Grade 12
Applied Mathematics
Achievement Test

Exemplars

Use in conjunction with *Marking Guide*

June 2025

Manitoba

Grade 12 Applied Mathematics Achievement Test:
Exemplars (June 2025)

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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.

Preamble

This document is one of a series of two documents.

- ***Grade 12 Applied Mathematics Achievement Test: Exemplars***
- *Grade 12 Applied Mathematics Achievement Test: Marking Guide*

The exemplars contained in this document are intended to improve marking accuracy and consistency. The marking exemplars include marks assigned by the test development committee, together with rationales for the marks. Conversely, the training exemplars do not include marks and can be used for practice purposes. Markers may use these exemplars to practice marking on their own. They can then compare their work with the answers provided in the *Training Exemplar Answers* section at the end of this document.

Marking Exemplar 1

Question 3 — Total: 3 marks

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*)

[max] $x = 2.16$ sec
$y =$ 42.89 m

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

[zero]
$x =$ 5.29 seconds
$y = 0$

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

[intersect]
$x_1 = -0.28$ $x_2 =$ 4.59
$y_1 = 20$ $y_2 = 20$ E5

Mark(s): 2.5/3

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)
5. 0.5 mark for appropriate work in (c)
6. 0.5 mark for consistent answer in (c)

E5 does not include the units in the final answer in (c)

Marking Exemplar 2

Question 3 — Total: 3 marks

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*)

42.89 meters

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

5.49 seconds

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

4.59 seconds

Mark(s): 1.5/3

2 0.5 mark for consistent answer in (a)
4 0.5 mark for consistent answer in (b)
6 0.5 mark for consistent answer in (c)

Training Exemplar 1

Question 3 **Total: 3 marks**

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

height ↑ Time

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

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*)

[y=]
$-3.85x^2+16.6x+25$
[maximum]
Left Bound
Right Bound
$x = 2.16s$
$y = 42.89m$

42.89m is the maximum height.

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

[zero] $y_1 = 0$
$x_1 = -1.18s$

[zero] $y_2 = 0$
$x_2 = 5.49s$

$1.18 + 5.49 =$ 6.67 seconds in the air

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

$x = -0.28s$
$y = 20$
[Intersect]
$x = 4.59s$
$y = 20$

Training Exemplar 2

Question 3 — Total: 3 marks

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*)

Stat Calc 4

(2.13, 42.9)

43 meters high

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

5.32 seconds

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

0.85 seconds

Marking Exemplar 1

Question 4 — Total: 4.5 marks

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
1	16 541
10	24 581
15	30 633
20	38 175

E2

Regression equation: $y = a(b)^x$ $a = 15829$ and $b = 1{,}045$

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

$15829 \times 1{,}045^{10} \approx 24528$ (1)

PE

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*)

$y > 30000 \Rightarrow x = 14{,}526$

So, in 15 years the population will reach 30 000

Mark(s): 3.5/4.5

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)

PE 0.5 mark deduction for procedural error in (b)

E2 does not include one of the following in the equation: "*y* =", "sin", "ln", or "*x*", or writes parameters separately from the equation in (a)

Marking Exemplar 2

Question 4 — Total: 4.5 marks

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
1	16541
2	17295
3	19063
4	19870

E2 E6

Regression equation: [exp reg] $15\,829.56(1.05)^x$

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

10 years

$15\,829.56(1.05)^{10}$

$= 25783.06$

population will be 25783

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*)

$y = 30\,000$ [intersect] $x = 1453$ $y = 30\,000$

E6

2016 + 15 = 2031

2031

Mark(s): 4.5/4.5

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)

E2 does not include one of the following in the equation: "*y* =", "sin", "ln", or "*x*", or writes parameters separately from the equation in (a)

E6 does not express the answer to the appropriate number of decimal places in (a)

E6 rounds incorrectly in (c)

Training Exemplar 1

Question 4 — Total: 4.5 marks

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

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

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*)

x y

Time (years since 2016)	Population
1	71231
2	320537
3	1.44E6
4	6.49E6

2nd → Table

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

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

2026 − 2016 = 10 years

2nd → Calc → 1: value

$x = 10$ $y = 5.39\text{E}10$ people

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*)

Training Exemplar 2

Question 4 — Total: 4.5 marks

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
1	16541
2	17286
3	18064
4	18876

Regression equation: $15829 \cdot 1.045^x$

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

$15829 \cdot 1.045^{10}$

[VALUE] $x = 10$

$y = 24582$ people

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*)

$y_2 = 30000$

[INTERSECT]

$x = 14.53$ years

$2016 + 15 = 2031$

by the year 2031 they build a new mall

Marking Exemplar 1

Question 5 **Total: 3 marks**

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*)

$y = a\sin(b(x-c))+d$

$y = 11.52\sin(0.55(x-4.08))+11.43$

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*)

8

$x = 8$ month $y = 20$°c

↑ E6

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

Range $\{y \mid 0 \le y \le 23, y \in R\}$

↑ E6

Mark(s): 3/3

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)

(E6) rounds incorrectly in (b) and (c)

Marking Exemplar 2

Question 5 — Total: 3 marks

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*)

$y = -0.72x^2 + 9.47x + (-11.71)$

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*)

$18.029^{\circ}C$

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

$\{y \mid y < 19.97 \quad y \in R\}$

Mark(s): 0.5/3

❹ 0.5 mark for consistent answer in (b)

Training Exemplar 1

Question 5 — Total: 3 marks

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*)

$11.5243 \cdot \sin(.5548861 - 2.26222) + 11.4292$

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*)

Temp will be 10 °C?

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

$y \leq -.095$

Training Exemplar 2

Question 5 — Total: 3 marks

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*)

$y = 11.5243 \sin(0.55x - 2.26) + 11.43$

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*)

the tempature in august will be 20.9°C at the start, and 16.6°C at the end

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

$R: \{y \mid -0.095 \leq y \leq 22.954, y \in R\}$

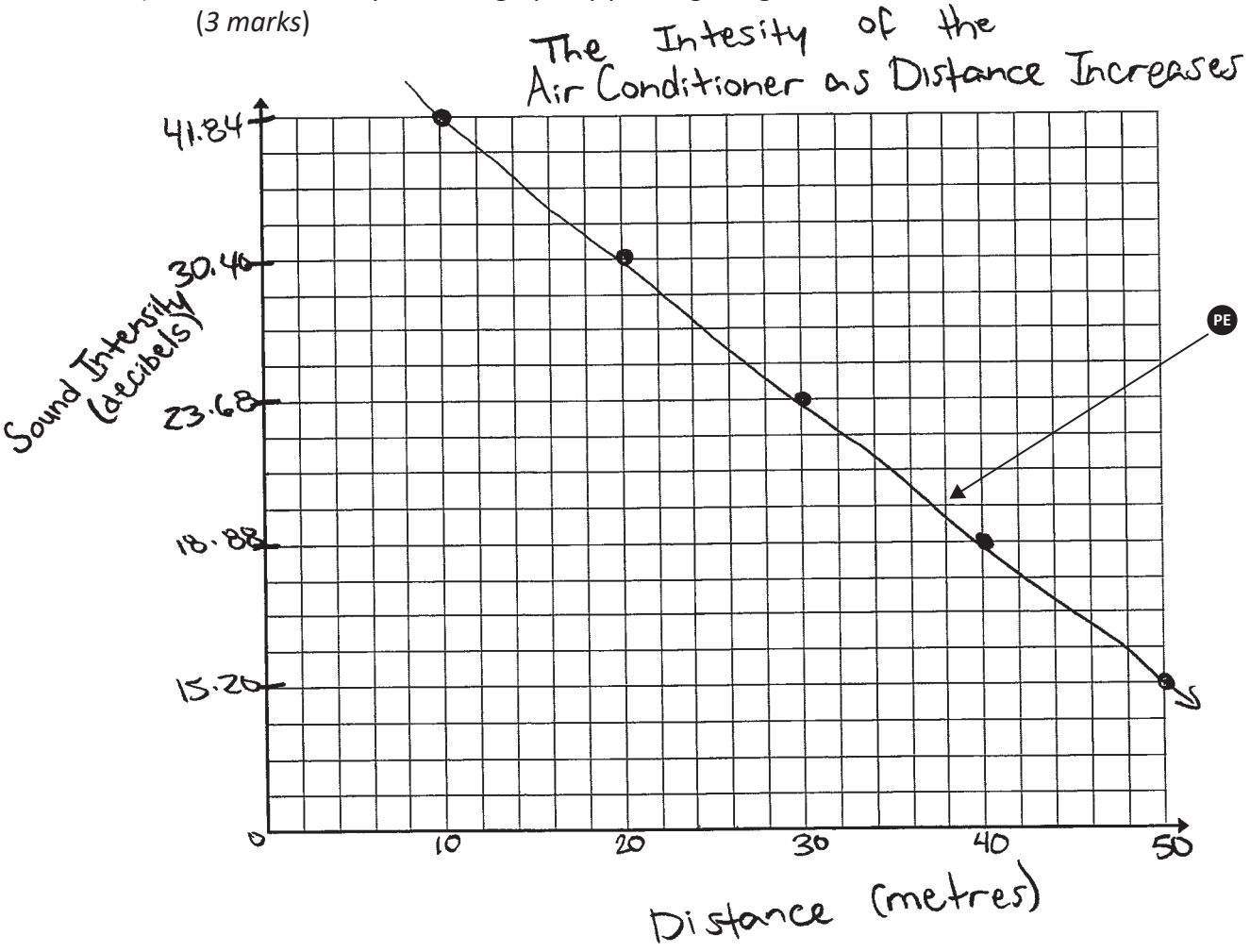
Marking Exemplar 1

Question 6 — Total: 5 marks

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*)



