Grade 12
Applied Mathematics
Achievement Test

Exemplars

Use in conjunction with *Marking Guide*

January 2025

Manitoba

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

This resource is available in print and electronic formats.

ISBN: 978-0-7711-6652-5 (print)

ISBN: 978-0-7711-6650-1 (pdf)

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Winnipeg, Manitoba, Canada

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.

Preamble

This document is one of a series of two documents.

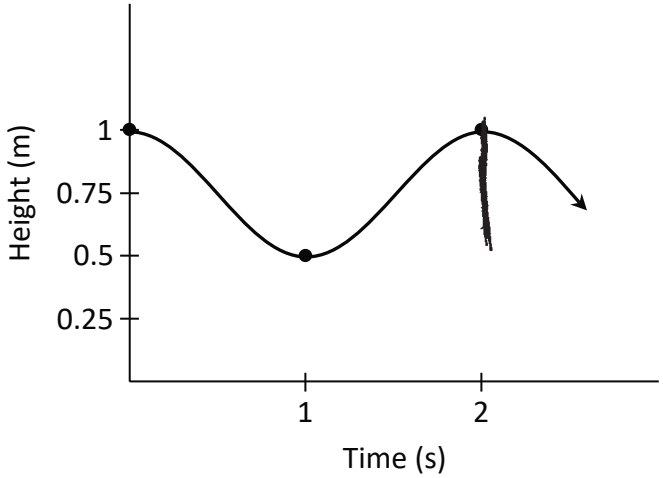
- ***Grade 12 Applied Mathematics Achievement Test: Exemplars***
- *Grade 12 Applied Mathematics Achievement Test: Marking Guide*

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: 1 mark

A baby is in a swing. The following graph represents the height of the baby as a function of time.



State the amplitude of the graph.

1 - 0.5 = 0.5

Amplitude = 0.5

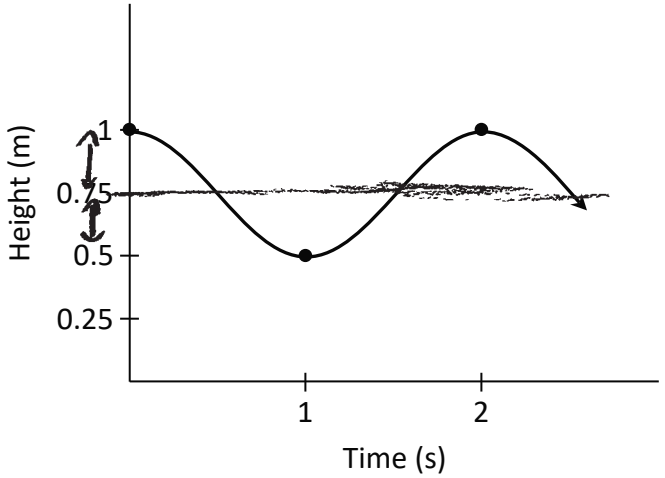
Mark(s): 0/1

→ no criteria met

Training Exemplar 1

Question 3 — Total: 1 mark

A baby is in a swing. The following graph represents the height of the baby as a function of time.



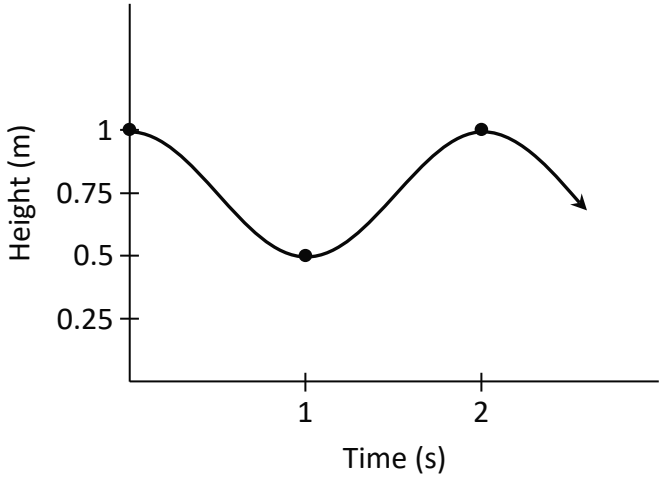
State the amplitude of the graph.

0.25 distance from mid line to minimum or maximum

Training Exemplar 2

Question 3 — Total: 1 mark

A baby is in a swing. The following graph represents the height of the baby as a function of time.



State the amplitude of the graph.

$1 - 0.5 = \frac{0.5}{2} = 0.25 + 0.5 = 0.75$

0.75

$\frac{m - \$m}{2} + \$m$

Marking Exemplar 1

Question 4 — Total: 2 marks

The following equation models the relationship between time and the number of apples on a tree:

$$T = -76.94 + 27.64\ln(a)$$

where T represents the time (in days)
and a represents the number of apples.

a) Determine on which day the tree will have 80 apples. (*1 mark*)

$T = -76.94 + 27.64\ln(80)$

$= 44$ days

b) Determine the number of apples on day 18. (*1 mark*)

$18 = -76.94 + 27.64\ln(a)$

$a = 31.03$

E4

Mark(s): 2/2

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)

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

Marking Exemplar 2

Question 4 — Total: 2 marks

The following equation models the relationship between time and the number of apples on a tree:

$$T = -76.94 + 27.64\ln(a)$$

where T represents the time (in days)
and a represents the number of apples.

a) Determine on which day the tree will have 80 apples. (*1 mark*)

44th day

b) Determine the number of apples on day 18. (*1 mark*)

31

Mark(s): 1/2

2 0.5 mark for consistent answer in (a)

4 0.5 mark for consistent answer in (b)

Training Exemplar 1

Question 4 — Total: 2 marks

The following equation models the relationship between time and the number of apples on a tree:

$$T = -76.94 + 27.64\ln(a)$$

where T represents the time (in days)
and a represents the number of apples.

a) Determine on which day the tree will have 80 apples. (*1 mark*)

$y = -76.94 + 27.64 \ln x$

When $x = 80$, $y = 44.1792$

When $a = 80$, $T = 44.1792$ days

It will take **44 days** for the tree to have 80 apples.

b) Determine the number of apples on day 18. (*1 mark*)

$18 = -76.94 + 27.64 \ln(a)$

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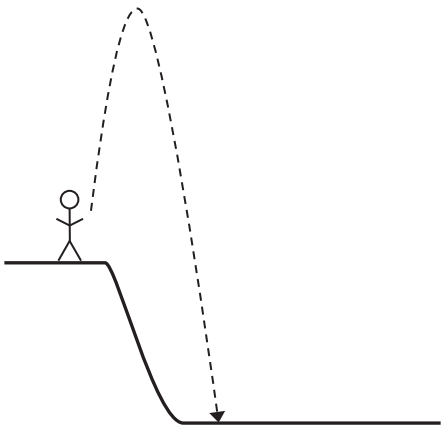
Marking Exemplar 1

Question 5 — Total: 3 marks

Avery is on top of a hill. From 15 m above the ground, he throws a stone in the air. The stone reaches its maximum height of 31.53 m after 1.84 s. The stone hits the ground after 4.37 s.



a) State the quadratic regression equation that models this situation. You may use the table below. (*1 mark*)

Time (s)	Height (m)
0	15 m
1.84	31.53
4.37	0

Regression equation: $-4.90x^2 + 18.01x + 15$

E2 E6

b) Determine how much time the stone is above 25 m. (*2 marks*)

2.98 Seconds

E6

Mark(s): 1.5/3

1 1 mark for equation in (a)

3 0.5 mark for consistent second *x*-value in (b)

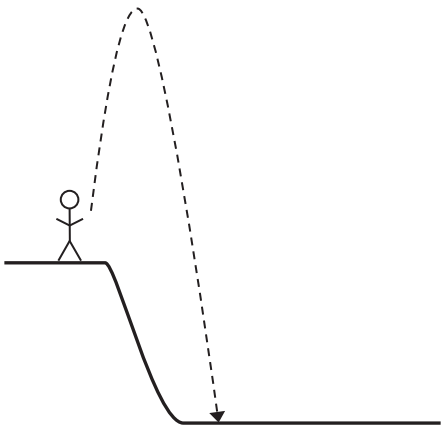
E2 does not include one of the following in the equation: "*y* =", "sin", "ln", or "*x*", or writes parameters separately from the equation in (a)

E6 rounds incorrectly in (a) and (b)

Marking Exemplar 2

Question 5 — Total: 3 marks

Avery is on top of a hill. From 15 m above the ground, he throws a stone in the air. The stone reaches its maximum height of 31.53 m after 1.84 s. The stone hits the ground after 4.37 s.



a) State the quadratic regression equation that models this situation. You may use the table below. (*1 mark*)

Time (s)	Height (m)
0	15 m
1.84	31.53
4.37	0

Regression equation: $y = -4.9108x^2 + 18.0137x + 15$

b) Determine how much time the stone is above 25 m. (*2 marks*)

$2.989 - 0.682$

$= \boxed{2.307 \text{ secs}}$

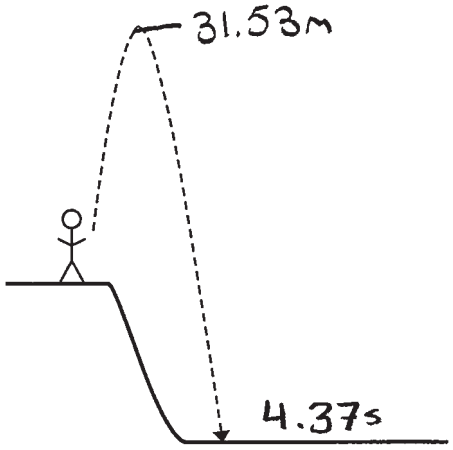
Mark(s): 3/3

1. 1 mark for equation in (a)
2. 0.5 mark for consistent first x-value in (b)
3. 0.5 mark for consistent second x-value in (b)
4. 1 mark for consistent difference in (b)

Training Exemplar 1

Question 5 **Total: 3 marks**

Avery is on top of a hill. From 15 m above the ground, he throws a stone in the air. The stone reaches its maximum height of 31.53 m after 1.84 s. The stone hits the ground after 4.37 s.

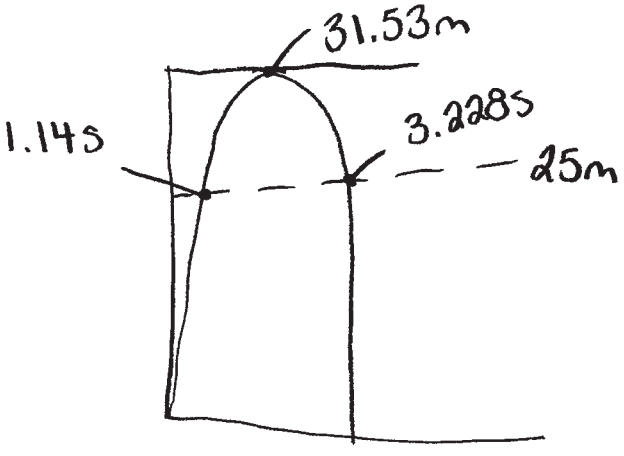


a) State the quadratic regression equation that models this situation. You may use the table below. (*1 mark*)

Time (s)	Height (m)
0	0
1.84	31.53
4.37	0

Regression equation: $y = -6.77x^2 + 29.598x + 0$

b) Determine how much time the stone is above 25 m. (*2 marks*)

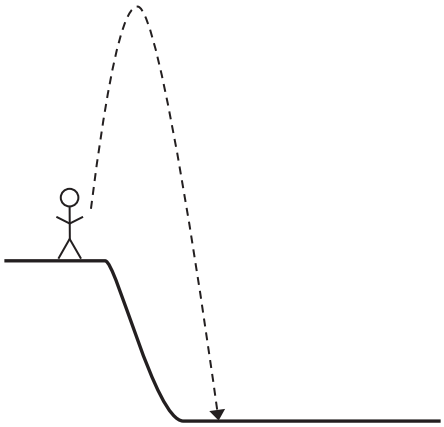


$3.2283 - 1.14 = 2.088\text{s}$

Training Exemplar 2

Question 5 — Total: 3 marks

Avery is on top of a hill. From 15 m above the ground, he throws a stone in the air. The stone reaches its maximum height of 31.53 m after 1.84 s. The stone hits the ground after 4.37 s.



a) State the quadratic regression equation that models this situation. You may use the table below. (*1 mark*)

Time (s)	Height (m)
0	15
1.84	31.53
4.37	0

Regression equation: _____

b) Determine how much time the stone is above 25 m. (*2 marks*)

0.68 | 25 m

Marking Exemplar 1

Question 6 — Total: 3 marks

The pitch of a siren changes over time. Ryan collects the following data:

Time (s)	0.295	0.687	1.080	1.473	1.865
Pitch (Hz)	962	865	770	865	962

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

$y = 96.02 \sin(227.47(x - -0.11)) + 866.02$

b) Determine the pitch of the siren at 12 seconds. (*1 mark*)

$x = 12$ $\quad \therefore 788.41$ Hz

c) State the range of this situation. (*1 mark*)

$y: 770 \leq y \leq 962$

E2 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)

E2 does not include braces when using set notation in (c)

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

Marking Exemplar 2

Question 6 — Total: 3 marks

The pitch of a siren changes over time. Ryan collects the following data:

Time (s)	0.295	0.687	1.080	1.473	1.865
Pitch (Hz)	962	865	770	865	962

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

$y_1 \sim 96.015 \sin(3.970(x_1 - 0.106)) + 866.015$

E2

b) Determine the pitch of the siren at 12 seconds. (*1 mark*)

The pitch of the siren at 12 secons is 788.652 Hz.

c) State the range of this situation. (*1 mark*)

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 change "$y \sim$" to "$y =$" when writing an equation in (a)

Training Exemplar 1

Question 6 — Total: 3 marks

The pitch of a siren changes over time. Ryan collects the following data:

Time (s)	0.295	0.687	1.080	1.473	1.865
Pitch (Hz)	962	865	770	865	962

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

$y = ax^3 + bx^2 + cx + d$

$a = 0$

$b = 268.14$

$c = -579.18$

$d = 1,119.90$

$y = 0x^3 + 268.14x^2 - 579.18x + 1,119.90$

b) Determine the pitch of the siren at 12 seconds. (*1 mark*)

the pitch will be at 32,776.81 Hz

c) State the range of this situation. (*1 mark*)

the range is between 1,119.90 Hz to 32,776.81 Hz

Training Exemplar 2

Question 6 — Total: 3 marks

The pitch of a siren changes over time. Ryan collects the following data:

