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

Complete the four equations below using the numbers 1, 3, 5, 7.

For each equation:

- use all four numbers once
- you may use any combination of the following operators $\times$, $\div$, $+$, $-$, ( ). Operators may be used more than once.

Example: $(7 + 5) \div 3 + 1 = 5$

i) $(3 + 7) \div 5 - 1 = 1$

ii) $7 + 3 - (5 + 1) = 4$

iii) $7 \times (5 - 3 - 1) = 7$

iv) $3 \times 7 - 5 - 1 = 15$

Other answers are possible.

Marking Key

1. 0.5 mark for equation i
2. 0.5 mark for equation ii
3. 0.5 mark for equation iii
4. 0.5 mark for equation iv

Appendices

Appendix A:
Table of Questions by Unit and Learning Outcome

Relations and Functions		
Question	**Learning Outcome(s)**	**Mark(s)**
1	12.A.R.3	1
2	12.A.R.1	1
3 a)	12.A.R.1	1
3 b)	12.A.R.1	1
3 c)	12.A.R.1	1
4 a)	12.A.R.2	2
4 b)	12.A.R.2	1
4 c)	12.A.R.2	1.5
5 a)	12.A.R.3	1
5 b)	12.A.R.3	1
5 c)	12.A.R.3	1
6 a)	12.A.R.2	3
6 b)	12.A.R.2	1
6 c)	12.A.R.2	1
		Total: 17.5
Probability		
Question	**Learning Outcome(s)**	**Mark(s)**
7	12.A.P.1	1
8	12.A.P.2	1
9 a)	12.A.P.3, 12.A.P.5	1
9 b)	12.A.P.3, 12.A.P.5	2
9 c)	12.A.P.3, 12.A.P.5	1
10	12.A.P.3	2
11 a)	12.A.P.1, 12.A.P.4	1
11 b)	12.A.P.1, 12.A.P.4	1
12 a)	12.A.P.1, 12.A.P.3, 12.A.P.6	2
12 b)	12.A.P.1, 12.A.P.3, 12.A.P.6	1
13	12.A.P.4	1
14	12.A.P.2, 12.A.P.3	2
		Total: 16

Financial Mathematics		
Question	**Learning Outcome(s)**	**Mark(s)**
15	12.A.FM.1	1
16	12.A.FM.2	1
17 a)	12.A.FM.1, 12.A.FM.3	2
17 b)	12.A.FM.1, 12.A.FM.3	2
17 c)	12.A.FM.1, 12.A.FM.3	1
17 d)	12.A.FM.1, 12.A.FM.3	1.5
17 e)	12.A.FM.1, 12.A.FM.3	0.5
18 a)	12.A.FM.1, 12.A.FM.2	2
18 b)	12.A.FM.1, 12.A.FM.2	2
19 a)	12.A.FM.3	1
19 b)	12.A.FM.3	1
19 c)	12.A.FM.3	1
20	12.A.FM.1	1
		Total: 17
Design and Measurement		
Question	**Learning Outcome(s)**	**Mark(s)**
21	12.A.D.1	1
22	12.A.D.1	1
23 a)	12.A.D.1	1
23 b)	12.A.D.1	1
23 c)	12.A.D.1	1.5
24 a)	12.A.D.1	1
24 b)	12.A.D.1	2
24 c)	12.A.D.1	1
		Total: 9.5
Logical Reasoning		
Question	**Learning Outcome(s)**	**Mark(s)**
25 a)	12.A.L.3	1
25 b)	12.A.L.3	1
26 a)	12.A.L.2	3
26 b)	12.A.L.2	1
27	12.A.L.1	2
		Total: 8

Total Marks for Test: 68

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 number: _____

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: _____