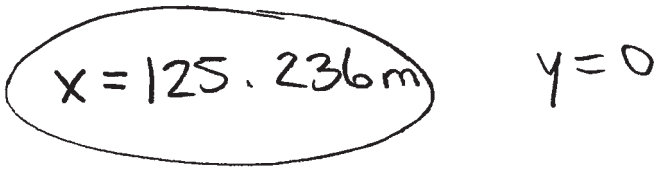
b) State the logarithmic regression equation that models this situation. (*1 mark*)

$y = a + b\ln(x)$

E2 → $a = 79.985$

$b = -16.559$

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



Mark(s): 4/5

- 1 mark for communicating the context of the graph with appropriate title and/or labels in (a)
- 0.5 mark for using an appropriate domain (i.e., window settings/grid range) for the context of the question in (a)
- 1 mark for plotting the data and appropriate logarithmic curve of best fit in (a)
- 1 mark for answer in (b)
- 0.5 mark for appropriate work in (c)
- 0.5 mark for consistent distance in (c)
- PE 0.5 mark deduction for procedural error in (a)
- E2 does not include one of the following in the equation: "$y =$", "sin", "ln", or "x", or writes parameters separately from the equation in (b)

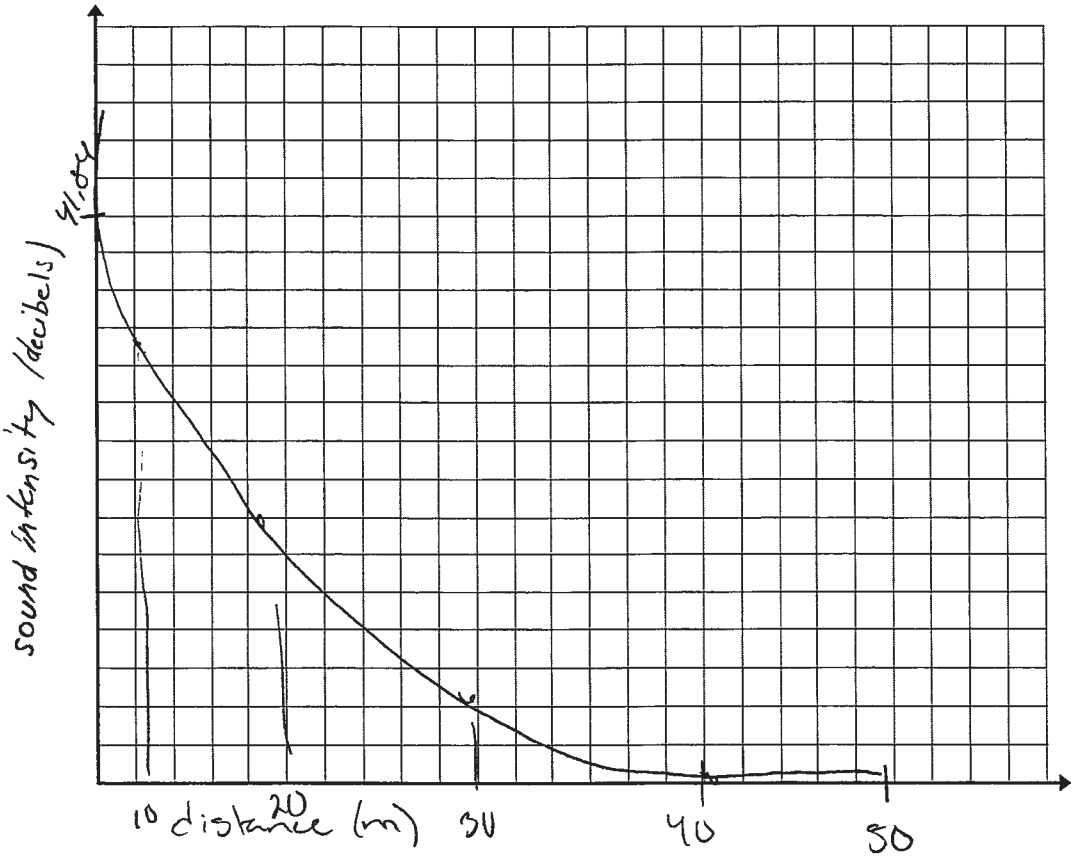
Marking Exemplar 2

Question 6 — Total: 5 marks

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*)

$y=0$

when $y=0$ x must be $= 118\,m$

Mark(s): 2.5/5

1. 1 mark for communicating the context of the graph with appropriate title and/or labels in (a)
5. 1 mark for answer in (b)
6. 0.5 mark for appropriate work in (c)

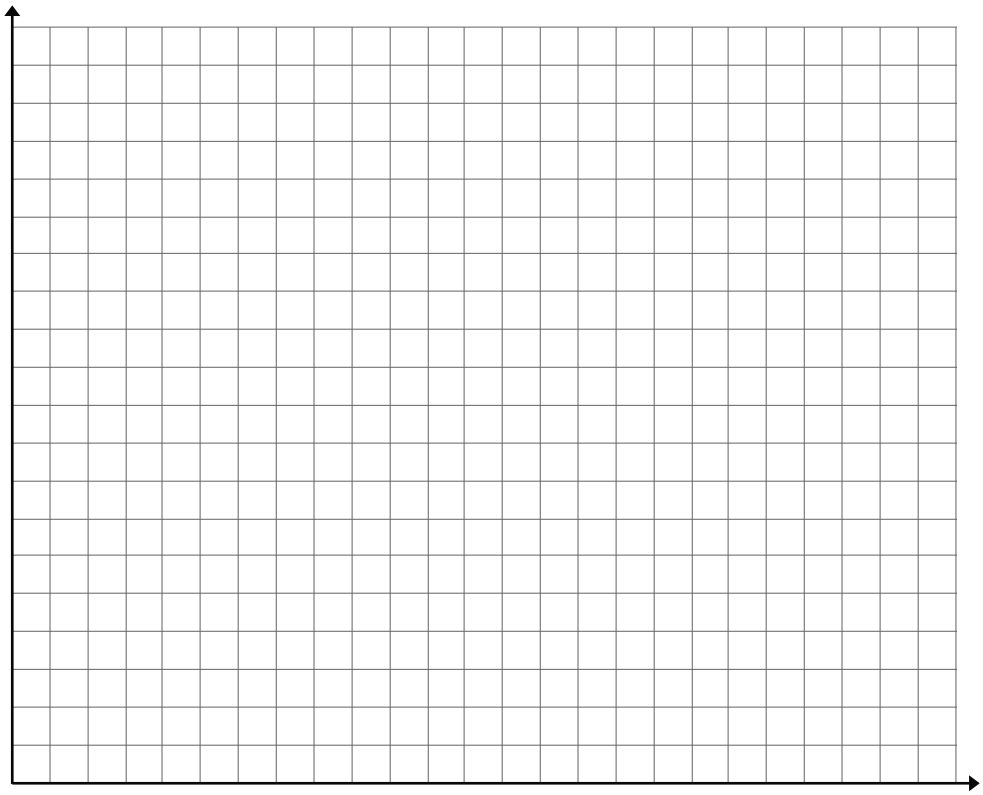
Training Exemplar 1

Question 6 — Total: 5 marks

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*)