Time (s)	0.295	0.687	1.080	1.473	1.865
Pitch (Hz)	962	865	770	865	962

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

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

$a = 96.015$

$b = 3.97$

$c = -0.107$

$d = 866.015$

b) Determine the pitch of the siren at 12 seconds. (*1 mark*)

$(12, 788.405)$

The pitch at 12 seconds is 788.405 Hz

c) State the range of this situation. (*1 mark*)

$[962.03, 770]$

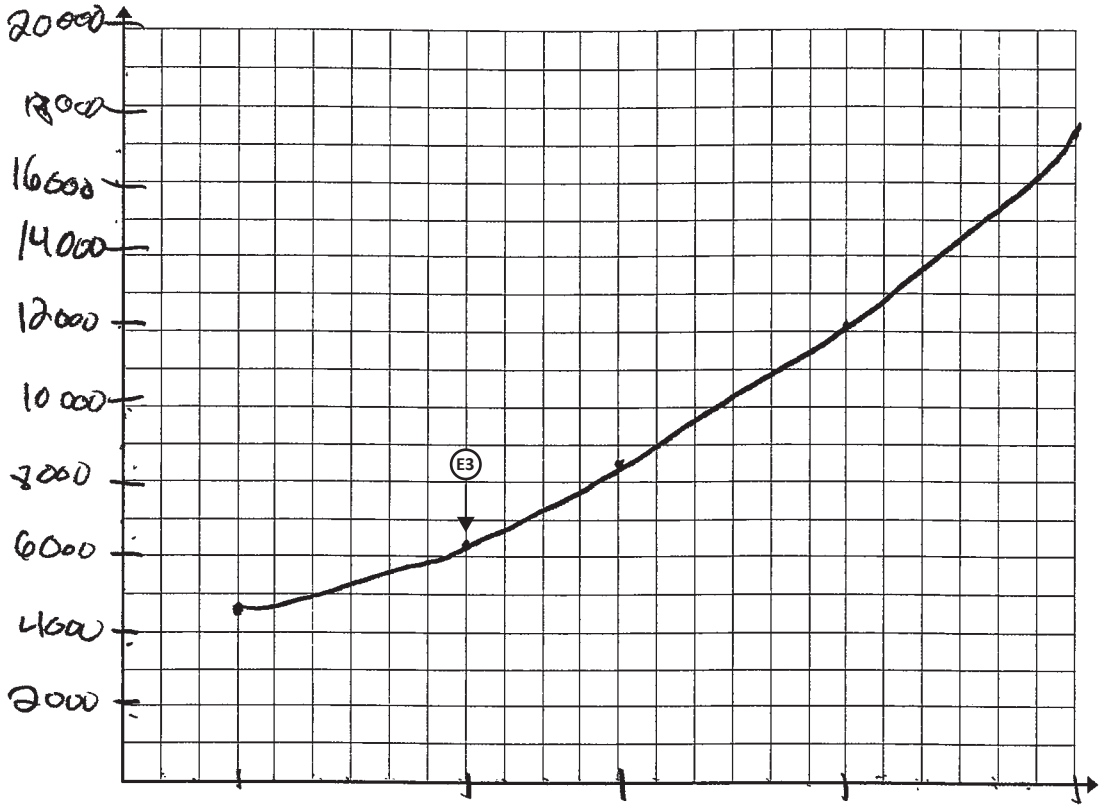
Marking Exemplar 1

Question 7 — Total: 7 marks

Joel made an investment that increased in value.

Time (years)	3	8	13	19	25
Value of Investment ($)	4764	6375	8531	12 102	17 167

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

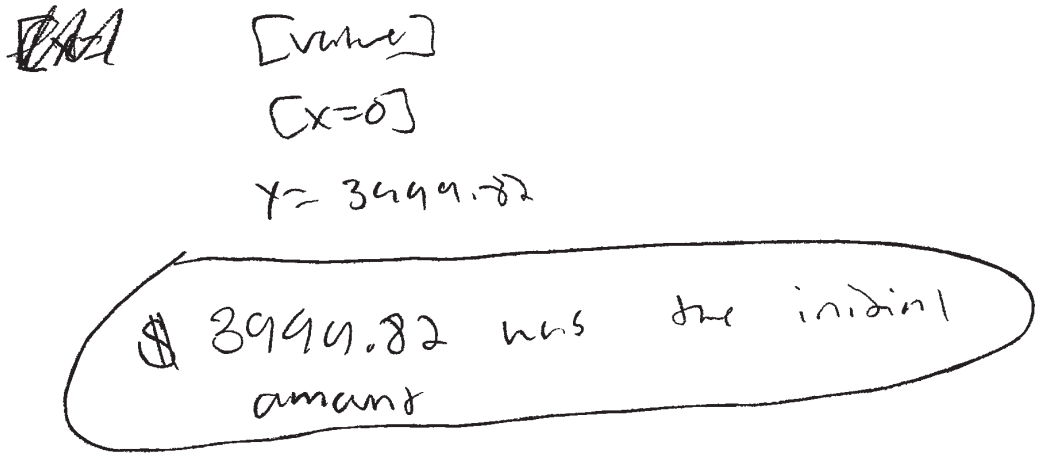


b) State the exponential regression equation that models this situation. (*1 mark*)

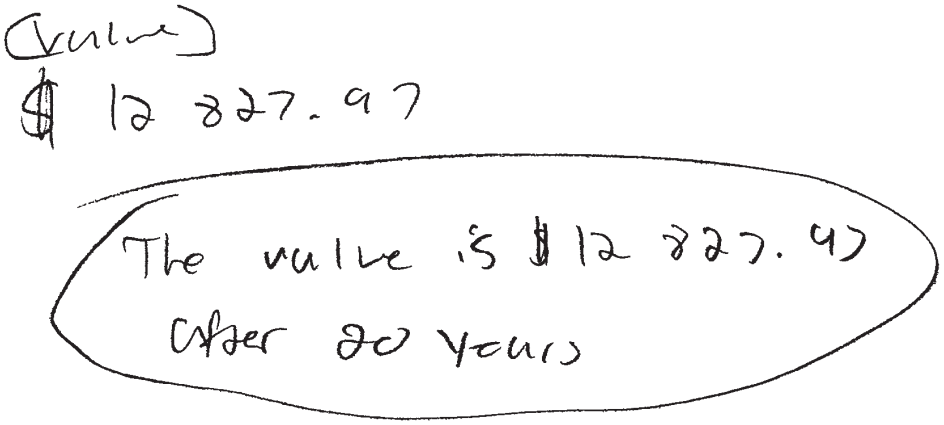
$3944.82 \cdot 1.06^{x}$

E2

c) State the initial amount of Joel's investment. (*1 mark*)



d) Determine the value of Joel's investment at 20 years. (*1 mark*)



e) Calculate the rate of return at 20 years. (*1 mark*)

$$\frac{(12.827.97 - 3994.82)}{3994.82}$$

Mark(s): 4.5/7

- ❸ 0.5 mark for using an appropriate range (i.e., window settings/grid range) for the context of the question in (a)
- ❹ 1 mark for plotting the data in (a)
- ❺ 0.5 mark for consistent initial value in (b)
- ❻ 0.5 mark for consistent rate of change in (b)
- ❼ 1 mark for consistent initial value in (c)
- ❽ 0.5 mark for appropriate work in (d)
- ❾ 0.5 mark for consistent answer in (d)
- Ⓔ3 inaccurately plots one point on a scatter plot in (a)
- Ⓔ2 does not include one of the following in the equation: "$y =$", "sin", "ln", or "x", or writes parameters separately from the equation in (b)

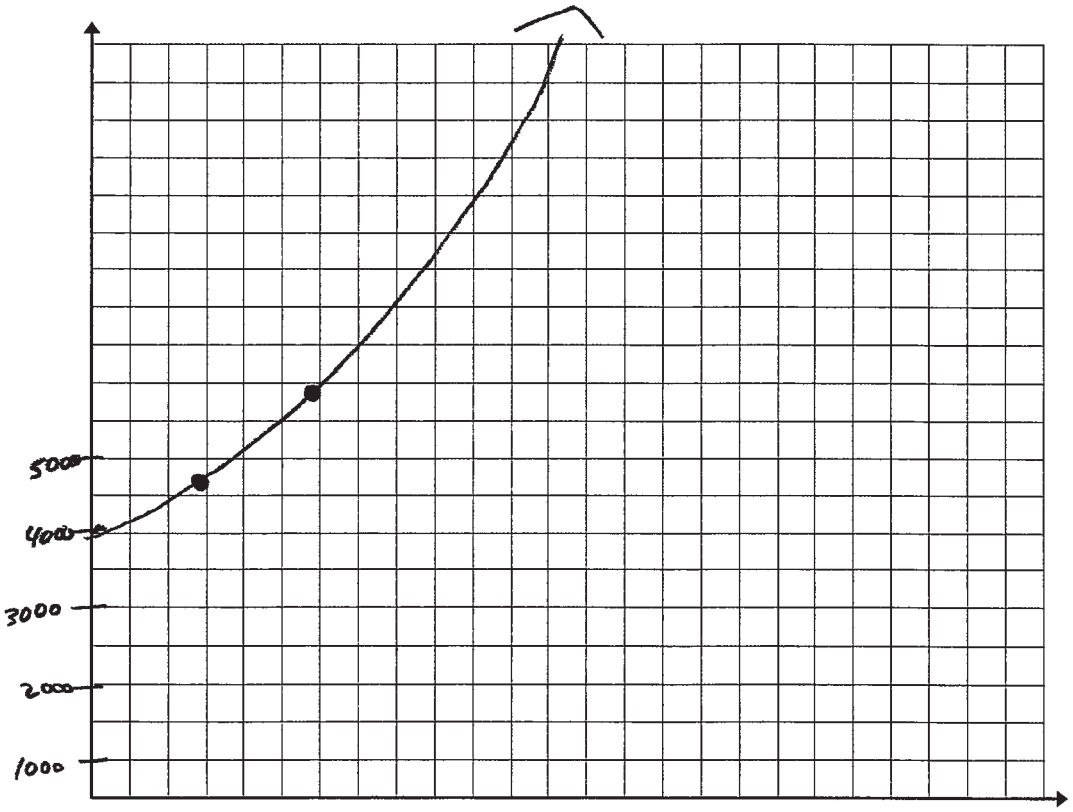
Marking Exemplar 2

Question 7 — Total: 7 marks

Joel made an investment that increased in value.

Time (years)	3	8	13	19	25
Value of Investment ($)	4764	6375	8531	12 102	17 167

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



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

$y = 3999.82x + 1.06$

PE

c) State the initial amount of Joel's investment. (*1 mark*)

3999.82

d) Determine the value of Joel's investment at 20 years. (*1 mark*)

12837.99

e) Calculate the rate of return at 20 years. (*1 mark*)

$$\begin{array}{r} -\ 12837.99 \\ 3999.82 \\ \hline 8838.17 \end{array}$$

Mark(s): 1.5/7

5 0.5 mark for consistent initial value in (b)
6 0.5 mark for consistent rate of change in (b)
7 1 mark for consistent initial value in (c)
PE 0.5 mark deduction for procedural error in (b)

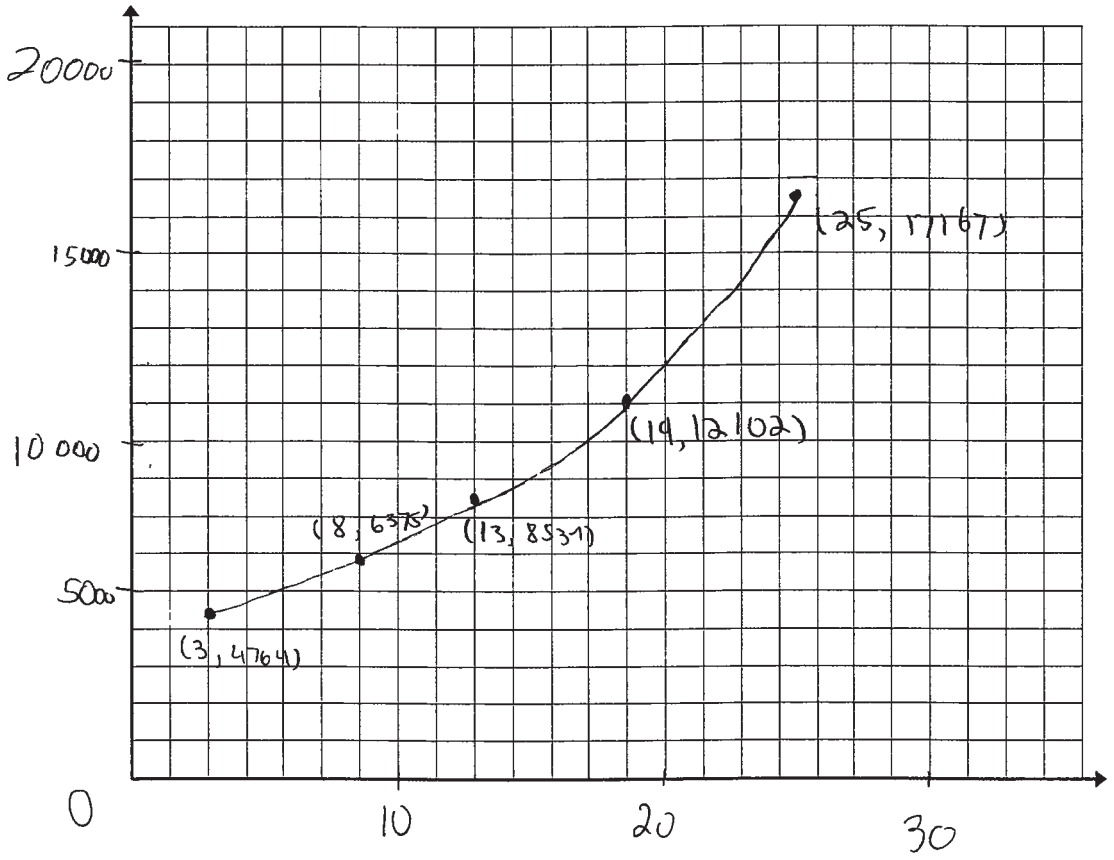
Training Exemplar 1

Question 7 — Total: 7 marks

Joel made an investment that increased in value.

