Grade 12
Applied Mathematics
Achievement Test

Exemplars

Use in conjunction with *Marking Guide*

January 2024

Manitoba

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 2   **Total: 3 marks**

A pilot determined a function that shows the relation between height and atmospheric pressure:

$$H = 45.786 - 6.902 \ln p$$

where H represents the height of the plane above the ground (in km)
and p represents the atmospheric pressure (in mm of mercury).

a)   Determine the atmospheric pressure at ground level in mm of mercury.

(1 mark)

77.57mm of mercury

b)   A plane is flying at a height of 11 km and the air pressure inside is 561 mm of mercury. Determine the difference between the air pressure inside the plane and the atmospheric pressure outside the plane in mm of mercury. Show your work.

(2 marks)

11➔29.2357➔29.24

561
−29.24
‾‾‾‾‾‾
531.76

Difference of 531.76mm of mercury

> **1 mark:**
> ❸ → 1 mark for consistent answer in (b)

Marking Exemplar 2

Question 2   **Total: 3 marks**

A pilot determined a function that shows the relation between height and atmospheric pressure:

$$H = 45.786 - 6.902 \ln p$$

(handwritten annotation: y under H, x under p)

where *H* represents the height of the plane above the ground (in km)
and *p* represents the atmospheric pressure (in mm of mercury).

a) Determine the atmospheric pressure at ground level in mm of mercury.

(1 mark)

when y = 0, $\boxed{x = 760 \text{ mm of mercury}}$ (E6)

$$H = y$$
$$P = x$$

Desmos

The atmospheric pressure at ground level is 760 mm of mercury

b) A plane is flying at a height of 11 km and the air pressure inside is 561 mm of mercury. Determine the difference between the air pressure inside the plane and the atmospheric pressure outside the plane in mm of mercury. Show your work.

(2 marks)

Desmos   *when the plane is at height y = 11 km, the pressure is* $\boxed{x = 154.468 \text{ mm of murcury}}$

---

2 marks:
❶ → 1 mark for answer in (a)
❷ → 1 mark for *x*-value in (b)

....

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

Training Exemplar 1

Question 2

Total: 3 marks

A pilot determined a function that shows the relation between height and atmospheric pressure:

$$H = 45.786 - 6.902 \ln p$$

where H represents the height of the plane above the ground (in km)
and p represents the atmospheric pressure (in mm of mercury).

a) Determine the atmospheric pressure at ground level in mm of mercury.

(1 mark)

760.312 mm of mercury

b) A plane is flying at a height of 11 km and the air pressure inside is 561 mm of mercury. Determine the difference between the air pressure inside the plane and the atmospheric pressure outside the plane in mm of mercury. Show your work.

(2 marks)

I used Desmos software

$$y = 11$$

154.468mm of mercury

Training Exemplar 2

Question 2   **Total: 3 marks**

A pilot determined a function that shows the relation between height and atmospheric pressure:

$$H = 45.786 - 6.902 \ln p$$

where H represents the height of the plane above the ground (in km)
and p represents the atmospheric pressure (in mm of mercury).

a) Determine the atmospheric pressure at ground level in mm of mercury.

(1 mark)

b) A plane is flying at a height of 11 km and the air pressure inside is 561 mm of mercury. Determine the difference between the air pressure inside the plane and the atmospheric pressure outside the plane in mm of mercury. Show your work.

(2 marks)

$$\boxed{Y=} \quad Y_2 = 11 \rightarrow \boxed{2nd} \quad \boxed{CALC} \quad \boxed{5 \text{ intersect}} \quad 3x \boxed{Enter}$$

154.47

Marking Exemplar 1

Question 3   Total: 4 marks

For a math project, a student visits an amusement park. While riding the roller coaster, they use their smartphone to record their height above the ground as a function of time for a portion of the ride.

They collect the following data:

Time (s)	1	3	15	20	25	30
Height (m)	10	25	28	20	13	20

(x on Time row, y on Height row)

a)   Determine the cubic regression equation that models this data.

(1 mark)

$$y = 0.01x^3 - 0.60x^2 + 8.07x + 3.91$$

b)   Determine the *y*-intercept using your equation in (a).

(1 mark)

$$y = 3.91$$

c)   Explain what the *y*-intercept represents in this situation.

(1 mark)

2nd [calc]
value
x = 0   y = 3.91

3.91 is the constant term of the equation, which is also know as the y-value

d)   Using your equation in (a), determine the maximum height of the roller coaster in the first 20 seconds.

(1 mark)

2nd [calc]
max
x = 9.23   y = 36.62

2nd calc
value
x = 20   y = 18.86

(E1) (E5)

---

3 marks:
❶ → 1 mark for answer in (a)
❷ → 1 mark for consistent answer in (b)
❹ → 1 mark for consistent answer in (d)

....

Ⓔ1 → does not identify the answer in (d)
Ⓔ5 → does not include the units in the final answer in (d)

Marking Exemplar 2

Question 3   **Total: 4 marks**

For a math project, a student visits an amusement park. While riding the roller coaster, they use their smartphone to record their height above the ground as a function of time for a portion of the ride.

They collect the following data:

Time (s)	1	3	15	20	25	30
Height (m)	10	25	28	20	13	20

a)   Determine the cubic regression equation that models this data.