$= 79.9645$

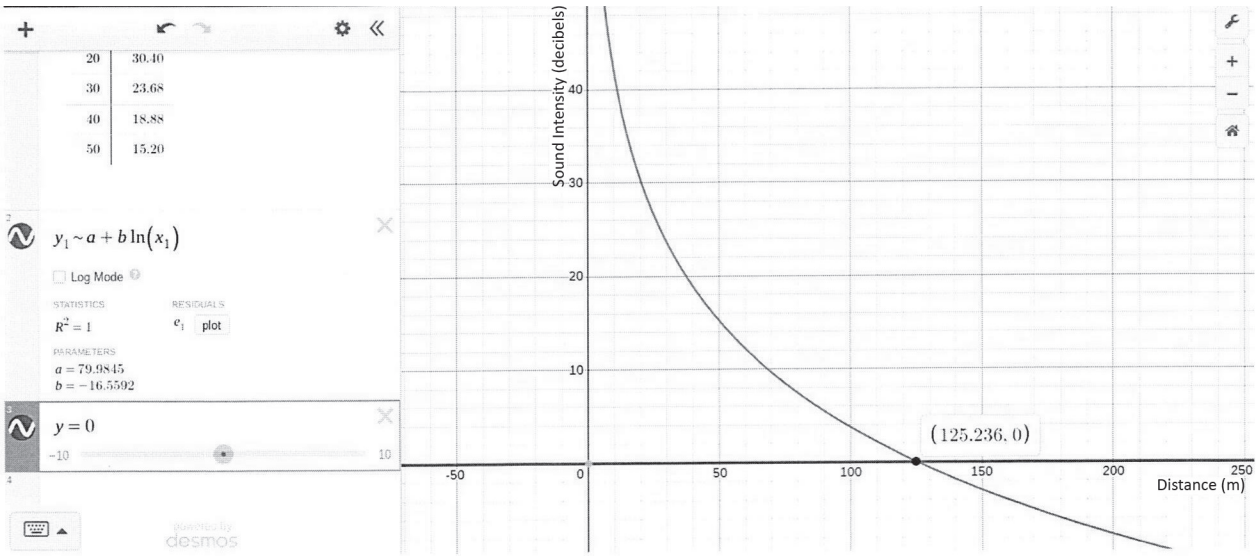
$= -16.5592$

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

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

y=0 (125.236, 0) Peter will be 125.24 m away.

x=2



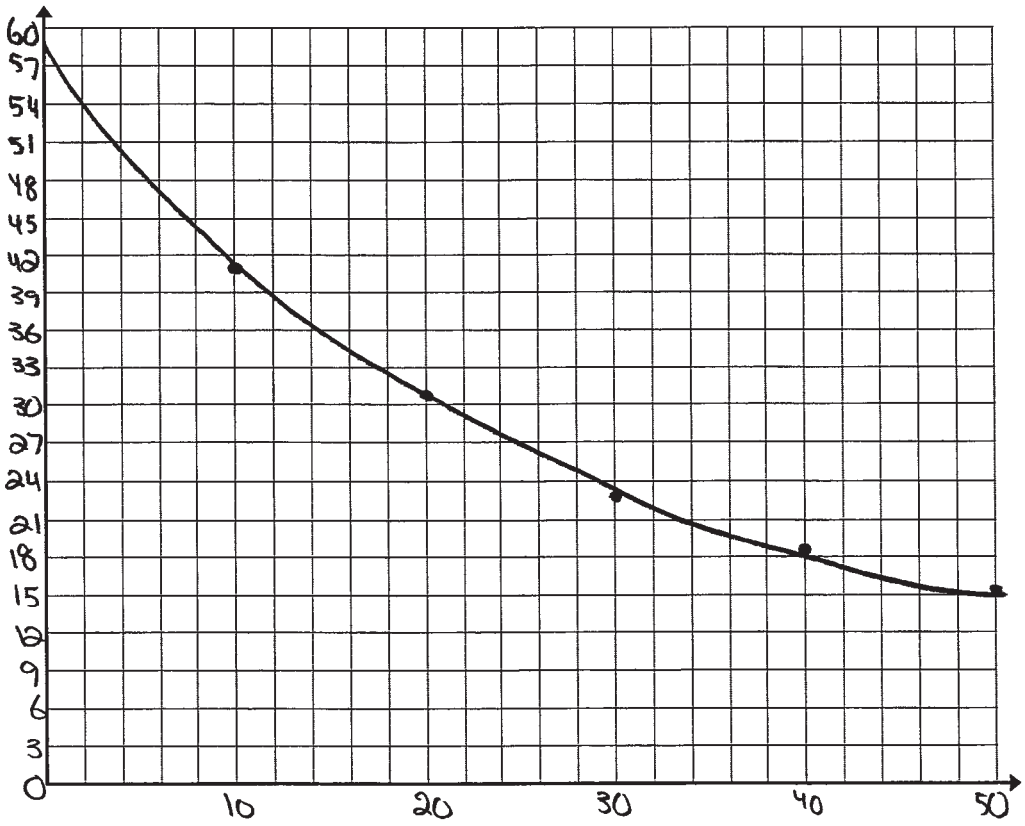
Training Exemplar 2

Question 6 — Total: 5 marks

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*)

$y = -37.53 \log x + 79.05$

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

127.73 m

Marking Exemplar 1

Question 9 **Total: 4 marks**

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*)

$_7P_7 = 5040$ 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*)

$\frac{7!}{3!} = \frac{5040}{6} = 840$ ways

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

$\frac{840}{5040} = \frac{1}{6}$ that 3 blue cars are parked beside each other

Mark(s): 2.5/4

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

Marking Exemplar 2

Question 9 **Total: 4 marks**

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*)

Assuming that each car is an individual, and not based on colour

$7! = 5040$ 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*)

$4! \times 3! \times 5 = 150$ ways

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

$$\frac{150}{5040} = \frac{15}{504}$$

Mark(s): 2.5/4

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

Training Exemplar 1

Question 9 **Total: 4 marks**

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*)

$7! = 5,040$

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*)

$3!4!2! = 288$

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

$\frac{288}{5,040} = \frac{2}{35}$

Training Exemplar 2

Question 9 **Total: 4 marks**

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*)

$7P_7$

$= 5040$

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*)

$n = 5$

$x_1 = 3$'s

$5!3!$

$= 120 \times 6$

$= 720$

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

$P(\text{blue cars beside each other}) = \frac{3}{7}$

Marking Exemplar 1

Question 10 **Total: 2 marks**

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

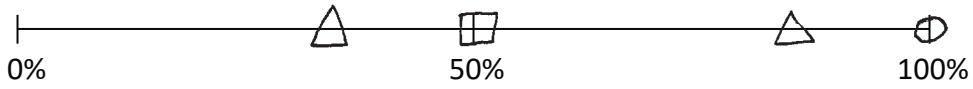
Draw the following symbols on the line.

◯: 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.



Mark(s): 0.5/2

1. 0.5 mark for appropriate location of ◯

Marking Exemplar 2

Question 10 **Total: 2 marks**

The probability of an event occuring 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. 2/6 = 30%.

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

eg.) 1800 students over 12 months

Mark(s): 0.5/2

4 0.5 mark for appropriate location of ◇

Training Exemplar 1

Question 10 — Total: 2 marks

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

Draw the following symbols on the line.

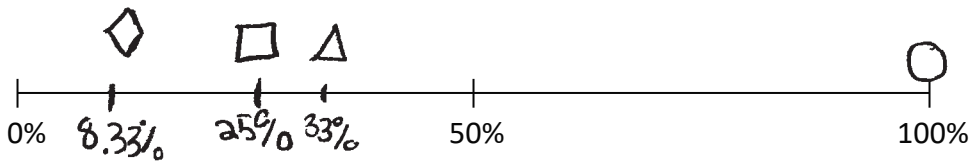
○: The probability that it will snow in Manitoba in the winter.

□: The probability of flipping two coins that both land on heads. $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ 25%

△: 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.

◇ $\frac{1}{12} = 8.33\%$ $\frac{2}{6} = 33\%$ △



Training Exemplar 2

Question 10 — Total: 2 marks

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

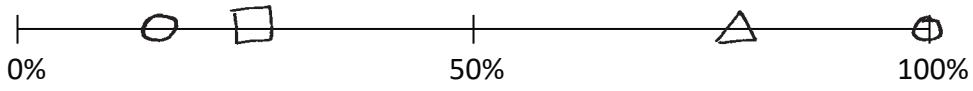
Draw the following symbols on the line.

○: 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 Exemplar 1

Question 11 **Total: 2 marks**

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*)

P(B ∩ Y)
P(B ∩ M)
P(G ∩ M)
P(G ∩ Y)
P(R ∩ Y)
P(R ∩ M)

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

Milo has 1:5 against

Mark(s): 1/2

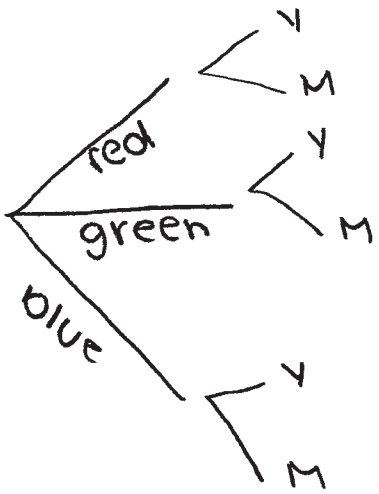
1 1 mark for appropriate graphic organizer in (a)

Marking Exemplar 2

Question 11 — Total: 2 marks

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*)



PE

9 possible outcomes

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

8:1

Mark(s): 1.5/2

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

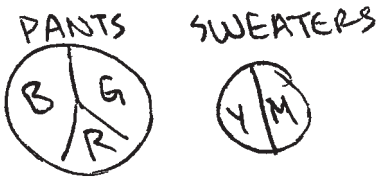
PE 0.5 mark deduction for procedural error in (a)

Training Exemplar 1

Question 11 **Total: 2 marks**

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*)