Time (years)	3	8	13	19	25
Value of Investment ($)	4764	6375	8531	12 102	17 167

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



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

$y = ab^x$

$a = 3999.72$

$b = 1.06$

c) State the initial amount of Joel's investment. (*1 mark*)

$3999.72

d) Determine the value of Joel's investment at 20 years. (*1 mark*)

$y = (3999.72)(1.06)^{20}$

$y = 12827.64389$

The value Joe's investment at 20 years is $12827.64

e) Calculate the rate of return at 20 years. (*1 mark*)

$$RofR = \frac{(12827.64) - (3999.72)}{3999.72} \times 100$$

$RofR = 220.71\ \%$

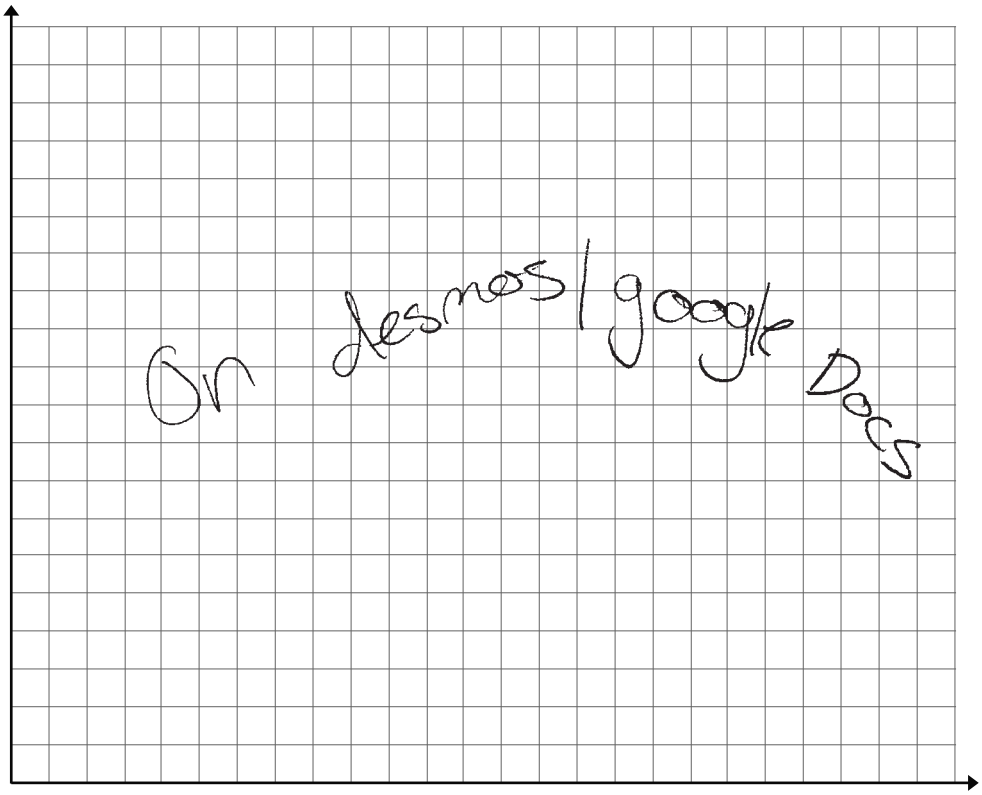
Training Exemplar 2

Question 7 — Total: 7 marks

Joel made an investment that increased in value.

Time (years)	3	8	13	19	25
Value of Investment ($)	4764	6375	8531	12 102	17 167

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



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

$y = 3999.72 \cdot 1,06^{x}$

c) State the initial amount of Joel's investment. (*1 mark*)

(0, y?) → (0, 3999.71)

Joels initial investment was $3999.71

d) Determine the value of Joel's investment at 20 years. (*1 mark*)

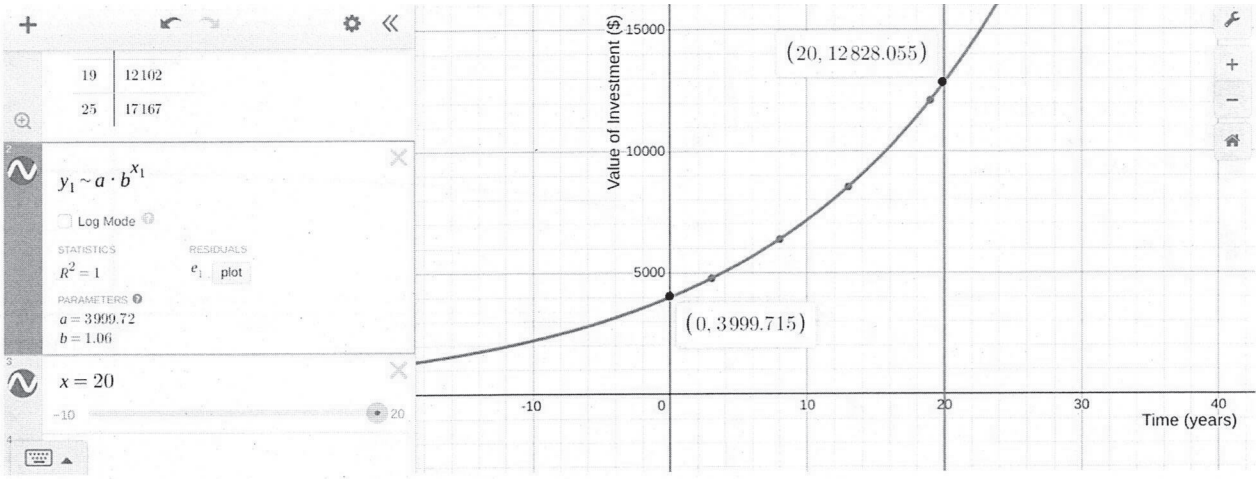
(20, y) → (20, 12,828)

at 20yrs Joels investment was at $12,828

e) Calculate the rate of return at 20 years. (*1 mark*)

$$\frac{(\text{current value} - \text{previous value})}{\text{previous value}} \times 100$$

$$\frac{(12{,}828 - 3999.71)}{3999.71} \times 100 = 220.723$$



Marking Exemplar 1

Question 10 — Total: 2 marks

Omar has $65 000.00 to invest. His bank provides two options.

Option 1: Guaranteed investment certificates (GICs)

Option 2: Stocks

State one advantage for each option.

GICs

he has a Guaranteed investment certificate
So that can help him

Stocks

Stocks are really good they
can help a lot and normally they are
good

Mark(s): 0/2

→ no criteria met

Marking Exemplar 2

Question 10 — Total: 2 marks

Omar has $65 000.00 to invest. His bank provides two options.

Option 1: Guaranteed investment certificates (GICs)

Option 2: Stocks

State one advantage for each option.

GICs

Gic's have a higher return on your investment.

Stocks

Stocks can have a very high return as well.

Mark(s): 1/2

2 1 mark for appropriate stock advantage

Training Exemplar 1

Question 10 — Total: 2 marks

Omar has $65 000.00 to invest. His bank provides two options.

Option 1: Guaranteed investment certificates (GICs)

Option 2: Stocks

State one advantage for each option.

GICs

it's guaranteed

Stocks

could really "pay off"

Training Exemplar 2

Question 10 — Total: 2 marks

Omar has $65 000.00 to invest. His bank provides two options.

Option 1: Guaranteed investment certificates (GICs)

Option 2: Stocks

State one advantage for each option.

GICs

Guarantees profit

Stocks

Can make more

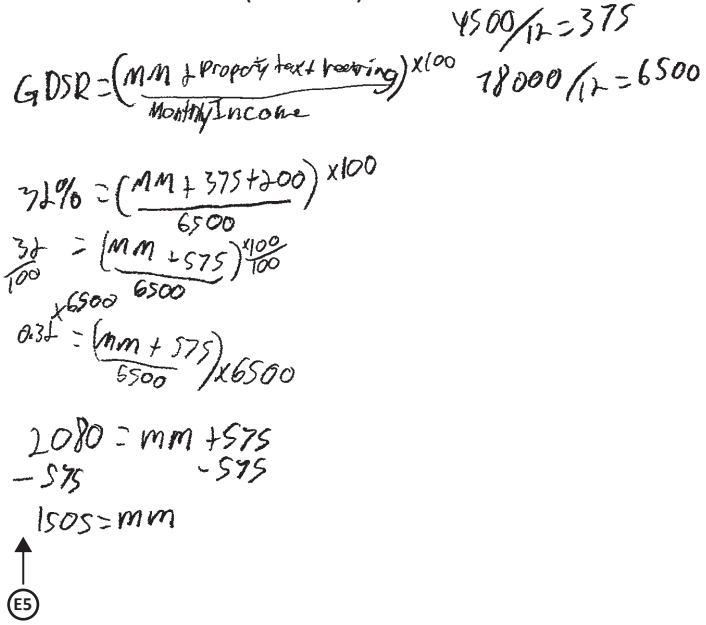
Marking Exemplar 1

Question 11 — Total: 4 marks

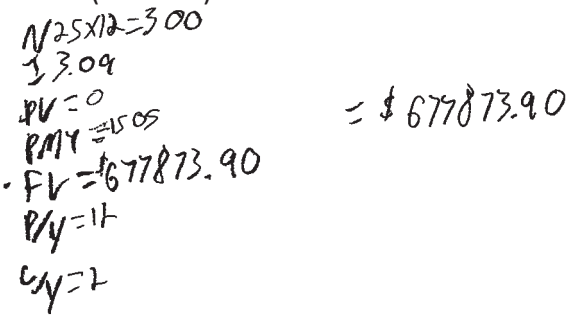
Callie wants to buy a house in a new neighbourhood.

- The average property taxes in the neighbourhood are $4500.00 per year.
- The average heating costs are $200.00 per month.
- Her gross family income is $78 000.00 per year.

a) Determine the maximum monthly mortgage payment for which Callie would qualify when using the gross debt service ratio. (*2 marks*)



b) The bank offers Callie a mortgage at an interest rate of 3.09%, compounded semi-annually and amortized over 25 years. Based on your answer in (a), determine the maximum mortgage she could afford. (*2 marks*)



Mark(s): 3/4

1. 0.5 mark for monthly property taxes and gross monthly family income in (a)
2. 0.5 mark for using 32% in (a)
3. 0.5 mark for substitution in (a)
4. 0.5 mark for consistent answer in (a)
6. 1 mark for consistent mortgage value in (b)

E5 does not include the dollar sign for monetary values in (a)

Marking Exemplar 2

Question 11 — Total: 4 marks

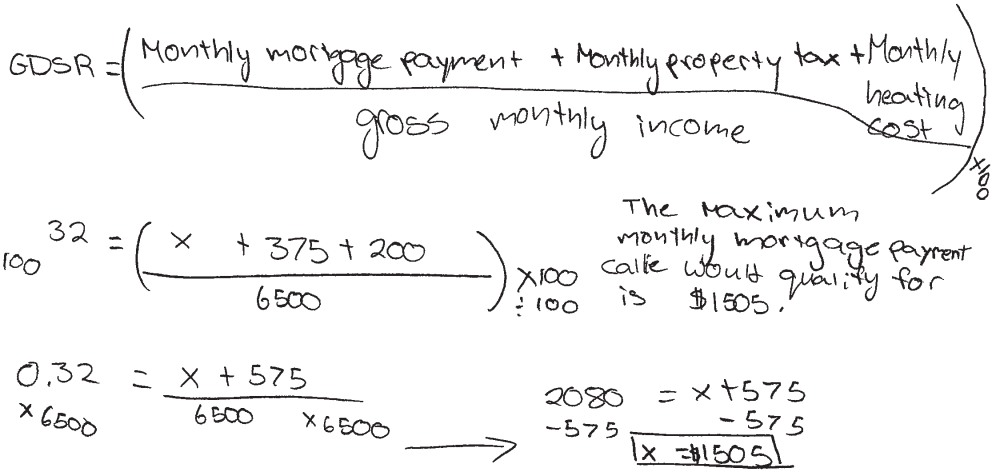
Callie wants to buy a house in a new neighbourhood.

÷12 = 375

- The average property taxes in the neighbourhood are $4500.00 per year.
- The average heating costs are $200.00 per month.
- Her gross family income is $78 000.00 per year.

÷12 = 6500

a) Determine the maximum monthly mortgage payment for which Callie would qualify when using the gross debt service ratio. (*2 marks*)



b) The bank offers Callie a mortgage at an interest rate of 3.09%, compounded semi-annually and amortized over 25 years. Based on your answer in (a), determine the maximum mortgage she could afford. (*2 marks*)

N = 25 • 12 = 300
I = 3.09
P/V = • 377, 516.74
PMT = 1505
FV = 0
P/Y = 25
C/Y = 2

$ 377,516.74

The maximum mortgage she could afford would be $377,516.74.

Mark(s): 3/4

1. 0.5 mark for monthly property taxes and gross monthly family income in (a)
2. 0.5 mark for using 32% in (a)
3. 0.5 mark for substitution in (a)
4. 0.5 mark for consistent answer in (a)
6. 1 mark for consistent mortgage value in (b)

Training Exemplar 1

Question 11 **Total: 4 marks**

Callie wants to buy a house in a new neighbourhood.

- The average property taxes in the neighbourhood are $4500.00 per year.
- The average heating costs are $200.00 per month.
- Her gross family income is $78 000.00 per year.

a) Determine the maximum monthly mortgage payment for which Callie would qualify when using the gross debt service ratio. (*2 marks*)

GDSR = $\frac{\text{monthly mortgage payment + monthly property taxes + monthly heating cost}}{\text{gross monthly income}} \times 100$

$\frac{4500}{12} = 375$

$\frac{78000}{12} = 6500$

GDSR = $\frac{\text{monthly mortgage payment} + 375 + 200}{6500} \times 100$

GDSR = $\frac{1500 + 375 + 200}{6500} \times 100$

$= 32\%$

Maximum mortgage payment would be $1500 per month.

b) The bank offers Callie a mortgage at an interest rate of 3.09%, compounded semi-annually and amortized over 25 years. Based on your answer in (a), determine the maximum mortgage she could afford. (*2 marks*)

N = 50
I = 3.09
PV = 0
PMT = -1500
FV = 0
P/y = 2
C/y = 2
END
FV = 111 885.52

$= \$111\,885.52$

Training Exemplar 2

Question 11 **Total: 4 marks**

Callie wants to buy a house in a new neighbourhood.

- The average property taxes in the neighbourhood are $4500.00 per year.
- The average heating costs are $200.00 per month.
- Her gross family income is $78 000.00 per year.

a) Determine the maximum monthly mortgage payment for which Callie would qualify when using the gross debt service ratio. (*2 marks*)

$4,500 \div 12 = 375$

$78,000 \div 12 = 6,500$

$32 = \frac{(MP + 375 + 200)}{6,500} \times 100$

$\div 100 \qquad \div 100$

$0.32 = \frac{(MP + 575)}{6,500}$

$\times 6,500 \qquad \times 6,500$

$2,080 = MP + 575$

$-575 \qquad -575$

$1,505 = MP$

∴ $1,505

b) The bank offers Callie a mortgage at an interest rate of 3.09%, compounded semi-annually and amortized over 25 years. Based on your answer in (a), determine the maximum mortgage she could afford. (*2 marks*)

PV = Loan

ILA = ?

FLA = 0

MP = 1,505

Ir = 3.09

Y = 25

S/E

ILA = $314,258.15

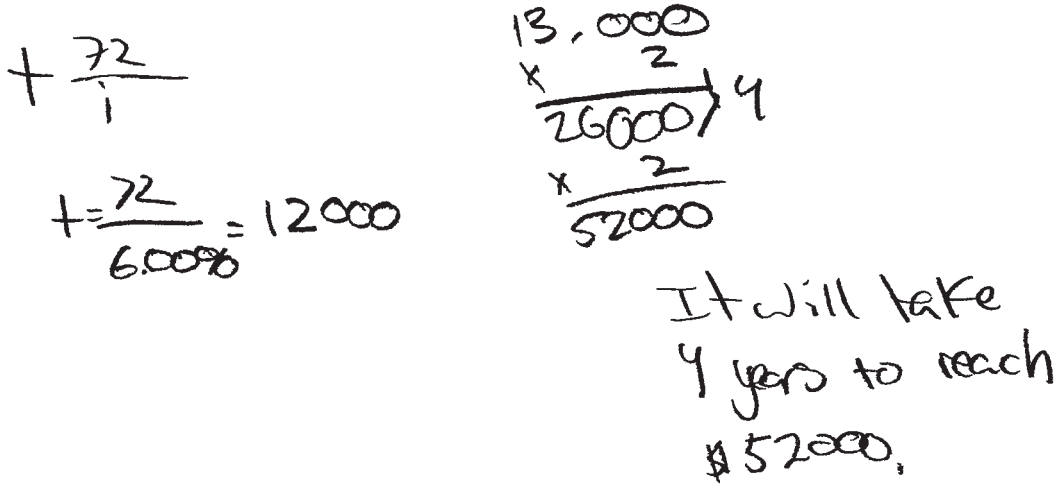
∴ The maximum she can afford is $314,258.15

Marking Exemplar 1

Question 12 **Total: 1 mark**

Suchitra invests $13 000.00 at an interest rate of 6.00%.

Using the Rule of 72, estimate the number of years it will take for her investment to reach a value of $52 000.00.



Mark(s): 0/1

→ no criteria met

Marking Exemplar 2

Question 12 — Total: 1 mark

Suchitra invests $13 000.00 at an interest rate of 6.00%.

Using the Rule of 72, estimate the number of years it will take for her investment to reach a value of $52 000.00.

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

Mark(s): 0.5/1

1. 0.5 mark for doubling time (12 years)

Training Exemplar 1

Question 12 **Total: 1 mark**

Suchitra invests $13 000.00 at an interest rate of 6.00%.

Using the Rule of 72, estimate the number of years it will take for her investment to reach a value of $52 000.00.

72 ÷ 6 = 12

12 · 2 = 24 years

52000 ÷ 13000 = 4 double twice

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Marking Exemplar 1

Question 13 **Total: 6 marks**

Geoff and Jamie are 38 years old and plan to retire at age 60.

Geoff started to invest when he turned 18 years old.

- He made an initial investment of $1000.00.
- He invested $250.00 per month at an interest rate of 5.00%, compounded monthly, until he turned 38 years old.

a) Determine the value of Geoff's investment at age 38. (*2 marks*)

38 - 18 = 20

N = 20 x 12
I = 5
PV = -1000
PMT = -250
FV = ? ← 10 547.06$
P/y = 12
C/y = 12

7.

(b) Geoff stops monthly investments at 38 years old and lets the investment earn interest until he turns 60 years old. The interest rate will remain at 5.00%, compounded monthly. Determine the value of Geoff's investment when he turns 60. (*2 marks*)

60 - 38 = 22

N = 22 x 12
I = 5
PV = -1000
PMT = 0
FV = ? ← 2997.31$
P/y = 12
C/y = 12

Jamie starts to invest at 38 years old.

- She makes an initial investment of $1000.00.
- She makes monthly deposits at an interest rate of 5.00%, compounded monthly, until she turns 60 years old.

c) Determine the monthly deposit amount Jamie should make to match Geoff's total investment in (b). (*2 marks*)

N = 22×12
I = 5
PV = -1000
PMT = ? ← 3.38$
Fv = 2,997.31
P/y = 12
C/y = 12

Sorry I messed up b and now it messed up c...

Mark(s): 5/6

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

Marking Exemplar 2

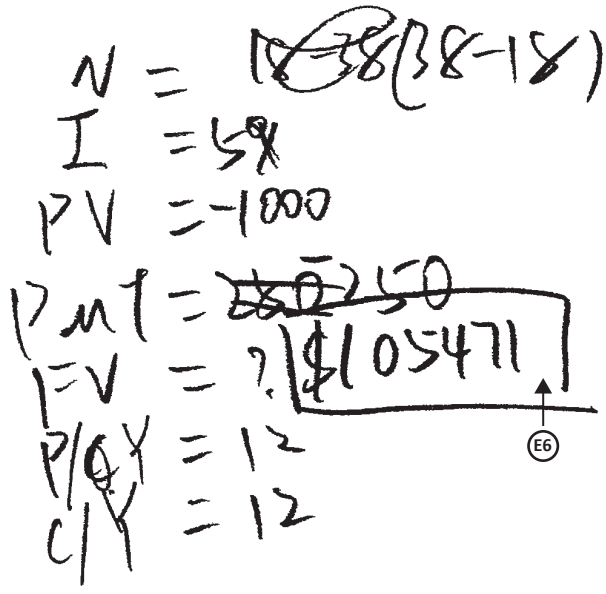
Question 13 — Total: 6 marks

Geoff and Jamie are 38 years old and plan to retire at age 60.

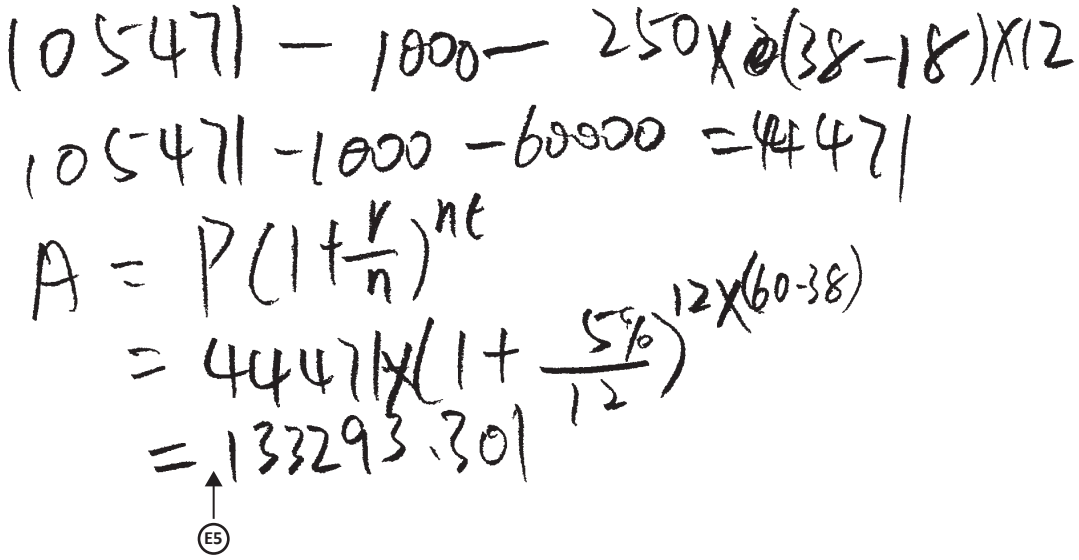
Geoff started to invest when he turned 18 years old.

- He made an initial investment of $1000.00.
- He invested $250.00 per month at an interest rate of 5.00%, compounded monthly, until he turned 38 years old.

a) Determine the value of Geoff's investment at age 38. (*2 marks*)



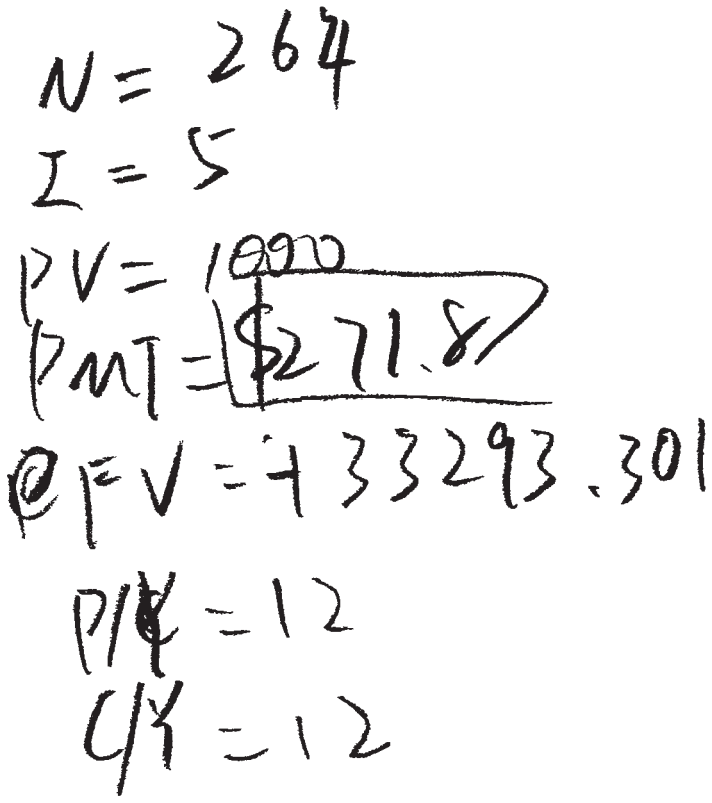
b) Geoff stops monthly investments at 38 years old and lets the investment earn interest until he turns 60 years old. The interest rate will remain at 5.00%, compounded monthly. Determine the value of Geoff's investment when he turns 60. (*2 marks*)



Jamie starts to invest at 38 years old.

- She makes an initial investment of $1000.00.
- She makes monthly deposits at an interest rate of 5.00%, compounded monthly, until she turns 60 years old.

c) Determine the monthly deposit amount Jamie should make to match Geoff's total investment in (b). (*2 marks*)



Mark(s): 5/6

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

E6 does not express the answer to the appropriate number of decimal places, including monetary values to two decimal places in (a)

E5 does not include the dollar sign for monetary values in (b)

Training Exemplar 1

Question 13 — Total: 6 marks

Geoff and Jamie are 38 years old and plan to retire at age 60.

Geoff started to invest when he turned 18 years old.

- He made an initial investment of $1000.00.
- He invested $250.00 per month at an interest rate of 5.00%, compounded monthly, until he turned 38 years old.

a) Determine the value of Geoff's investment at age 38. (*2 marks*)

$105 471.05

b) Geoff stops monthly investments at 38 years old and lets the investment earn interest until he turns 60 years old. The interest rate will remain at 5.00%, compounded monthly. Determine the value of Geoff's investment when he turns 60. (*2 marks*)

$316 129.26

Jamie starts to invest at 38 years old.

- She makes an initial investment of $1000.00.
- She makes monthly deposits at an interest rate of 5.00%, compounded monthly, until she turns 60 years old.

c) Determine the monthly deposit amount Jamie should make to match Geoff's total investment in (b). (*2 marks*)

$653.24

Training Exemplar 2

Question 13 **Total: 6 marks**

Geoff and Jamie are 38 years old and plan to retire at age 60.

Geoff started to invest when he turned 18 years old.

- He made an initial investment of $1000.00.
- He invested $250.00 per month at an interest rate of 5.00%, compounded monthly, until he turned 38 years old. 20 years

a) Determine the value of Geoff's investment at age 38. (*2 marks*)

N 20x12 = 240
I = 5
PV 1,000
Pmt -250
Fv =100,045.78
P/y 12
C/y 12

at 38 years old his investment is worth $100,045.78

b) Geoff stops monthly investments at 38 years old and lets the investment earn interest until he turns 60 years old. The interest rate will remain at 5.00%, compounded monthly. Determine the value of Geoff's investment when he turns 60. (*2 marks*)

N 22
I 5.00
PV 100,045.78
Pmt=0
Fv=173206.62
P/y=2
C/y=12

his investment value when he turns 60 will be $173,206.62

Jamie starts to invest at 38 years old.

- She makes an initial investment of $1000.00.
- She makes monthly deposits at an interest rate of 5.00%, compounded monthly, until she turns 60 years old.

c) Determine the monthly deposit amount Jamie should make to match Geoff's total investment in (b). (*2 marks*)

N 264
I 5
PV 1,000
Pmt -367.59
FV 173206.62
P/Y 12
C/Y 12

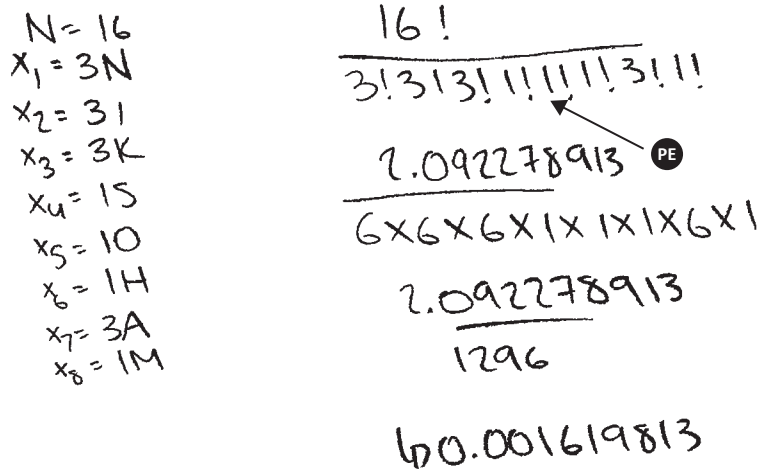
She would have to make monthly investments of $ 367.59

Marking Exemplar 1

Question 16 — Total: 1 mark

The Cree expression NIKISKINOHAMAKAN translates as “I am teaching” in English.