$3 \times 2 = 6$

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

$\frac{1}{3} \times \frac{1}{2}$

$= \frac{1}{6}$

1:5

Training Exemplar 2

Question 11 **Total: 2 marks**

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*)

pants / sweaters	blue	green	red
yellow	yellow	yellow	yellow
maroon	maroon	maroon	maroon

6 possible outcomes

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

1:1

Marking Exemplar 1

Question 12 — Total: 3 marks

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*)

$12C4 = 495$

$5C3 = 10$

$495 \times 10 = 4950$

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

$12C4 = 495$

$5C3 = 10$

$]X = \frac{4950}{17C7} = \frac{4950}{19448} = \frac{205}{884} = P(3T)$

Mark(s): 1/3

1. 0.5 mark for ${}_{12}C_4 \times {}_5C_3$ in (a)
4. 0.5 mark for consistent numerator in (b)

Marking Exemplar 2

Question 12 — Total: 3 marks

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*)

$_{12}C_4 \cdot {}_5C_3 = 4950$

$+$

or

$_{12}C_5 \cdot {}_5C_2 = 7920$

$= 12870$ ways

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

$3 : 12 = \frac{3}{12} = 0.25 = 25\%$

Probability of 3 teachers is 25%

Mark(s): 2/3

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)

Training Exemplar 1

Question 12 **Total: 3 marks**

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*)

$_{12}C_4 \times {}_5C_3 + {}_{12}C_5 \times {}_5C_2 = 12\,870$ ways

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

495

Training Exemplar 2

Question 12 **Total: 3 marks**

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*)

possible cases ${}_{17}C_7 = 19\,448$

4 students

${}_{12}C_4 \cdot {}_5C_3 = 4950$

2 teachers

${}_{12}C_5 \cdot {}_5C_2 = 7920$

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

${}_{12}C_4 \cdot {}_5C_3 = 4950 = 0.25$ $p(3 \text{ teachers}) \frac{4950}{19448}$

Marking Exemplar 1

Question 13 **Total: 1 mark**

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

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

$$\frac{10!}{5!\,5!}$$

$$3628800 \leftarrow \text{AE}$$

Mark(s): 0/1

2 0.5 mark for consistent quotient

AE 0.5 mark deduction for arithmetic error

Marking Exemplar 2

Question 13 **Total: 1 mark**

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

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

$\frac{2}{\text{red}} \times \frac{2}{\text{purple}} \times \frac{2}{\text{blue}} \times \frac{2}{\text{green}} \times \frac{2}{\text{yellow}} = 32 \text{ ways}$

Mark(s): 0/1

→ no criteria met

Training Exemplar 1

Question 13 **Total: 1 mark**

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

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

$\frac{10!}{5!2!} = 15120$ ways

Marking Exemplar 1

Question 14 **Total: 2 marks**

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.

Prize 1 : $\frac{5}{100}$

Prize 2 : $\frac{4}{99}$

Prize 3 : $\frac{3}{98}$

$P(\text{win all 3}) = \underbrace{\frac{5}{100} \cdot \frac{4}{99} \cdot \frac{3}{98}}$

E1

Mark(s): 2/2

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

E1 incorrectly states the final answer

Marking Exemplar 2

Question 14 — Total: 2 marks

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.

$P(\text{win all 3}) = \frac{5}{100} \cdot \frac{5}{99} \cdot \frac{5}{98}$

$\frac{125}{970200} \times 100 = 0.01\%$

Mark(s): 1.5/2

- ❷ 0.5 mark for considering dependency in the denominator
- ❸ 1 mark for consistent product

Training Exemplar 1

Question 14 **Total: 2 marks**

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.

$\frac{5}{100} = 0.05$ $\frac{4}{99} = 0.04$ $\frac{3}{98} = 0.0306$

$0.05 + 0.04 + 0.0306 = 0.12\%$

Training Exemplar 2

Question 14 — Total: 2 marks

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.

$$\frac{5}{100} + \frac{4}{99} + \frac{3}{98} \qquad \frac{12}{297}$$

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Marking Exemplar 1

Question 17 — Total: 7 marks

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*)

Her total future value would be $55 234.04

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

Her total future value would be $19 533.57

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

$$\frac{35234.04}{20000} \times 100 = 176.17\%$$

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

$$\frac{39533.57}{40000} \times 100 = 98.83\%$$

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

I would say Tess should go with option 2, as she would end up making more money, and her RoR is less

---

Mark(s): 4.5/7

- 2 1 mark for consistent answer in (a)
- 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)

Marking Exemplar 2

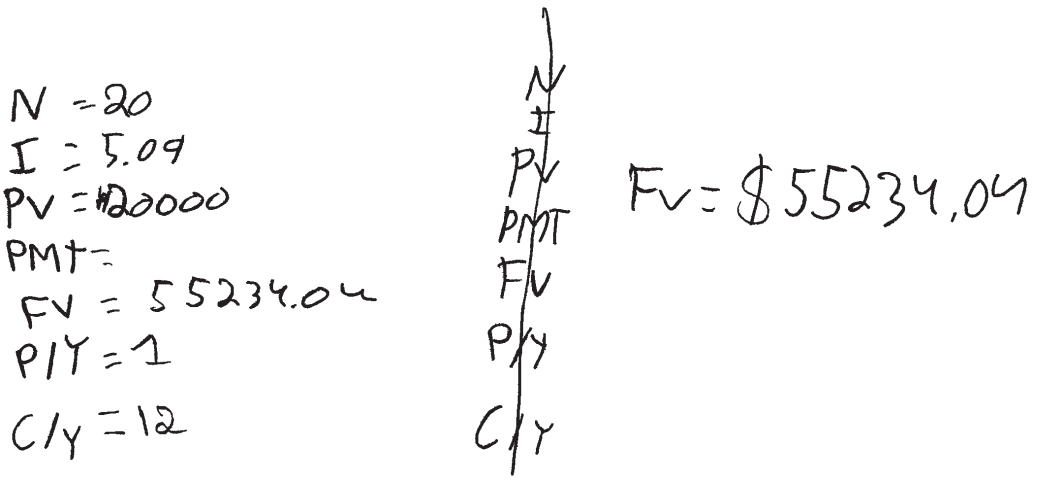
Question 17 **Total: 7 marks**

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:

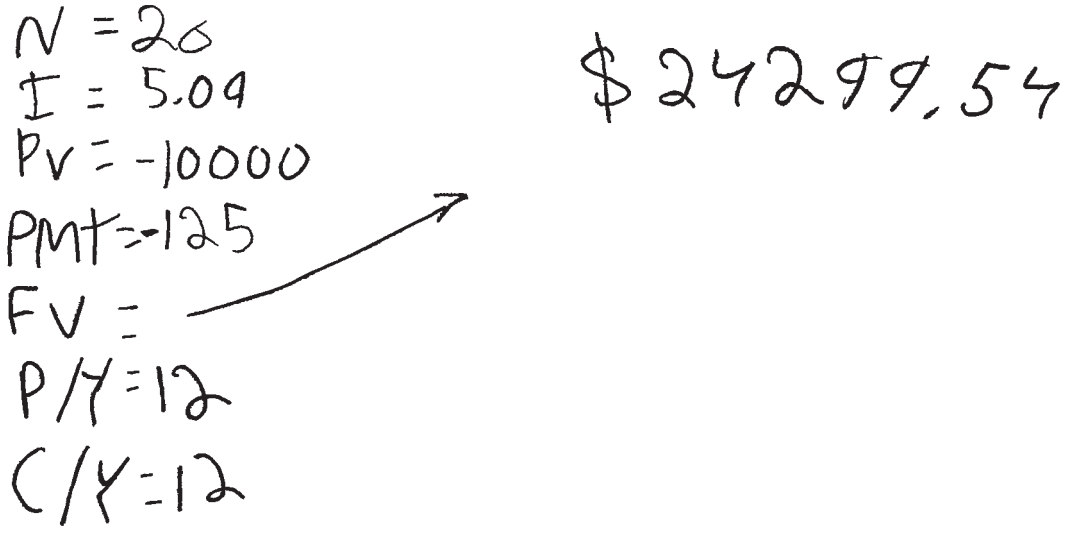
Option 1: She invests the entire sum of $20 000.00 in an account that earns 5.09%, compounded monthly.