State the expression to represent the total number of ways the letters can be arranged. Leave the answer in factorial form.



Mark(s): 0.5/1

1. 0.5 mark for 16! in numerator
2. 0.5 mark for 3!3!3!3! in denominator

PE 0.5 mark deduction for procedural error

Marking Exemplar 2

Question 16 — Total: 1 mark

The Cree expression, NIKISKINOHAMAKAN translates as “I am teaching” in English.

State the expression to represent the total number of ways the letters can be arranged. Leave the answer in factorial form.

$$\frac{16!}{3!3!3!2!}$$

Mark(s): 0.5/1

1. 0.5 mark for 16! in numerator

Training Exemplar 1

Question 16 **Total: 1 mark**

The Cree expression 'NIKISKINOHAMAKAN' translates as "I am teaching" in English.

State the expression to represent the total number of ways the letters can be arranged. Leave the answer in factorial form.

$n = 16$

$X_1 = 3N$

$X_2 = 3I$

$X_3 = 3K$

$X_4 = 3A$

$X_5 = 4$ other

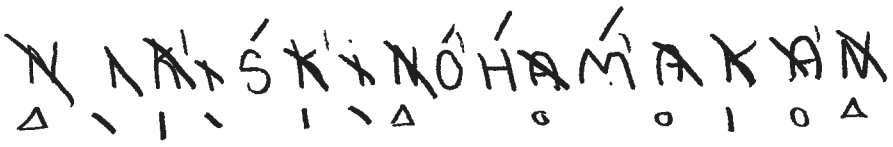
$$\frac{16!}{3!3!3!3!4!} = \frac{2.0923_{\times 10^{13}}}{31104}$$

Training Exemplar 2

Question 16 **Total: 1 mark**

The Cree expression NIKISKINOHAMAKAN translates as “I am teaching” in English.

State the expression to represent the total number of ways the letters can be arranged. Leave the answer in factorial form.



$$\frac{{}^{16}C_{16}}{({}^{3}C_{1})({}^{3}C_{1})({}^{3}C_{1})({}^{3}C_{1})}$$

$$\frac{{}^{16}C_{16}}{12} = \frac{1}{12} =$$

N = 3
I = 3
K = 3
S = 1
O = 1
H = 1
M = 1
A = 3

Marking Exemplar 1

Question 17 — Total: 2 marks

There are 12 people enrolled in a fitness class. They must be divided into three equal groups and rotate through three stations.

a) State the number of possible ways the people in one group can be seated on a rowing machine if there are 4 rowing machines. (*1 mark*)

$4!\,3!\,2!\,1! = 288$

b) State the odds in favour of a group beginning their workout on the rowing machines if there are three workout stations. (*1 mark*)

3 stations

1 : 2

Mark(s): 1/2

❷ 1 mark for answer in (b)

Marking Exemplar 2

Question 17 — Total: 2 marks

There are 12 people enrolled in a fitness class. They must be divided into three equal groups and rotate through three stations.

a) State the number of possible ways the people in one group can be seated on a rowing machine if there are 4 rowing machines. (*1 mark*)

4!

E1

b) State the odds in favour of a group beginning their workout on the rowing machines if there are three workout stations. (*1 mark*)

1:2

Mark(s): 2/2

1 1 mark for answer in (a)

2 1 mark for answer in (b)

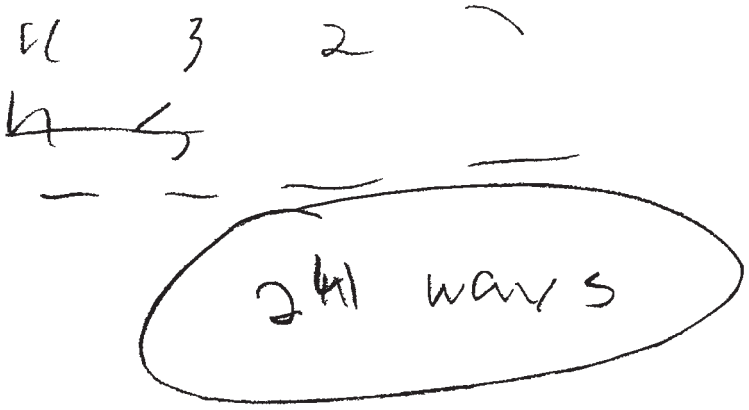
E1 incorrectly states the final answer in (a)

Training Exemplar 1

Question 17 — Total: 2 marks

There are 12 people enrolled in a fitness class. They must be divided into three equal groups and rotate through three stations.

a) State the number of possible ways the people in one group can be seated on a rowing machine if there are 4 rowing machines. (*1 mark*)



b) State the odds in favour of a group beginning their workout on the rowing machines if there are three workout stations. (*1 mark*)

1 : 2

Training Exemplar 2

Question 17 — Total: 2 marks

There are 12 people enrolled in a fitness class. They must be divided into three equal groups and rotate through three stations.

a) State the number of possible ways the people in one group can be seated on a rowing machine if there are 4 rowing machines. (*1 mark*)

$4P_4$ = 24 different ways.

b) State the odds in favour of a group beginning their workout on the rowing machines if there are three workout stations. (*1 mark*)

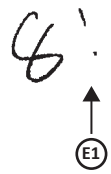
1 : 3

Marking Exemplar 1

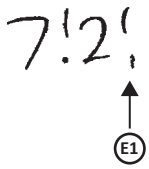
Question 18 — Total: 4 marks

There are 8 students in a drama class going on a field trip to see a play. At the theatre, they must sit in a row of seats.

a) State the number of ways the students can be seated. (*1 mark*)

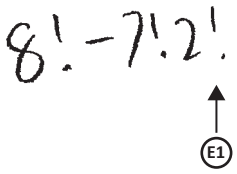


b) Determine the number of ways the students can be seated if Payton and Alex, 2 of the students, sit together. (*2 marks*)



c) Payton and Alex are no longer allowed to sit together.

State the number of ways the students can be seated. (*1 mark*)



Mark(s): 4/4

1. 1 mark for answer in (a)
2. 0.5 mark for 2! or ${}_2P_2$ in (b)
3. 0.5 mark for 7! or ${}_7P_7$ in (b)
4. 1 mark for consistent product in (b)
5. 1 mark for consistent answer in (c)

E1 incorrectly states the final answer in (a), (b), and (c)

Marking Exemplar 2

Question 18 **Total: 4 marks**

There are 8 students in a drama class going on a field trip to see a play. At the theatre, they must sit in a row of seats.

a) State the number of ways the students can be seated. (*1 mark*)

$8! = 40320$ ways

b) Determine the number of ways the students can be seated if Payton and Alex, 2 of the students, sit together. (*2 marks*)

$2!\ 6! = 1440$ ways

c) Payton and Alex are no longer allowed to sit together.

State the number of ways the students can be seated. (*1 mark*)

$\_1 \quad \_6 \quad \_5 \quad \_4 \quad \_3 \quad \_2 \quad \_1 \quad \_1 = 720$ ways

Mark(s): 2.5/4

1. 1 mark for answer in (a)
2. 0.5 mark for 2! or ${}_2P_2$ in (b)
4. 1 mark for consistent product in (b)

Training Exemplar 1

Question 18 **Total: 4 marks**

There are 8 students in a drama class going on a field trip to see a play. At the theatre, they must sit in a row of seats.

a) State the number of ways the students can be seated. (*1 mark*)

$_8P_8 = 40\,320$ ways

b) Determine the number of ways the students can be seated if Payton and Alex, 2 of the students, sit together. (*2 marks*)

$n = 7$ groups

$x_1 =$ Payton + Alex (2)

$\frac{7!}{2!} = 2\,520$ ways

c) Payton and Alex are no longer allowed to sit together.

State the number of ways the students can be seated. (*1 mark*)

$40\,320 - 2\,520 = 37\,800$ ways

Training Exemplar 2

Question 18 **Total: 4 marks**

There are 8 students in a drama class going on a field trip to see a play. At the theatre, they must sit in a row of seats.

a) State the number of ways the students can be seated. (*1 mark*)

$8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = \boxed{40,320}$

b) Determine the number of ways the students can be seated if Payton and Alex, 2 of the students, sit together. (*2 marks*)

$8 \times 7 \times 6 \times 5 \times 4 \times 3 = \boxed{20,160}$

c) Payton and Alex are no longer allowed to sit together.

State the number of ways the students can be seated. (*1 mark*)

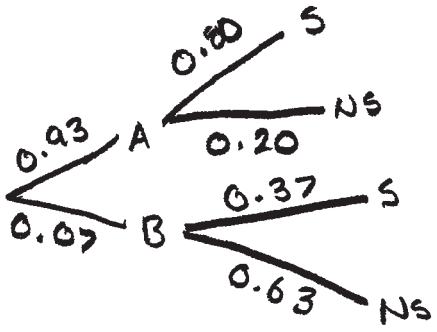
$8 \times 7 \times 6 \times 5 = \boxed{1,680}$

Marking Exemplar 1

Question 19 — Total: 3 marks

The probability that the temperature will be above -15°C on Saturday is 0.93. If the temperature is above -15°C, the probability that Tera will participate in a cross-country ski race on Saturday is 0.80. If the temperature is not above -15°C, the probability that Tera will participate in a cross-country ski race is 0.37.

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



b) Determine the probability that Tera will participate in the cross-country ski race on Saturday. (*2 marks*)

$0.93 \times 0.80 = 1.73$

$0.07 + 0.37 = 0.44$

$1.73 + 0.44$

$= 2.17 \times 100$

$= 217\%$

Mark(s): 2/3

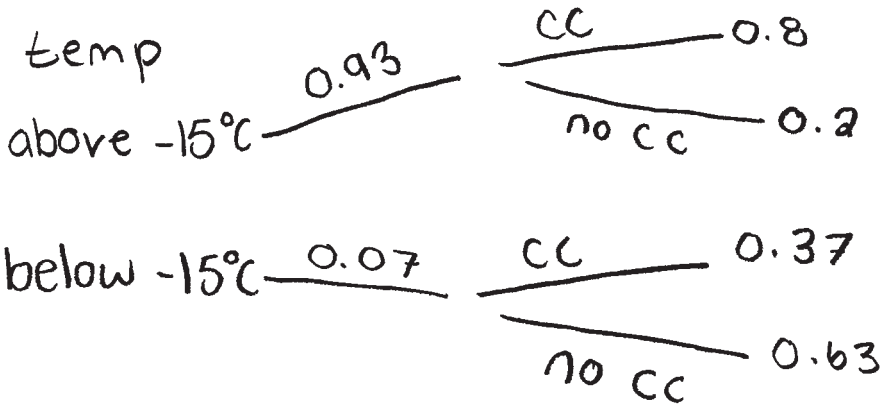
1. 1 mark for appropriate graphic organizer in (a)
4. 1 mark for consistent sum in (b)

Marking Exemplar 2

Question 19 **Total: 3 marks**

The probability that the temperature will be above -15°C on Saturday is 0.93. If the temperature is above -15°C, the probability that Tera will participate in a cross-country ski race on Saturday is 0.80. If the temperature is not above -15°C, the probability that Tera will participate in a cross-country ski race is 0.37.

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



b) Determine the probability that Tera will participate in the cross-country ski race on Saturday. (*2 marks*)

$0.93 \times 0.8 = 0.744 - (0.2 \times 0.93) = 0.558$

$+$

$0.07 \times 0.37 = 0.259 - (0.07 \times 0.63) = 0.2149$

$= 77.29\%$

She will do cross country

Mark(s): 2/3

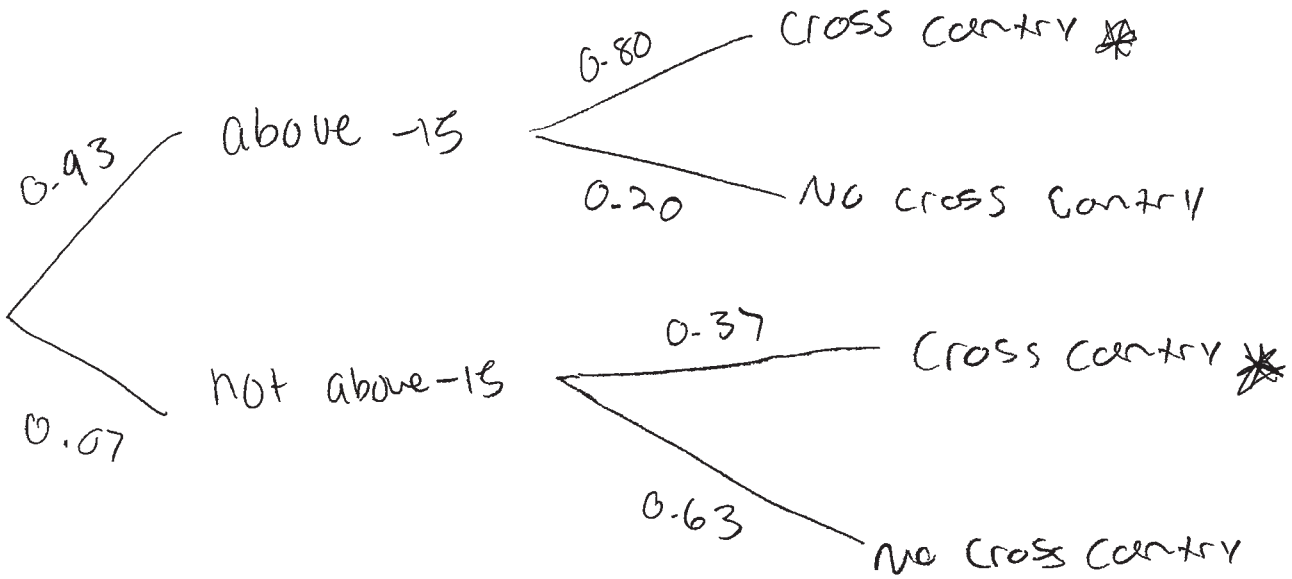
1. 1 mark for appropriate graphic organizer in (a)
4. 1 mark for consistent sum in (b)

Training Exemplar 1

Question 19 **Total: 3 marks**

The probability that the temperature will be above -15°C on Saturday is 0.93. If the temperature is above -15°C, the probability that Tera will participate in a cross-country ski race on Saturday is 0.80. If the temperature is not above -15°C, the probability that Tera will participate in a cross-country ski race is 0.37.

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



b) Determine the probability that Tera will participate in the cross-country ski race on Saturday. (*2 marks*)

$(0.93)(0.80) + (0.07)(0.37)$

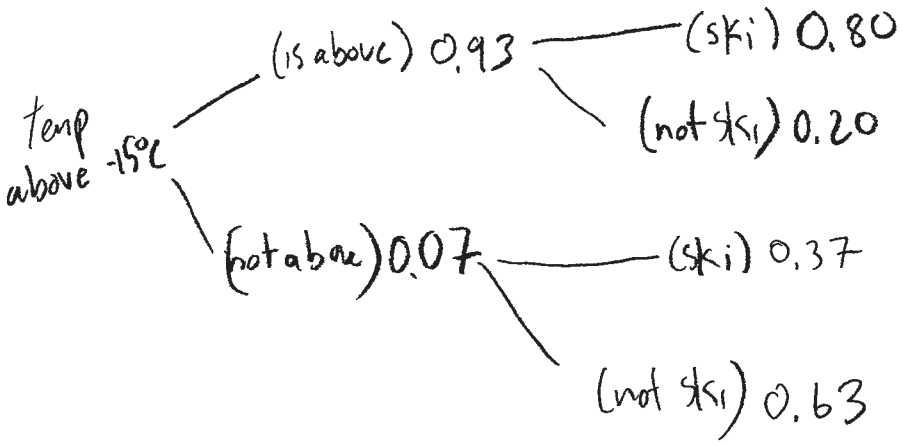
$= 0.77$ or 77%.

Training Exemplar 2

Question 19 **Total: 3 marks**

The probability that the temperature will be above -15°C on Saturday is 0.93. If the temperature is above -15°C, the probability that Tera will participate in a cross-country ski race on Saturday is 0.80. If the temperature is not above -15°C, the probability that Tera will participate in a cross-country ski race is 0.37.

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



b) Determine the probability that Tera will participate in the cross-country ski race on Saturday. (*2 marks*)

$P(\text{ski}) = P(A) + P(B) - P(A \cap B)$

$0.80 + 0.37 -$

$P(A \cap B) = P(A) \cdot P(B/A)$

$0.80 + 0.37 - 0.43$

$= 0.74$

$= 74\%$

Marking Exemplar 1

Question 20 — Total: 3 marks

There are 13 students in Class A and 16 students in Class B that would like to volunteer at a dog shelter. Only 3 students will be randomly selected to volunteer.

a) Determine the number of ways at least 1 student in Class A can be chosen to volunteer. (*2 marks*)

Class A = 13

Class B = 16

$_{16}C_2 \times {}_{13}C_1 = \frac{16!}{2!14!} \times \frac{13!}{1!12!} = (120)(13) = 1560$

$_{16}C_1 \times {}_{13}C_2 = \frac{16!}{1!15!} \times \frac{13!}{2!11!} = (16)(78) = 1248$

$_{16}C_0 \times {}_{13}C_3 = \frac{16!}{0!16!} \times \frac{13!}{3!10!} = (1)(286) = 286$

3094 ways

b) Determine the probability that all 3 students chosen are from Class B. (*1 mark*)

120

$_{16}C_3 = \frac{16!}{3!13!} = 560$

$13 + 16 = 29$

$_{29}C_3 = \frac{29}{3!26!} = 3654$

$\frac{560}{3654} = 0.153 = 15.3\%$

Mark(s): 3/3

1. 0.5 mark for $_{13}C_1 \times {}_{16}C_2$ in (a)
2. 0.5 mark for a second case in (a)
3. 0.5 mark for the third case in (a)
4. 0.5 mark for consistent sum in (a)
5. 0.5 mark for numerator in (b)
6. 0.5 mark for denominator in (b)

Marking Exemplar 2

Question 20 **Total: 3 marks**

There are 13 students in Class A and 16 students in Class B that would like to volunteer at a dog shelter. Only 3 students will be randomly selected to volunteer.

a) Determine the number of ways at least 1 student in Class A can be chosen to volunteer. (*2 marks*)

$_{13}C_1 + {}_{13}C_2 + {}_{13}C_3$

$13 + 78 + 286$

377 ways for
AT LEAST 1 student in class A
to be chosen

b) Determine the probability that all 3 students chosen are from Class B. (*1 mark*)

$_{16}C_3 = 560$

$13+16=29 \qquad {}_{29}C_3 = 3654$

$$\frac{560}{3654} = \frac{40}{261}$$

$$P(3 \text{ from } B) = \frac{40}{261} = 15.33\%$$

Mark(s): 1.5/3

4. 0.5 mark for consistent sum in (a)
5. 0.5 mark for numerator in (b)
6. 0.5 mark for denominator in (b)

Training Exemplar 1

Question 20 — Total: 3 marks

There are 13 students in Class A and 16 students in Class B that would like to volunteer at a dog shelter. Only 3 students will be randomly selected to volunteer.

a) Determine the number of ways at least 1 student in Class A can be chosen to volunteer. (*2 marks*)

$${}_{13}C_1 \cdot {}_{16}C_2 + {}_{13}C_2 \cdot {}_{16}C_1 + {}_{13}C_3 \cdot {}_{16}C_0$$

b) Determine the probability that all 3 students chosen are from Class B. (*1 mark*)

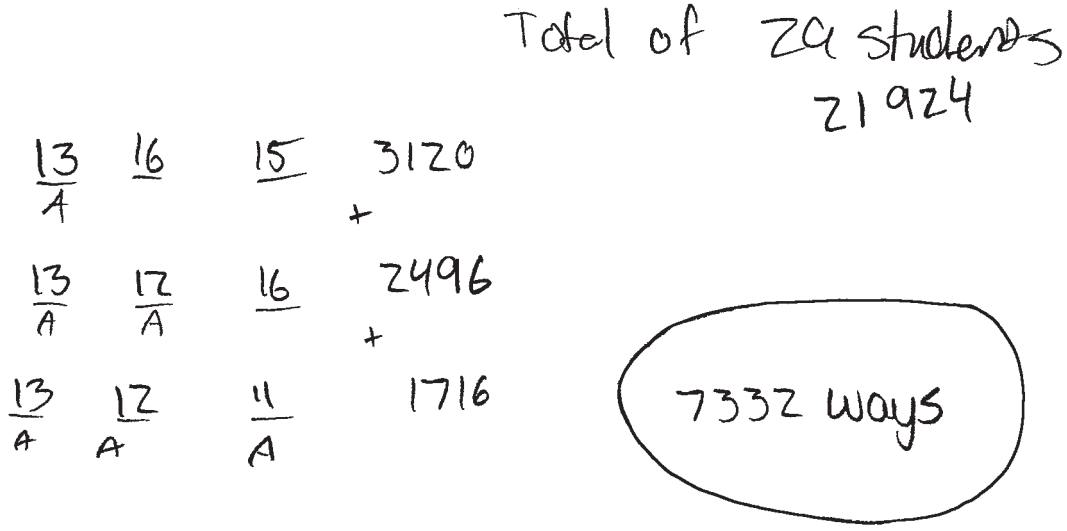
$${}_{13}C_0 \cdot {}_{16}C_3 = 560$$

Training Exemplar 2

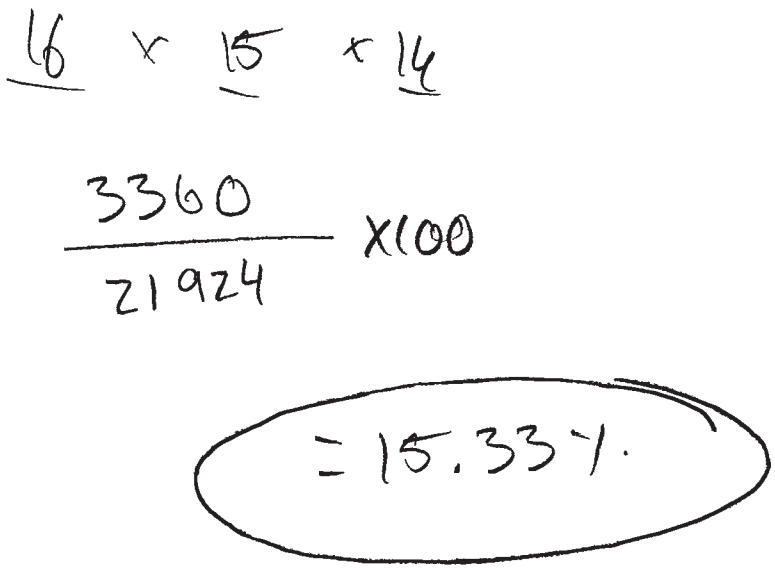
Question 20 **Total: 3 marks**

There are 13 students in Class A and 16 students in Class B that would like to volunteer at a dog shelter. Only 3 students will be randomly selected to volunteer.

a) Determine the number of ways at least 1 student in Class A can be chosen to volunteer. (*2 marks*)



b) Determine the probability that all 3 students chosen are from Class B. (*1 mark*)

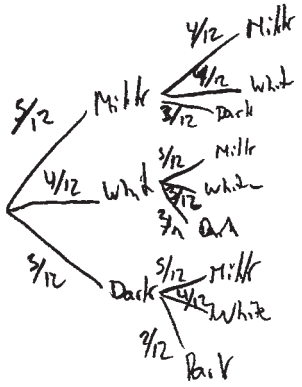


Marking Exemplar 1

Question 21 — Total: 2 marks

Danielle received a bag of chocolates for her birthday. There are 5 milk chocolates, 4 white chocolates, and 3 dark chocolates in the bag.

She randomly picks 2 chocolates from the bag, without replacement. Determine the probability that both chocolates are the same kind.



$$\text{Milk} = \frac{5}{12} \times \frac{4}{12} = \frac{20}{144} = 13.89\%$$

$$\text{White} = \frac{4}{12} \times \frac{3}{12} = \frac{12}{144} = 8.33\%$$

$$\text{Dark} = \frac{3}{12} \times \frac{2}{12} = \frac{6}{144} = 4.17\%$$

Mark(s): 1/2

- ❷ 0.5 mark for considering dependency in the numerator
- ❸ 0.5 mark for demonstrating multiplication in three cases

Marking Exemplar 2

Question 21 — Total: 2 marks

Danielle received a bag of chocolates for her birthday. There are 5 milk chocolates, 4 white chocolates, and 3 dark chocolates in the bag.

She randomly picks 2 chocolates from the bag, without replacement. Determine the probability that both chocolates are the same kind.

$\frac{5}{12} \times \frac{4}{11} = 0.15$

$\frac{4}{12} \times \frac{3}{11} = 0.91$

$\frac{3}{12} \times \frac{2}{11} = 0.45$

$0.15 \times 0.91 \times 0.45 = 0.06$

PE

6%

Mark(s): 1/2

1. 0.5 mark for considering dependency in the denominator
2. 0.5 mark for considering dependency in the numerator
3. 0.5 mark for demonstrating multiplication in three cases

PE 0.5 mark deduction for procedural error

Training Exemplar 1

Question 21 **Total: 2 marks**

Danielle received a bag of chocolates for her birthday. There are 5 milk chocolates, 4 white chocolates, and 3 dark chocolates in the bag.

She randomly picks 2 chocolates from the bag, without replacement. Determine the probability that both chocolates are the same kind.

$$P(W_1) \times P(W_2|W_1) + P(M_1) \times P(M_2|M_1) + P(D_1) \times P(D_2|D_1)$$

$$\frac{4}{12} \times \frac{3}{11} + \frac{5}{12} \times \frac{4}{11} + \frac{3}{12} \times \frac{2}{11}$$

$$\frac{12}{132} + \frac{20}{132} + \frac{6}{136} = \frac{38}{136} \rightarrow \frac{19}{68}$$

Training Exemplar 2

Question 21 **Total: 2 marks**

Danielle received a bag of chocolates for her birthday. There are 5 milk chocolates, 4 white chocolates, and 3 dark chocolates in the bag.

She randomly picks 2 chocolates from the bag, without replacement. Determine the probability that both chocolates are the same kind.

milk

$P(C_1 \cap C_2) = P(C_1) \cdot P(C_2|C_1)$

$= \frac{5}{12} \cdot \frac{4}{11}$

$\frac{20}{132}$

15%.

white

$= \frac{4}{12} \cdot \frac{3}{11}$

$= \frac{12}{132}$

9%.

dark

$\frac{3}{12} \cdot \frac{2}{11}$

$= \frac{6}{132}$

5%.

Marking Exemplar 1

Question 22 — Total: 4 marks

Mandy makes 7 hats for a birthday party.

- The slant height of each hat is 5.996 in.
- The radius of each hat is 2.5 in.

a) State the surface area of one hat. (*1 mark*)

$SA = \pi(2.5)\sqrt{2.5^2 + 5.996^2} + \pi(2.5)^2$

$= 70.66 \text{ in}^2$

b) Mandy adds 5% more paper per hat for gluing purposes. Determine the total amount of paper needed to make all 7 hats. (*1 mark*)

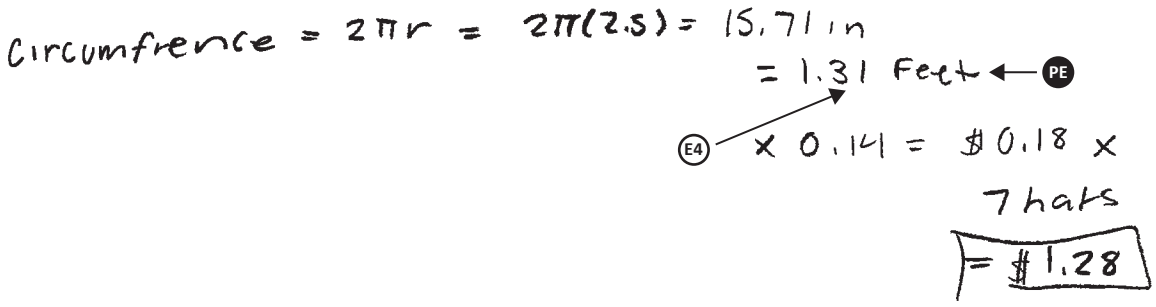
$70.66 \times 1.05 = 74.19 \text{ in}^2 \times 7$

$= 519.33 \text{ in}^2$

c) Mandy adds a ribbon around the base of each hat.