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*)



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



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

$$ror = \frac{5523.04 - 20000}{20000}$$

$$ror = 1.76 \leftarrow \text{E1}$$

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

$$\frac{24299.54 - 10000}{10000}$$

$$ror = 1.43 \leftarrow \text{E1}$$

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

Option 2 because ror is higher

Mark(s): 4/7

1. 1 mark for appropriate work in (a)
2. 1 mark for consistent answer in (a)
5. 1 mark for consistent rate of return in (c)
7. 1 mark for consistent rate of return in (d)

E1 incorrectly states the final answer in (c) and (d)

Training Exemplar 1

Question 17 **Total: 7 marks**

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*)

N = 20 × 12
I/. - 5.09
PV = 20,000
Pmt = 0
-> FV = $55234.04
P/y = 12
C/y = 1

FV = $55234.04

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

N = 20 × 12
I/. = 5.09
PV = -10 000
Pmt = -125
-> FV = $79533.57
P/y = 12
C/y = 12

FV = $79633.57

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

$$ROR = \frac{I}{P} = \frac{55,234.04}{20,000} = \boxed{2.76\%}$$

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

$$ROR = \frac{I}{P} = \frac{79,533.57}{10,000 + (125 \cdot 20 \cdot 12)}$$

$$ROR = 1.99\%$$

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

Option 1, the rate of return is higher

Training Exemplar 2

Question 17 — Total: 7 marks

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*)

N = 20
I = 5.09
PV = -20000
Pmt = 0
-> FV = $55 234.04
P/y = 1
C/y = 12

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

N = 20 × 12 = 240
I = 5.09%
PV = -10 000
Pmt = -120
-> FV = $77 456.91
P/y = 12
C/y = 12

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

$$\frac{I}{P} = \frac{\$55\,234.04 - \$20\,000}{\$20\,000} = 1.76\%$$

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

$$\frac{I}{P} = \frac{77\,456.91 - 10\,000}{10\,000} = 6.75\%$$

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

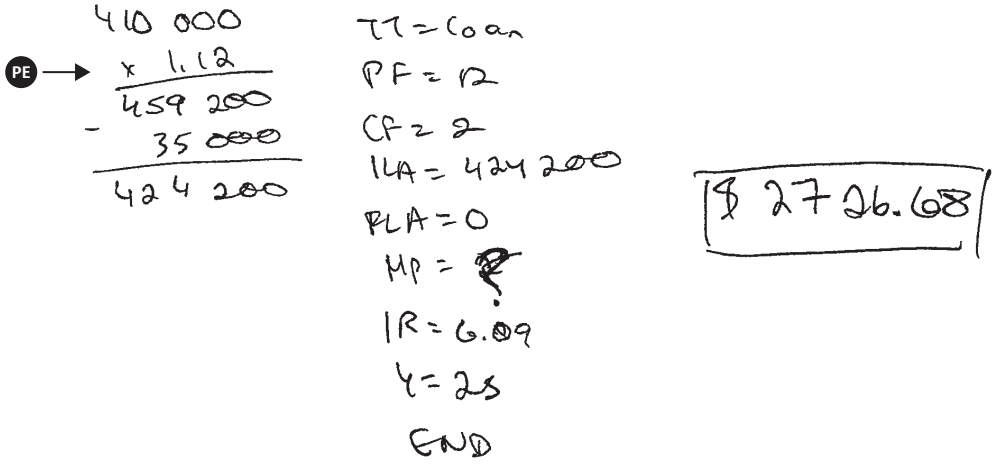
Option 2.
future value is $22 222.87 larger than option 1
& rate of return is greater.

Marking Exemplar 1

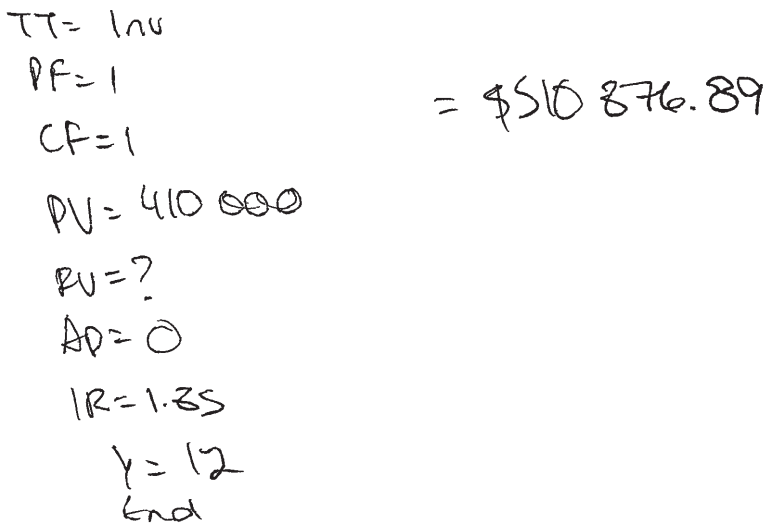
Question 18 — Total: 4 marks

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*)



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



Mark(s): 3.5/4

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)

PE 0.5 mark deduction for procedural error in (a)

Marking Exemplar 2

Question 18 **Total: 4 marks**

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*)

N = 300
I% = 6.05
PV = 375000
PMT = -2410.43
FV = 0
P/Y = 12
C/Y = 2
END

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*)

$410 000 × 1.85^12 = $658 938.067

Their house value after 12 years is $658 938.067 (E6)

Mark(s): 2/4

1. 1 mark for appropriate work in (a)
2. 1 mark for consistent answer in (a)
- (E6) does not express the answer to the appropriate number of decimal places, including monetary values to two decimal places in (b)

Training Exemplar 1

Question 18 **Total: 4 marks**

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*)

410 000
- 35 000
375 000

12x25
N = 300
I = 6.05%
PV = 375000
*Pmt = -2410.43
FV = 0
P/Y = 12
C/Y = 2

Their monthly mortgage payment will be $2410.43.

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

Appreciation = $A = P(1+r)^t$

$A = 410\,000(1+0.0185)^{12}$

$A = \$510876.89$

Their house's value will be $510 876.89

Training Exemplar 2

Question 18 — Total: 4 marks

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*)

N = 50
I = 6.05%
PV = 35000
PMT = = ? = $-8034,34
FV = 410000
P/Y = 12
C/Y = 2

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

410 000 × 0.0185 × 12 = $91, 020.00

Marking Exemplar 1

Question 19 — Total: 3 marks

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*)

$NW = ((820000)+(45000)+(535000)-(454000+12000)+(85000))$

$=(1400000 - 551000)$

$= \$ 849000$

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

$$DTE = \left(\frac{551000 - 454000}{849000}\right) \times 100$$

$DTE = 82.35\%$. ← AE

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

NO, Bank will not because 82.35% is way more higher than 50%.

Mark(s): 2/3

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)
AE 0.5 mark deduction for arithmetic error in (b)

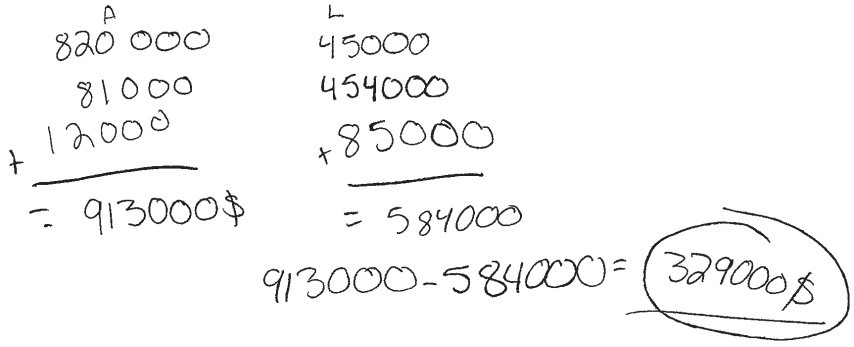
Marking Exemplar 2

Question 19 **Total: 3 marks**

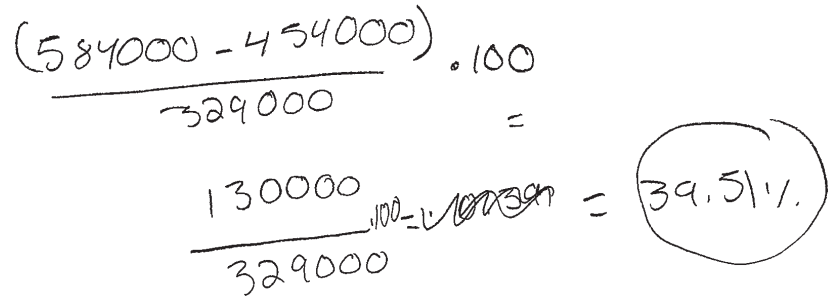
Lori is a farmer in Rivers, Manitoba and is buying a new tractor. Lori is applying for a bank loan and has the following financial situation:

- 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.

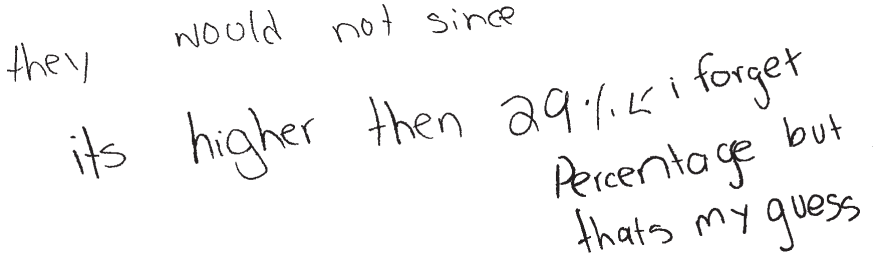
a) Calculate her net worth. (*1 mark*)



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



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



Mark(s): 1.5/3

❷ 0.5 mark for consistent net worth in (a)

❸ 0.5 mark for consistent total liabilities – mortgage in (b)

❹ 0.5 mark for consistent debt-to-equity ratio in (b)

Training Exemplar 1

Question 19 **Total: 3 marks**

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*)

net worth = total assets − total liabilities

= 820 000 − 632 000 = 188 000

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

$$DER = \frac{(632\,000 - 454\,000)}{188\,000} \times 100$$

$$= \frac{178000}{188\,000} = 0.9468 \times 100 = 94.680$$

Lori's DER = 94.7 %

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

the bank would not lend her money based on her DER because it exceeds 50 %.