- The ribbon is sold by the foot.
- The cost of ribbon is $0.14 per foot, taxes included.

Determine the total cost to add a ribbon around the base of all 7 hats. (*2 marks*)



Mark(s): 2.5/4

- 2 0.5 mark for consistent total amount of paper for one hat in (b)
- 3 0.5 mark for consistent total amount of paper for all seven hats in (b)
- 4 0.5 mark for circumference of one hat in (c)
- 5 0.5 mark for consistent circumference of seven hats in (c)
- 6 0.5 mark for converting either price or measurement in (c)
- 7 0.5 mark for consistent total cost in (c)
- PE 0.5 mark deduction for procedural error in (c)
- E4 does not use whole units for materials purchased in design and measurement questions in (c)

Marking Exemplar 2

Question 22 — Total: 4 marks

Mandy makes 7 hats for a birthday party.

- The slant height of each hat is 5.996 in.
- The radius of each hat is 2.5 in.

a) State the surface area of one hat. (*1 mark*)

$\pi rs = \pi \times 2.5 \times 5.996$ (E5)

$= 47.09 \text{ in}^3$

b) Mandy adds 5% more paper per hat for gluing purposes. Determine the total amount of paper needed to make all 7 hats. (*1 mark*)

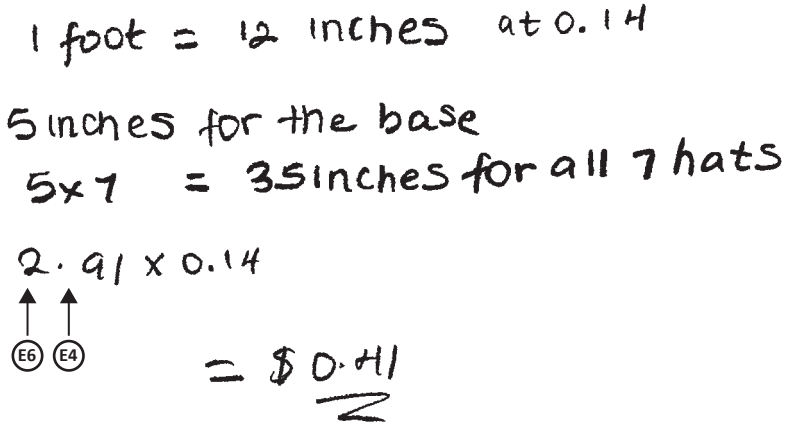
$47.09 + 2.35 = 49.44 \text{ inch}^3$ (E6, E5)

$= 49.44 \times 7 = 364.08 \text{ inch}^3$ (E3)

c) Mandy adds a ribbon around the base of each hat.

- The ribbon is sold by the foot.
- The cost of ribbon is $0.14 per foot, taxes included.

Determine the total cost to add a ribbon around the base of all 7 hats. (*2 marks*)



Mark(s): 3.5/4

1. 1 mark for consistent surface area in (a)
2. 0.5 mark for consistent total amount of paper for one hat in (b)
3. 0.5 mark for consistent total amount of paper for all seven hats in (b)
5. 0.5 mark for consistent circumference of seven hats in (c)
6. 0.5 mark for converting either price or measurement in (c)
7. 0.5 mark for consistent total cost in (c)

E5 confuses square and cubic units in (a) and (b)
E3 makes a transposition error (changing order of digits) in (b)
E6 rounds too soon in (b)
E4 does not use whole units for materials purchased in design and measurement questions in (c)
E6 rounds incorrectly in (c)

Training Exemplar 1

Question 22 **Total: 4 marks**

Mandy makes 7 hats for a birthday party.

- The slant height of each hat is 5.996 in.
- The radius of each hat is 2.5 in.

a) State the surface area of one hat. (*1 mark*)

$2\pi rh$

$2\pi \cdot 2.5 \cdot 5.996 = 94.18$

Surface area is 94.18 in

b) Mandy adds 5% more paper per hat for gluing purposes. Determine the total amount of paper needed to make all 7 hats. (*1 mark*)

$94.18 \div 100 \times 5 = 4.709 + 94.18$

$= 98.889 \times 7$

$= 692.22$ in

c) Mandy adds a ribbon around the base of each hat.

- The ribbon is sold by the foot.
- The cost of ribbon is $0.14 per foot, taxes included.

Determine the total cost to add a ribbon around the base of all 7 hats. (*2 marks*)

15.707 = 109.949 ÷ 12
= 9.1624
= 10

10 ribbons × 0.14
= 1.4

The cost for ribbon around 7 hats is $1.40

Training Exemplar 2

Question 22 **Total: 4 marks**

Mandy makes 7 hats for a birthday party.

- The slant height of each hat is 5.996 in.
- The radius of each hat is 2.5 in.

a) State the surface area of one hat. (*1 mark*)

SA no circle $= \pi r s$
$= \pi \cdot 2.5 \cdot 5.996$
$= 47.09 \text{ in}^2$

SA $= 47.09 \text{ in}^2$

b) Mandy adds 5% more paper per hat for gluing purposes. Determine the total amount of paper needed to make all 7 hats. (*1 mark*)

$47.09 \times 0.05 = 2.3545 + 47.09$
$= 49.44$ per hat
all hats $= 49.44 \times 7$
$= 346.11 \text{ in}^2$

c) Mandy adds a ribbon around the base of each hat.

- The ribbon is sold by the foot.
- The cost of ribbon is $0.14 per foot, taxes included.

Determine the total cost to add a ribbon around the base of all 7 hats. (*2 marks*)

$C = 2\pi r$
$= 2\pi \cdot 2.5$

c per 1 hat $= 15.71$ in

$\frac{109.96 \text{ in}}{12} = 9.16 \text{ ft} \times 0.14$

$= 1.28 + 9.16$

$= \$10.44$

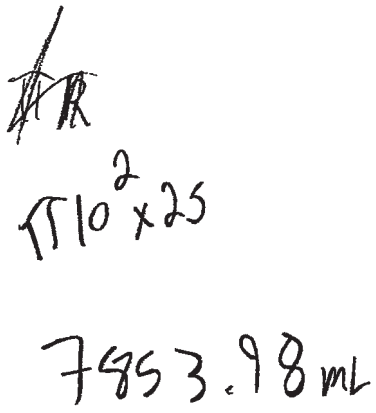
Marking Exemplar 1

Question 23 — Total: 4 marks

Zoey bought honey contained in a cylindrical pail.

- The pail has a diameter of 20 cm.
- The pail has a height of 25 cm.

a) Calculate the amount of honey in the pail, assuming the pail is filled to the top. (*1 mark*)



b) Zoey wants to empty the honey from the pail into jars. Each jar can contain 350 mL (1 mL = 1 cm^3) of honey. State the number of jars Zoey will need. (*1 mark*)

c) Determine the minimum cost if a case of 6 jars costs $5.40 and a single jar costs $0.95, taxes included. (*2 marks*)

Mark(s): 2/4

1. 0.5 mark for radius in (a)
2. 0.5 mark for consistent volume in (a)
3. 1 mark for consistent number of jars in (b)

Marking Exemplar 2

Question 23 — Total: 4 marks

Zoey bought honey contained in a cylindrical pail.

- The pail has a diameter of 20 cm.
- The pail has a height of 25 cm.

a) Calculate the amount of honey in the pail, assuming the pail is filled to the top. (*1 mark*)

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

$V = \pi \times 10^2 \times 25$

$V = 7853.98\ cm^3$

b) Zoey wants to empty the honey from the pail into jars. Each jar can contain 350 mL (1 mL = 1 cm^3) of honey. State the number of jars Zoey will need. (*1 mark*)

$$\frac{7853.98\ cm^3}{350\ mL} = 22.44$$

She will need to bring 22 jar (E6)

c) Determine the minimum cost if a case of 6 jars costs $5.40 and a single jar costs $0.95, taxes included. (*2 marks*)

?

Mark(s): 2/4

1. 0.5 mark for radius in (a)
2. 0.5 mark for consistent volume in (a)
3. 1 mark for consistent number of jars in (b)
- (E6) rounds incorrectly in (b)

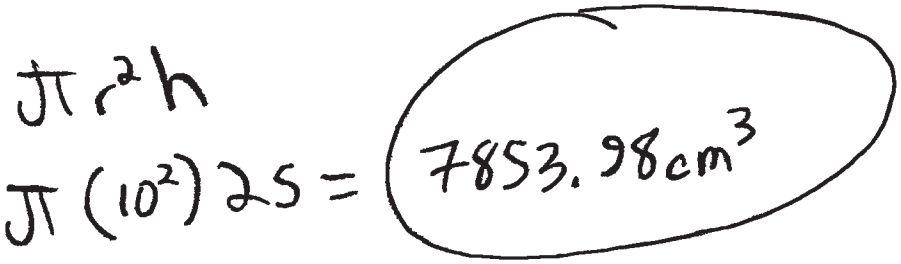
Training Exemplar 1

Question 23 **Total: 4 marks**

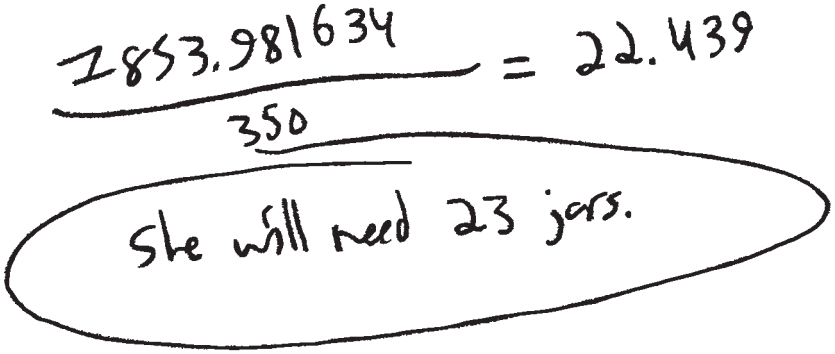
Zoey bought honey contained in a cylindrical pail.

- The pail has a diameter of 20 cm.
- The pail has a height of 25 cm.

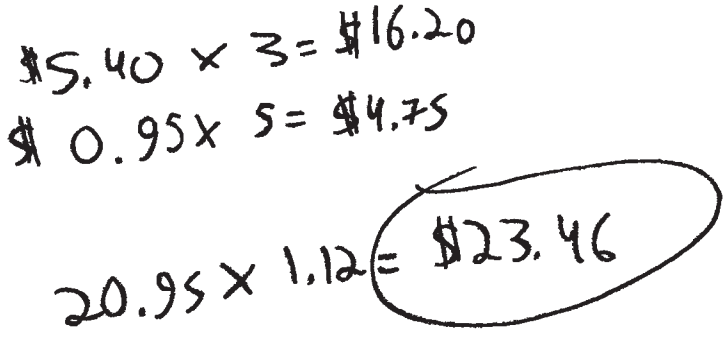
a) Calculate the amount of honey in the pail, assuming the pail is filled to the top. (*1 mark*)



b) Zoey wants to empty the honey from the pail into jars. Each jar can contain 350 mL (1 mL = 1 cm^3) of honey. State the number of jars Zoey will need. (*1 mark*)



c) Determine the minimum cost if a case of 6 jars costs $5.40 and a single jar costs $0.95, taxes included. (*2 marks*)



Training Exemplar 2

Question 23 — Total: 4 marks

Zoey bought honey contained in a cylindrical pail.

- The pail has a diameter of 20 cm.
- The pail has a height of 25 cm.

a) Calculate the amount of honey in the pail, assuming the pail is filled to the top. (*1 mark*)

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi \times 10^2 \times 25$

$V = 2617.99\ cm^3$

$20/2 = 10$

b) Zoey wants to empty the honey from the pail into jars. Each jar can contain 350 mL (1 mL = 1 cm^3) of honey. State the number of jars Zoey will need. (*1 mark*)

$2617.99/350 = 7.48$ jars ↑ 8 jars

c) Determine the minimum cost if a case of 6 jars costs \$5.40 and a single jar costs \$0.95, taxes included. (*2 marks*)

$5.40/6 = 0.9$ per jar

1 jar = \$0.95

The minimum cost of a jar is \$0.90

Marking Exemplar 1

Question 25 — Total: 3 marks

Logically equivalent statements have the same truth tables.

a) Complete the truth table to show that $p \rightarrow q$ and $\sim q \rightarrow \sim p$ are logically equivalent. (*2 marks*)

T→F

p	q	$p \rightarrow q$	$\sim q$	$\sim p$	$\sim q \rightarrow \sim p$
True	True	F	False	False	F
True	False	T	True	False	T
False	True	F	False	True	F
False	False	F	True	True	F

b) Select the statement that $p \rightarrow q$ and $\sim q \rightarrow \sim p$ represent. (*1 mark*)

A) conditional statement and contrapositive statement

B) conditional statement and converse statement

C) inverse statement and contrapositive statement

D) inverse statement and converse statement

Mark(s): 2.5/3

2. 0.5 mark for filling out $\sim q$ column in (a)
3. 0.5 mark for filling out $\sim p$ column in (a)
4. 0.5 mark for consistently filling out $\sim q \rightarrow \sim p$ column in (a)
5. 1 mark for answer in (b) (Correct answer: A)

Training Exemplar 1

Question 25 — Total: 3 marks

Logically equivalent statements have the same truth tables.

a) Complete the truth table to show that $p \rightarrow q$ and $\sim q \rightarrow \sim p$ are logically equivalent. (*2 marks*)

p	q	$p \rightarrow q$	$\sim q$	$\sim p$	$\sim q \rightarrow \sim p$
True	True	True	False	False	False
True	False	False	True	False	True
False	True	True	False	True	False
False	False	True	True	True	False

b) Select the statement that $p \rightarrow q$ and $\sim q \rightarrow \sim p$ represent. (*1 mark*)

A) conditional statement and contrapositive statement

B) conditional statement and converse statement

C) inverse statement and contrapositive statement

D) inverse statement and converse statement

Marking Exemplar 1

Question 26 — Total: 2 marks

Given the following sets:

$A = \{\text{whole numbers}\}$

$B = \{\text{positive odd numbers}\}$

$C = \{\text{prime numbers}\}$

$D = \{\text{positive multiples of two}\}$

a) State an example of one set that is the subset of another using two of the sets above. (*1 mark*)

$A \supset B$

b) State the two given sets that are disjoint. (*1 mark*)

C and D

Mark(s): 1/2

1 1 mark for example of one set that is the subset of another in (a)

Marking Exemplar 2

Question 26 — Total: 2 marks

Given the following sets:

$A = \{\text{whole numbers}\}$

$B = \{\text{positive odd numbers}\}$

$C = \{\text{prime numbers}\}$

$D = \{\text{positive multiples of two}\}$

a) State an example of one set that is the subset of another using two of the sets above. (*1 mark*)

Positive odd number is a subset of whole numbers

b) State the two given sets that are disjoint. (*1 mark*)

D and B

Mark(s): 2/2

1. 1 mark for example of one set that is the subset of another in (a)
2. 1 mark for example of two disjoint sets in (b)

Training Exemplar 1

Question 26 — Total: 2 marks

Given the following sets:

$A = \{\text{whole numbers}\}$

$B = \{\text{positive odd numbers}\}$

$C = \{\text{prime numbers}\}$

$D = \{\text{positive multiples of two}\}$

a) State an example of one set that is the subset of another using two of the sets above. (*1 mark*)

D' of A

b) State the two given sets that are disjoint. (*1 mark*)

B and D,
because you can't have an odd number that is also a multiple of two.

Training Exemplar 2

Question 26 — Total: 2 marks

Given the following sets:

$A = \{\text{whole numbers}\}$

$B = \{\text{positive odd numbers}\}$

$C = \{\text{prime numbers}\}$

$D = \{\text{positive multiples of two}\}$

a) State an example of one set that is the subset of another using two of the sets above. (*1 mark*)

D and B are a subset of A

b) State the two given sets that are disjoint. (*1 mark*)

B and D

Marking Exemplar 1

Question 27 **Total: 1 mark**

A printer is used to number the pages of a 60-page book.

State how many times the digit 5 appears in the page numbers.

5
15
25
35
45
55

7 times

Mark(s): 0/1

→ no criteria met

Marking Exemplar 2

Question 27 — Total: 1 mark

A printer is used to number the pages of a 60-page book.

State how many times the digit 5 appears in the page numbers.

5 , 15, 25, 35, 45, 50-59=10, = 15

Mark(s): 0/1

→ no criteria met

Training Exemplar 1

Question 27 **Total: 1 mark**

A printer is used to number the pages of a 60-page book.

State how many times the digit 5 appears in the page numbers.

6

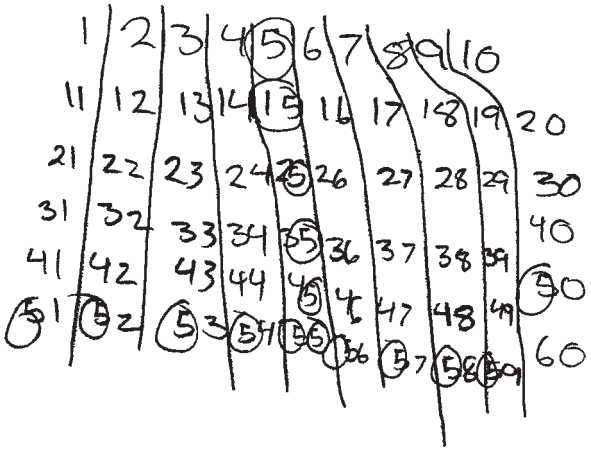
1 2 3 4 5 6
5 15 25 35 45 55

Training Exemplar 2

Question 27 **Total: 1 mark**

A printer is used to number the pages of a 60-page book.

State how many times the digit 5 appears in the page numbers.



16 times

Marking Exemplar 1

Question 28 — Total: 2 marks

Vern conducted an experiment and stated:

"If the water is frozen, then the temperature of the water is below 0°C."

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

IF THE TEMP IS BELOW 0°C, THE WATER IS FROZEN

b) Write the contrapositive of Vern's original statement. (*1 mark*)

IF THE TEMP IS NOT BELOW 0°C, THEN THE WATER IS NOT 0°.

Mark(s): 1.5/2

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

❷ 1 mark for contrapositive of the statement in (b)

Marking Exemplar 2

Question 28 **Total: 2 marks**

Vern conducted an experiment and stated:

"If the water is frozen, then the temperature of the water is below 0°C."

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

If the temperature of the water is below 0°C, then the water is frozen.

b) Write the contrapositive of Vern's original statement. (*1 mark*)

When the water is frozen, the temperature is below 0°C.

Mark(s): 1/2

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

Training Exemplar 1

Question 28 **Total: 2 marks**

Vern conducted an experiment and stated:

"If the water is frozen, then the temperature of the water is below 0°C."

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

If the temperature of the water is below 0°C, then the water is frozen.

b) Write the contrapositive of Vern's original statement. (*1 mark*)

If the temperature of the water is not below 0°C, then the water has frozen.

Training Exemplar 2

Question 28 **Total: 2 marks**

Vern conducted an experiment and stated:

"If the water is frozen, then the temperature of the water is below 0°C."

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

If the temperature of the water is below 0°C then the water is frozen

b) Write the contrapositive of Vern's original statement. (*1 mark*)

If not the temperature of the water is below 0°C then the water is not frozen

Training Exemplar Answers

Question 3 — Total: 1 mark

Training Exemplar 1

Mark(s): 1/1

1 1 mark for answer
ES does not include the units in the final answer

Training Exemplar 2

Mark(s): 0/1

→ no criteria met

Question 4 — Total: 2 marks

Training Exemplar 1

Mark(s): 1.5/2

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)

Question 5 — Total: 3 marks

Training Exemplar 1

Mark(s): 2/3

2 0.5 mark for consistent first x-value in (b)
3 0.5 mark for consistent second x-value in (b)
4 1 mark for consistent difference in (b)

Training Exemplar 2

Mark(s): 0.5/3

2 0.5 mark for consistent first x-value in (b)
ES does not include the units in the final answer in (b)

Question 6 — Total: 3 marks

Training Exemplar 1

Mark(s): 0.5/3

❹ 0.5 mark for consistent answer in (b)

Training Exemplar 2

Mark(s): 2.5/3

❶ 0.5 mark for two values in (a)
❷ 0.5 mark for remaining two values in (a)
❸ 0.5 mark for appropriate work in (b)
❹ 0.5 mark for consistent answer in (b)
❻ 0.5 mark for inclusivity of both upper and lower bounds in (c)
Ⓔ2 does not include one of the following in the equation: "$y =$", "sin", "ln", or "x", or writes parameters separately from the equation in (a)

Question 7 — Total: 7 marks

Training Exemplar 1

Mark(s): 4.5/7

❷ 0.5 mark for using an appropriate domain (i.e., window settings/grid range) for the context of the question in (a)
❺ 0.5 mark for consistent initial value in (b)
❻ 0.5 mark for consistent rate of change in (b)
❼ 1 mark for consistent initial value in (c)
❽ 0.5 mark for appropriate work in (d)
❾ 0.5 mark for consistent answer in (d)
❿ 1 mark for consistent rate of return in (e)
Ⓔ2 does not include one of the following in the equation: "$y =$", "sin", "ln", or "x", or writes parameters separately from the equation in (b)

Question 7 (continued) — Total: 7 marks

Training Exemplar 2

Mark(s): 6.5/7

- 1 1 mark for communicating the context of the graph with appropriate title and/or labels 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 in (a)
- 5 0.5 mark for consistent initial value in (b)
- 6 0.5 mark for consistent rate of change in (b)
- 7 1 mark for consistent initial value in (c)
- 8 0.5 mark for appropriate work in (d)
- 9 0.5 mark for consistent answer in (d)
- 10 1 mark for consistent rate of return in (e)
- E3 inaccurately plots one point on a scatter plot in (a)
- E6 rounds incorrectly in (c)
- E6 does not express the answer to the appropriate number of decimal places, including monetary values to two decimal places in (d)
- E1 does not include a percent sign in (e)

Question 10 — Total: 2 marks

Training Exemplar 1

Mark(s): 1.5/2

- 1 1 mark for appropriate GIC advantage
- LC 0.5 mark deduction for lack of clarity with GIC
- 2 1 mark for appropriate stock advantage

Training Exemplar 2

Mark(s): 2/2

- 1 1 mark for appropriate GIC advantage
- 2 1 mark for appropriate stock advantage

Question 11 — Total: 4 marks

Training Exemplar 1

Mark(s): 2/4

1. 0.5 mark for monthly property taxes and gross monthly family income in (a)
2. 0.5 mark for using 32% in (a)
3. 0.5 mark for substitution in (a)
4. 0.5 mark for consistent answer in (a)

Training Exemplar 2

Mark(s): 3/4

1. 0.5 mark for monthly property taxes and gross monthly family income in (a)
2. 0.5 mark for using 32% in (a)
3. 0.5 mark for substitution in (a)
4. 0.5 mark for consistent answer in (a)
6. 1 mark for consistent mortgage value in (b)

Question 12 — Total: 1 mark

Training Exemplar 1

Mark(s): 1/1

1. 0.5 mark for doubling time (12 years)
2. 0.5 mark for consistent answer

Question 13 — Total: 6 marks

Training Exemplar 1

Mark(s): 3/6

- 2 1 mark for consistent answer in (a)
- 4 1 mark for consistent answer in (b)
- 6 1 mark for consistent answer in (c)
- E6 rounds incorrectly in (a)

Training Exemplar 2

Mark(s): 4/6

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

Question 16 — Total: 1 mark

Training Exemplar 1

Mark(s): 0.5/1

- 1 0.5 mark for 16! in numerator

Training Exemplar 2

Mark(s): 0/1

→ no criteria met

Question 17 — Total: 2 marks

Training Exemplar 1

Mark(s): 2/2

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

Training Exemplar 2

Mark(s): 1/2

- 1 1 mark for answer in (a)

Question 18 — Total: 4 marks

Training Exemplar 1

Mark(s): 3/4

1. 1 mark for answer in (a)
2. 0.5 mark for 2! or ${}_2P_2$ in (b)
3. 0.5 mark for 7! or ${}_7P_7$ in (b)
5. 1 mark for consistent answer in (c)

Training Exemplar 2

Mark(s): 1/4

1. 1 mark for answer in (a)

Question 19 — Total: 3 marks

Training Exemplar 1

Mark(s): 3/3

1. 1 mark for appropriate graphic organizer in (a)
2. 0.5 mark for P(above -15°C, races) in (b)
3. 0.5 mark for P(not above -15°C, races) in (b)
4. 1 mark for consistent sum in (b)

E6 rounds too soon in (b)

Training Exemplar 2

Mark(s): 1/3

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

Question 20 — Total: 3 marks

Training Exemplar 1

Mark(s): 2.5/3

1. 0.5 mark for ${}_{13}C_1 \times {}_{16}C_2$ in (a)
2. 0.5 mark for a second case in (a)
3. 0.5 mark for the third case in (a)
4. 0.5 mark for consistent sum in (a)
5. 0.5 mark for numerator in (b)

E1 incorrectly states the final answer in (a)

Training Exemplar 2

Mark(s): 2/3

3. 0.5 mark for the third case in (a)
4. 0.5 mark for consistent sum in (a)
5. 0.5 mark for numerator in (b)
6. 0.5 mark for denominator in (b)

Question 21 — Total: 2 marks

Training Exemplar 1

Mark(s): 2/2

1. 0.5 mark for considering dependency in the denominator
2. 0.5 mark for considering dependency in the numerator
3. 0.5 mark for demonstrating multiplication in three cases
4. 0.5 mark for consistent sum

E3 makes a transcription error (inaccurate transferring of information)

Training Exemplar 2

Mark(s): 1.5/2

1. 0.5 mark for considering dependency in the denominator
2. 0.5 mark for considering dependency in the numerator
3. 0.5 mark for demonstrating multiplication in three cases

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

Question 22 — Total: 4 marks

Training Exemplar 1

Mark(s): 3/4

- 2 0.5 mark for consistent total amount of paper for one hat in (b)
- 3 0.5 mark for consistent total amount of paper for all seven hats in (b)
- 4 0.5 mark for circumference of one hat in (c)
- 5 0.5 mark for consistent circumference of seven hats in (c)
- 6 0.5 mark for converting either price or measurement in (c)
- 7 0.5 mark for consistent total cost in (c)
- E5 uses incorrect units of measure in (b)

Training Exemplar 2

Mark(s): 3.5/4

- 1 1 mark for consistent surface area in (a)
- 2 0.5 mark for consistent total amount of paper for one hat in (b)
- 3 0.5 mark for consistent total amount of paper for all seven hats in (b)
- 4 0.5 mark for circumference of one hat in (c)
- 5 0.5 mark for consistent circumference of seven hats in (c)
- 6 0.5 mark for converting either price or measurement in (c)
- E4 does not use whole units for materials purchased in design and measurement questions in (c)

Question 23 — Total: 4 marks

Training Exemplar 1

Mark(s): 3.5/4

1. 0.5 mark for radius in (a)
2. 0.5 mark for consistent volume in (a)
3. 1 mark for consistent number of jars in (b)
4. 1 mark for consistent number of cases and jars in (c)
5. 1 mark for consistent minimum amount in (c)

PE 0.5 mark deduction for procedural error in (c)

Training Exemplar 2

Mark(s): 1.5/4

1. 0.5 mark for radius in (a)
3. 1 mark for consistent number of jars in (b)

Question 25 — Total: 3 marks

Training Exemplar 1

Mark(s): 2.5/3

1. 0.5 mark for filling out $p \rightarrow q$ column in (a)
2. 0.5 mark for filling out $\sim q$ column in (a)
3. 0.5 mark for filling out $\sim p$ column in (a)
5. 1 mark for answer in (b) (Correct answer: A)

Question 26 — Total: 2 marks

Training Exemplar 1

Mark(s): 1/2

❷ 1 mark for example of two disjoint sets in (b)

Training Exemplar 2

Mark(s): 2/2

❶ 1 mark for example of one set that is the subset of another in (a)
❷ 1 mark for example of two disjoint sets in (b)

Question 27 — Total: 1 mark

Training Exemplar 1

Mark(s): 0/1

→ no criteria met

Training Exemplar 2

Mark(s): 1/1

❶ 1 mark for answer

Question 28 — Total: 2 marks

Training Exemplar 1

Mark(s): 1/2

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

Training Exemplar 2

Mark(s): 2/2

❶ 1 mark for converse of the statement in (a)
❷ 1 mark for contrapositive of the statement in (b)