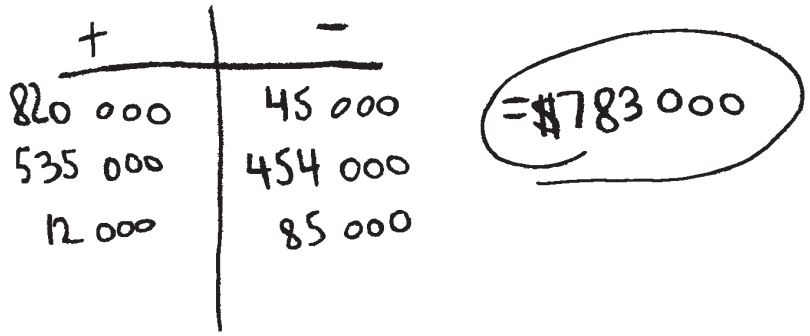
Training Exemplar 2

Question 19 **Total: 3 marks**

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*)



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

$$D/E = \frac{584\,000}{1\,367\,000}(100) = 42.72\%$$

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

No, the debt to equity ratio is over 32%.

Marking Exemplar 1

Question 20 **Total: 1 mark**

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.

She could save up money and buy the bike all at once

Mark(s): 0/1

→ no criteria met

Marking Exemplar 2

Question 20 **Total: 1 mark**

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.

pay off the bike asap you can do so by opening a line of credit w/ a lower rate ↑ compounding.

Mark(s): 1/1

1 1 mark for appropriate strategy

Training Exemplar 1

Question 20 — Total: 1 mark

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.

- By giving the full amound to buy the bike.

Training Exemplar 2

Question 20 **Total: 1 mark**

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.

getting a different plan where it doesn't compound daily

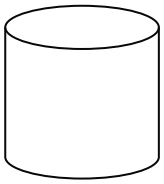
Marking Exemplar 1

Question 23 — Total: 3.5 marks

Taylor has two fish tanks for goldfish.

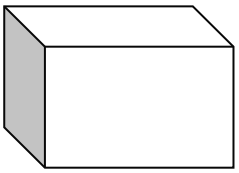
Tank 1

- 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*)

56548.67 cm^3

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

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

3.77

E4

Mark(s): 1/3.5

2 0.5 mark for consistent answer in (a)

5 0.5 mark for consistent number of goldfish for Tank 1 in (c)

E4 does not use whole units in contextual questions involving discrete data in (c)

Marking Exemplar 2

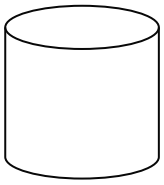
Question 23 — Total: 3.5 marks

Taylor has two fish tanks for goldfish.

Tank 1

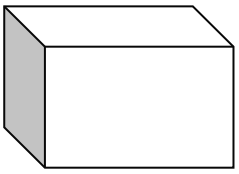
- The height is 45 cm.
- The diameter is 40 cm.

2 or



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*)

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

$= 56548.67\text{cm}^3$

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

$40 \times 32 \times 42 = 53760\text{cm}^3$

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

$\frac{56548.67}{15000} = 3.76$

↳ 4 gold fish in tank 1

E6

tank 2

$\frac{53760}{15000} = 3.58$

↳ 4 gold fish in tank 2

E6

Mark(s): 3.5/3.5

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)

E6 rounds incorrectly in (c)

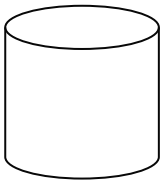
Training Exemplar 1

Question 23 — Total: 3.5 marks

Taylor has two fish tanks for goldfish.

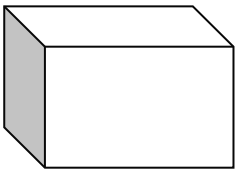
Tank 1

- 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*)

$V = 56548.67 cm^3$

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

$V = 53760 cm^3$

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*)

$$\frac{53760 cm^3}{15000 cm^3} = 3$$

$$\frac{56548.67}{15000} = 3$$

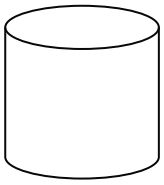
Training Exemplar 2

Question 23 **Total: 3.5 marks**

Taylor has two fish tanks for goldfish.

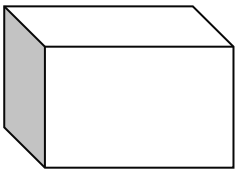
Tank 1

- 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*)

$\pi r^2 h$

$(\pi(20^2)(45) = 56548.67\ cm$

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

$40 \times 32 \times 42 = 53760\ cm$

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*)

$56548.67 + 53760 = 110308.67$

$\frac{110308.67}{15000} =$

$= 7.35$

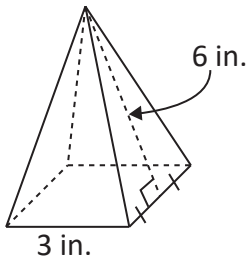
Taylor should put not more than 7 fish.

Marking Exemplar 1

Question 24 — Total: 4 marks

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*)

$SA = B + \frac{1}{2}Ps$

$3 \times 3 + \frac{1}{2} \cdot 6 \cdot 3$

$= 9 + 9 = 18 \text{ in}^2$

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*)

$75 \times 18 = 1350 \text{ in}^2$

12.5×120

$= 0.9 \rightarrow$ 1 roll is needed

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

$\frac{15,25}{75} = \$0,20$

Mark(s): 3.5/4

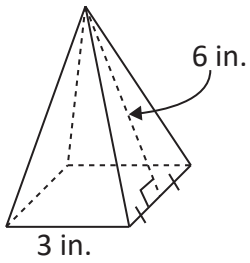
2. 0.5 mark for consistent area in (a)
3. 0.5 mark for appropriate work calculating area of one roll in (b)
4. 0.5 mark for consistent area of all trophies in (b)
5. 1 mark for consistent number of rolls in (b)
6. 0.5 mark for appropriate work in (c)
7. 0.5 mark for consistent cost per trophy in (c)

Marking Exemplar 2

Question 24 — Total: 4 marks

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*)

Volume = $\frac{1}{3}(B)(H)$

$= \frac{1}{3}(3)(6)$

= 6 inches of goldfoil

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*)

6 x 12 = 120 inches

6 x 75 = 450 inches

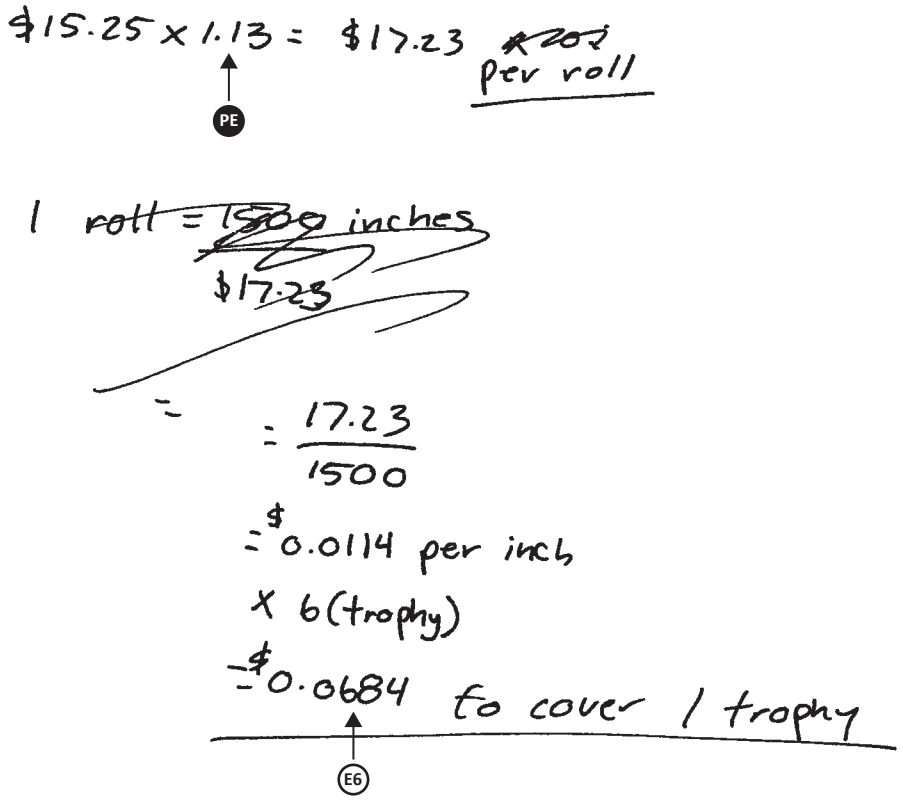
12.5 x 10 = 125 sq in x 12 = 1500 per roll

$\frac{450}{1500} = 0.3$ rolls needed!

12.5 x 120 = 1500 inches ÷ 450 = $3.\overline{3}$ rolls

or 4 rolls needed

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



Mark(s): 1.5/4

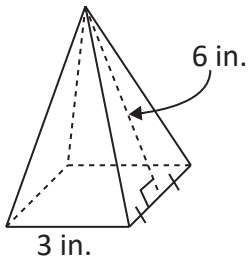
- 3 0.5 mark for appropriate work calculating area of one roll in (b)
- 4 0.5 mark for consistent area of all trophies in (b)
- 6 0.5 mark for appropriate work in (c)
- 7 0.5 mark for consistent cost per trophy in (c)
- PE 0.5 mark deduction for procedural error in (c)
- E6 does not express the answer to the appropriate number of decimal places, including monetary values to two decimal places in (c)

Training Exemplar 1

Question 24 **Total: 4 marks**

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*)

$SA = b^2 + 2bs$

$SA = 3^2 + 2(3)(6)$

$SA = 9 + 32$

$SA = 41 \text{ inch}^2$

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*)

$10 \text{ ft} = 120 \text{ inch}$

$41 \times 75 = 3075 \text{ in}^2$

$120 \times 12.5 = 1500 \text{ in}^2$

$$\frac{3075 \text{ in}^2}{1500 \text{ in}^2}$$

$= 2.05$

3 rolls

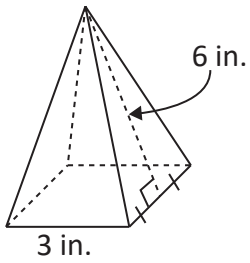
c) Each roll costs $15.25, taxes included. Calculate the cost per trophy. (*1 mark*)

Training Exemplar 2

Question 24 — Total: 4 marks

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*)

$3^2+2\times3\times6$

$=45in^3$

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*)

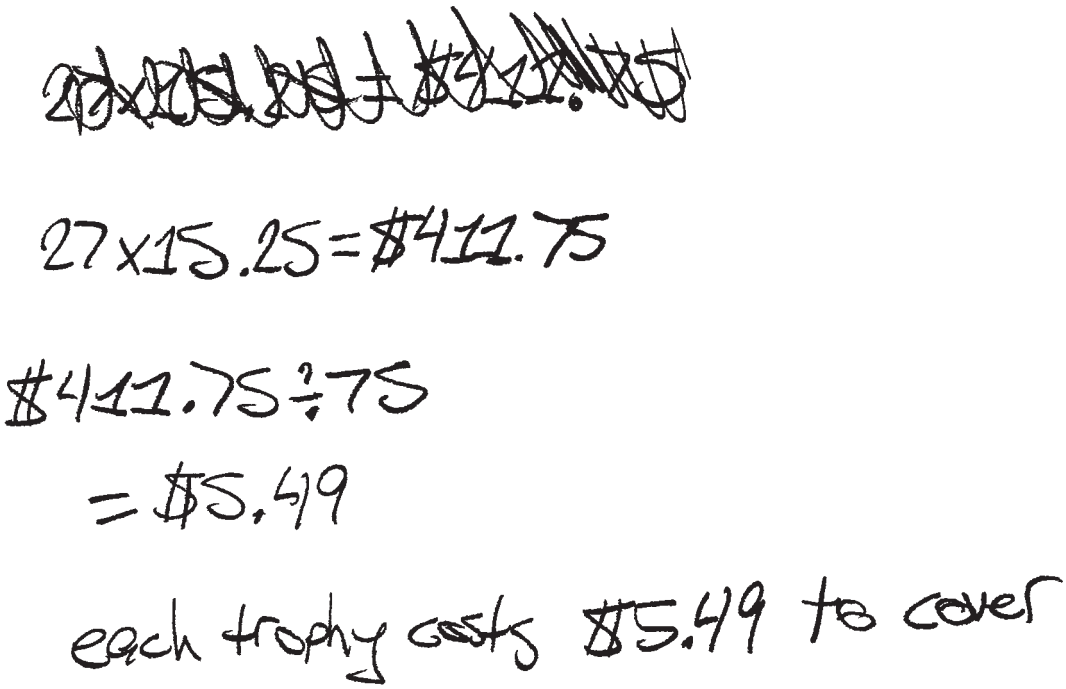
$45\times75=3375in^3$

$12.5\times10=125in^3$

$3375\div125=27$

27 rolls are needed

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



Marking Exemplar 1

Question 25 — Total: 2 marks

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 im in manitoba, then im in sagkeeng first nation

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

If im not in manitoba in not in Sagkeeng first nation

Mark(s): 1.5/2

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

→ 0.5 mark deduction for statement without "if" or "then" as per marker note in (b)

Marking Exemplar 2

Question 25 **Total: 2 marks**

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 im in Manitoba, then Im in Sagkeeng First nation

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

If and only if Im in sagkeeng first nation can I be in

manitoba

Mark(s): 1/2

1 1 mark for converse of the statement in (a)

Training Exemplar 1

Question 25 **Total: 2 marks**

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, I'm in Sagkeeng First Nation

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

If I'm not in Manitoba, I'm not in Sagkeeng first Nation.

Training Exemplar 2

Question 25 **Total: 2 marks**

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 am in MB, then I am in Sagkeeng First Nation.

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

If I'am not in Sagkeeng First Nation, then I am not in MB.

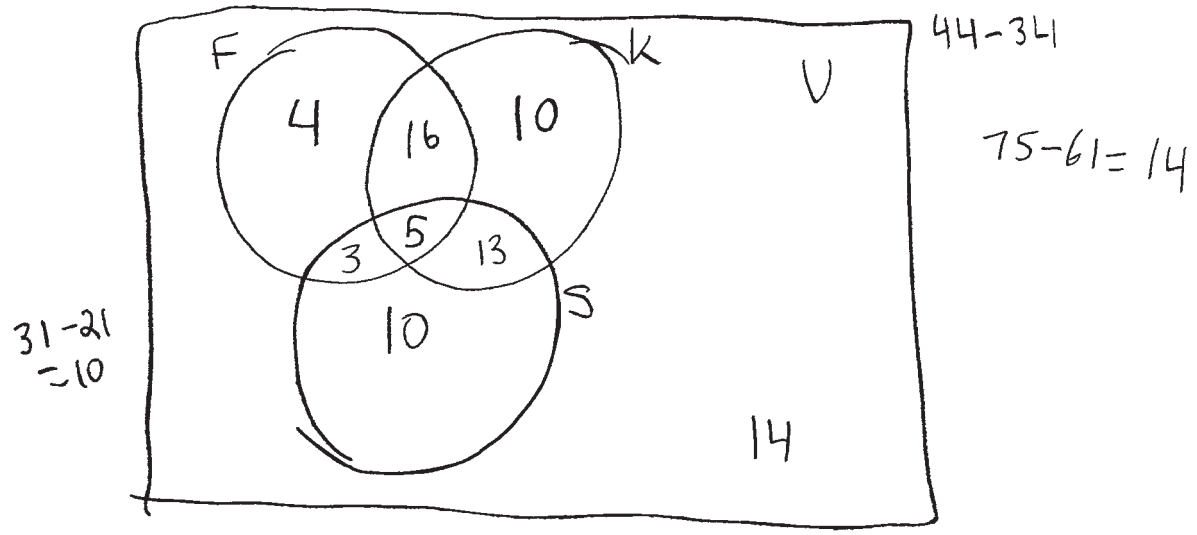
Marking Exemplar 1

Question 26 — Total: 4 marks

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*)

4 students only enjoy fishing.

Mark(s): 3/4

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)

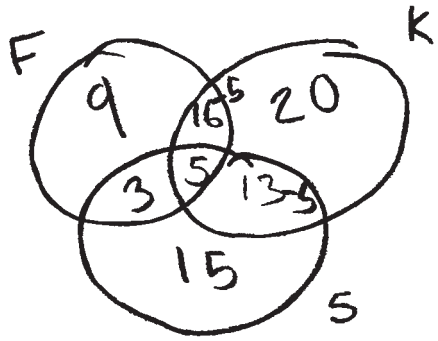
Marking Exemplar 2

Question 26 — Total: 4 marks

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*)



E2

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

9 students only enjoy fishing

Mark(s): 3/4

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)
5. 1 mark for consistent answer in (b)

E2 does not include a box when using a Venn diagram in (a)

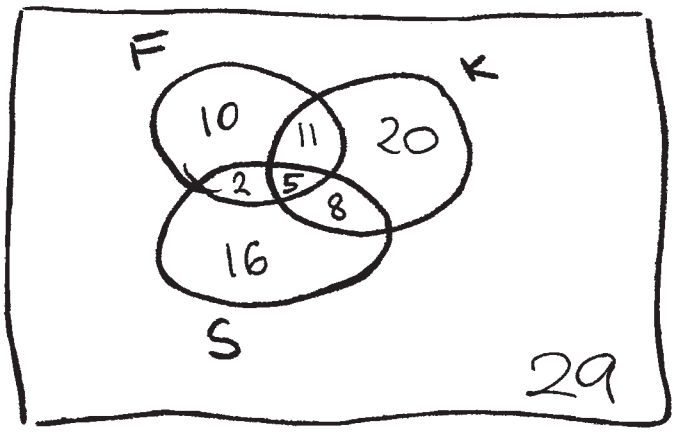
Training Exemplar 1

Question 26 — Total: 4 marks

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*)

10

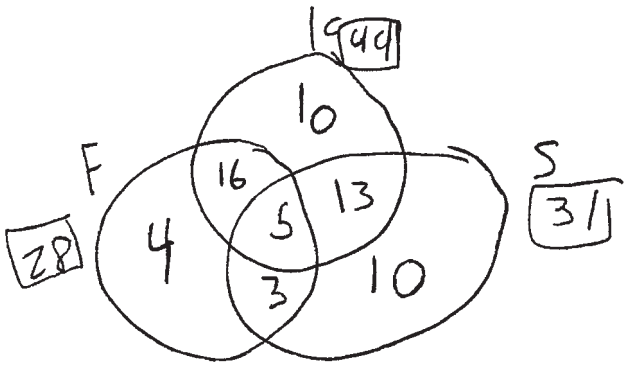
Training Exemplar 2

Question 26 — Total: 4 marks

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*)

Marking Exemplar 1

Question 27 — Total: 2 marks

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 ×, ÷, +, −, ( ). Operators may be used more than once.

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

i) $5 + 3 - 7 + 1 = 1$

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

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

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

Mark(s): 1.5/2

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

Marking Exemplar 2

Question 27 — Total: 2 marks

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 ×, ÷, +, −, ( ). Operators may be used more than once.

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

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

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

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

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

Mark(s): 1.5/2

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

Training Exemplar 1

Question 27 — Total: 2 marks

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) $5 - 7 \times 1 + 3 = 1$

ii) $5 + 7 \times 1 \div 3 = 4$

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

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

Training Exemplar 2

Question 27 — Total: 2 marks

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

ii) $(7 - 5) \times (3 - 1) = 4$

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

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

just press equals when I indicate ;x

Training Exemplar Answers

Question 3 — Total: 3 marks

Training Exemplar 1

Mark(s): 2/3

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)
5. 0.5 mark for appropriate work in (c)

Training Exemplar 2

Mark(s): 1/3

1. 0.5 mark for appropriate work in (a)
2. 0.5 mark for consistent answer in (a)

E6 does not express the answer to the appropriate number of decimal places in (a)

Question 4 — Total: 4.5 marks

Training Exemplar 1

Mark(s): 2/4.5

1. 1 mark for initial value in (a)
3. 0.5 mark for appropriate work in (b)
4. 0.5 mark for consistent answer in (b)

E1 incorrectly states the final answer in (b)

Training Exemplar 2

Mark(s): 4.5/4.5

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)

E2 does not include one of the following in the equation: "$y =$", "sin", "ln", or "x", or writes parameters separately from the equation in (a)

E6 rounds incorrectly in (c)

Question 5 — Total: 3 marks

Training Exemplar 1

Mark(s): 1.5/3

1. 0.5 mark for two values in (a)
2. 0.5 mark for remaining two values in (a)
4. 0.5 mark for consistent answer in (b)

E2. does not include one of the following in the equation: "$y =$", "sin", "ln", or "x", or writes parameters separately from the equation in (a)

E6. rounds incorrectly in (b)

E5. does not include the units in the final answer in (b)

Training Exemplar 2

Mark(s): 2/3

1. 0.5 mark for two values in (a)
2. 0.5 mark for remaining two values in (a)
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)

Question 6 — Total: 5 marks

Training Exemplar 1

Mark(s): 4/5

1. 1 mark for communicating the context of the graph with appropriate title and/or labels 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)

Question 6 (continued) — Total: 5 marks

Training Exemplar 2

Mark(s): 2/5

- 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)
- 7 0.5 mark for consistent distance in (c)
- PE 0.5 mark deduction for procedural error in (a)
- E6 rounds incorrectly in (c)

Question 9 — Total: 4 marks

Training Exemplar 1

Mark(s): 3.5/4

- 1 1 mark for total number of ways in (a)
- 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)

Training Exemplar 2

Mark(s): 3/4

- 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)

Question 10 — Total: 2 marks

Training Exemplar 1

Mark(s): 2/2

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 ◇

Training Exemplar 2

Mark(s): 0.5/2

2. 0.5 mark for appropriate location of □

Question 11 — Total: 2 marks

Training Exemplar 1

Mark(s): 0/2

→ no criteria met

Training Exemplar 2

Mark(s): 0.5/2

1. 1 mark for appropriate graphic organizer in (a)

PE 0.5 mark deduction for procedural error in (a)

Question 12 — Total: 3 marks

Training Exemplar 1

Mark(s): 2/3

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)

Training Exemplar 2

Mark(s): 1.5/3

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)
4. 0.5 mark for consistent numerator in (b)

Question 13 — Total: 1 mark

Training Exemplar 1

Mark(s): 0.5/1

2. 0.5 mark for consistent quotient

Question 14 — Total: 2 marks

Training Exemplar 1

Mark(s): 1/2

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

Training Exemplar 2

Mark(s): 1/2

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

Question 17 — Total: 7 marks

Training Exemplar 1

Mark(s): 5.5/7

- 1 mark for appropriate work in (a)
- 1 mark for consistent answer in (a)
- 1 mark for appropriate work in (b)
- 1 mark for consistent answer in (b)
- 0.5 mark for amount of principal in (d)
- 1 mark for consistent rate of return in (d)
- 0.5 mark for justification in (e)
- PE 0.5 mark deduction for procedural error in (d)
- E3 makes a transcription error (inaccurate transferring of information) in (a)

Training Exemplar 2

Mark(s): 6/7

- 1 mark for appropriate work in (a)
- 1 mark for consistent answer in (a)
- 1 mark for appropriate work in (b)
- 1 mark for consistent answer in (b)
- 1 mark for consistent rate of return in (c)
- 1 mark for consistent rate of return in (d)
- 0.5 mark for justification in (e)
- PE 0.5 mark deduction for procedural error in (c) and (d)
- E3 makes a transcription error (inaccurate transferring of information) in (b)

Question 18 — Total: 4 marks

Training Exemplar 1

Mark(s): 4/4

- 1 mark for appropriate work in (a)
- 1 mark for consistent answer in (a)
- 1 mark for appropriate work in (b)
- 1 mark for consistent answer in (b)

Training Exemplar 2

Mark(s): 1/4

- 1 mark for consistent answer in (a)

Question 19 — Total: 3 marks

Training Exemplar 1

Mark(s): 2.5/3

- ❷ 0.5 mark for consistent net worth in (a)
- ❸ 0.5 mark for consistent total liabilities – mortgage in (b)
- ❹ 0.5 mark for consistent debt-to-equity ratio in (b)
- ❺ 1 mark for explanation with reference to 50% in (c)
- Ⓔ5 does not include the dollar sign for monetary values in (a)
- Ⓔ6 does not express the answer to the appropriate number of decimal places, including monetary values to two decimal places in (b)

Training Exemplar 2

Mark(s): 1/3

- ❶ 0.5 mark for assets and liabilities in (a)
- ❷ 0.5 mark for consistent net worth in (a)

Question 20 — Total: 1 mark

Training Exemplar 1

Mark(s): 0/1

→ no criteria met

Training Exemplar 2

Mark(s): 0/1

→ no criteria met

Question 23 — Total: 3.5 marks

Training Exemplar 1

Mark(s): 3/3.5

- 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)

Training Exemplar 2

Mark(s): 2.5/3.5

- 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)
- E5 uses incorrect units of measure in (a) and (b)

Question 24 — Total: 4 marks

Training Exemplar 1

Mark(s): 2.5/4

- 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)
- AE 0.5 mark deduction for arithmetic error in (a)

Training Exemplar 2

Mark(s): 3.5/4

- 1 0.5 mark for appropriate work in (a)
- 2 0.5 mark for consistent area in (a)
- 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)
- E5 confuses square and cubic units in (a)

Question 25 — Total: 2 marks

Training Exemplar 1

Mark(s): 1.5/2

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

$\rightarrow$ 0.5 mark deduction for statement without "if" or "then" as per marker note in (a) and (b)

Training Exemplar 2

Mark(s): 1/2

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

Question 26 — Total: 4 marks

Training Exemplar 1

Mark(s): 3/4

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)
5. 1 mark for consistent answer in (b)

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

Training Exemplar 2

Mark(s): 1/4

3. 1 mark for consistent number of students who enjoy only one activity in (a)

E2 does not include a box when using a Venn diagram in (a)

Question 27 — Total: 2 marks

Training Exemplar 1

Mark(s): 1/2

1. 0.5 mark for equation i
4. 0.5 mark for equation iv

Training Exemplar 2

Mark(s): 2/2

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