(1 mark)

$$0.01x^3 - 0.60x^2 + 8.07x + 3.91$$

(E2)

b)   Determine the *y*-intercept using your equation in (a).

(1 mark)

$$y = 3.91$$

c)   Explain what the *y*-intercept represents in this situation.

(1 mark)

The height in (m) of the roller coaster.

d)   Using your equation in (a), determine the maximum height of the roller coaster in the first 20 seconds.

(1 mark)

$$Y = 18.86m$$

---

2 marks:

❶ → 1 mark for answer in (a)
❷ → 1 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)

Training Exemplar 1

For a math project, a student visits an amusement park. While riding the roller coaster, they use their smartphone to record their height above the ground as a function of time for a portion of the ride.

They collect the following data:

Time (s)	1	3	15	20	25	30
Height (m)	10	25	28	20	13	20

a) Determine the cubic regression equation that models this data.

(1 mark)

$$y = -0.04x^2 + 1.08x + 15.43$$

b) Determine the *y*-intercept using your equation in (a).

(1 mark)

15.43 m

c) Explain what the *y*-intercept represents in this situation.

(1 mark)

when the student started recording

d) Using your equation in (a), determine the maximum height of the roller coaster in the first 20 seconds.

(1 mark)

28 m

Training Exemplar 2

Question 3   **Total: 4 marks**

For a math project, a student visits an amusement park. While riding
the roller coaster, they use their smartphone to record their height
above the ground as a function of time for a portion of the ride.

They collect the following data:

Time (s)	1	3	15	20	25	30
Height (m)	10	25	28	20	13	20

a)   Determine the cubic regression equation that models this data.

(1 mark)

$$y = 0.01x^3 - 0.60x^2 + 8.07x + 3.91$$

b)   Determine the *y*-intercept using your equation in (a).

(1 mark)

$$3.91 = y \text{ intercept}$$

c)   Explain what the *y*-intercept represents in this situation.

(1 mark)

starting point of the function

d)   Using your equation in (a), determine the maximum height of the roller coaster in the first
     20 seconds.

(1 mark)

$$x = 20 \quad \boxed{y = 18.862 \rightarrow 18.86}$$

(2nd) (calc) 1: value $x = 20$
                        $y = 18.862$

Marking Exemplar 1

Question 4   **Total: 3 marks**

Hummingbirds beat their wings with a period of approximately 0.006 seconds. A transmitter is placed at the tip of a hummingbird's wing to measure the height above the ground.

a) Select the sinusoidal function that could model the relationship
    between the height, h (in feet) and the time, t (in seconds).

(1 mark)

   (A) $h = 0.15\sin(t) + 6$

   B) $h = 0.15\sin(10t) + 6$

   C) $h = 0.15\sin(100t) + 6$

   D) $h = 0.15\sin(1000t) + 6$

b) Using your chosen function in (a), determine the height of the wing at the 17th second.

(1 mark)

$$h = 0.15\sin(17) + 6$$
$$= 6.04 \text{ ft} \quad \text{PE}$$

c) Determine the range of the function you chose in (a).

(1 mark)

$$(0,6)$$

+--+
| **0.5 mark:** |
| ❷ → 1 mark for consistent answer in (b) |
| ⓅⒺ → 0.5 mark deduction for procedural error in (b) |
+--+

Marking Exemplar 2

Question 4	Total: 3 marks

Hummingbirds beat their wings with a period of approximately 0.006 seconds. A transmitter is placed at the tip of a hummingbird's wing to measure the height above the ground.

a) Select the sinusoidal function that could model the relationship between the height, h (in feet) and the time, t (in seconds).

(1 mark)

(A) $h = 0.15\sin(t) + 6$

B) $h = 0.15\sin(10t) + 6$

C) $h = 0.15\sin(100t) + 6$

D) $h = 0.15\sin(1000t) + 6$

b) Using your chosen function in (a), determine the height of the wing at the 17th second.

(1 mark)

5.86 ft at the 17th second

c) Determine the range of the function you chose in (a).

(1 mark)

$(5.85, 6.15)$

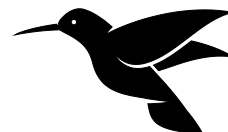---

1.5 marks:
❷ → 1 mark for consistent answer in (b)
❸ → 0.5 mark for upper and lower bounds of the range in (c)

Training Exemplar 1

Hummingbirds beat their wings with a period of approximately 0.006 seconds. A transmitter is placed at the tip of a hummingbird's wing to measure the height above the ground.

a) Select the sinusoidal function that could model the relationship between the height, h (in feet) and the time, t (in seconds).

(1 mark)

    A) $h = 0.15\sin(t) + 6$

    B) $h = 0.15\sin(10t) + 6$

    C) $h = 0.15\sin(100t) + 6$

    D) $h = 0.15\sin(1000t) + 6$

b) Using your chosen function in (a), determine the height of the wing at the 17th second.

(1 mark)

$$\text{analytrace} \rightarrow \text{value}$$

$$x = 17$$

$$(y) \text{ hight} = 5.94 \text{ft}$$

c) Determine the range of the function you chose in (a).

(1 mark)

$$[6.15, 5.85]$$

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Marking Exemplar 1

Question 5   Total: 6 marks
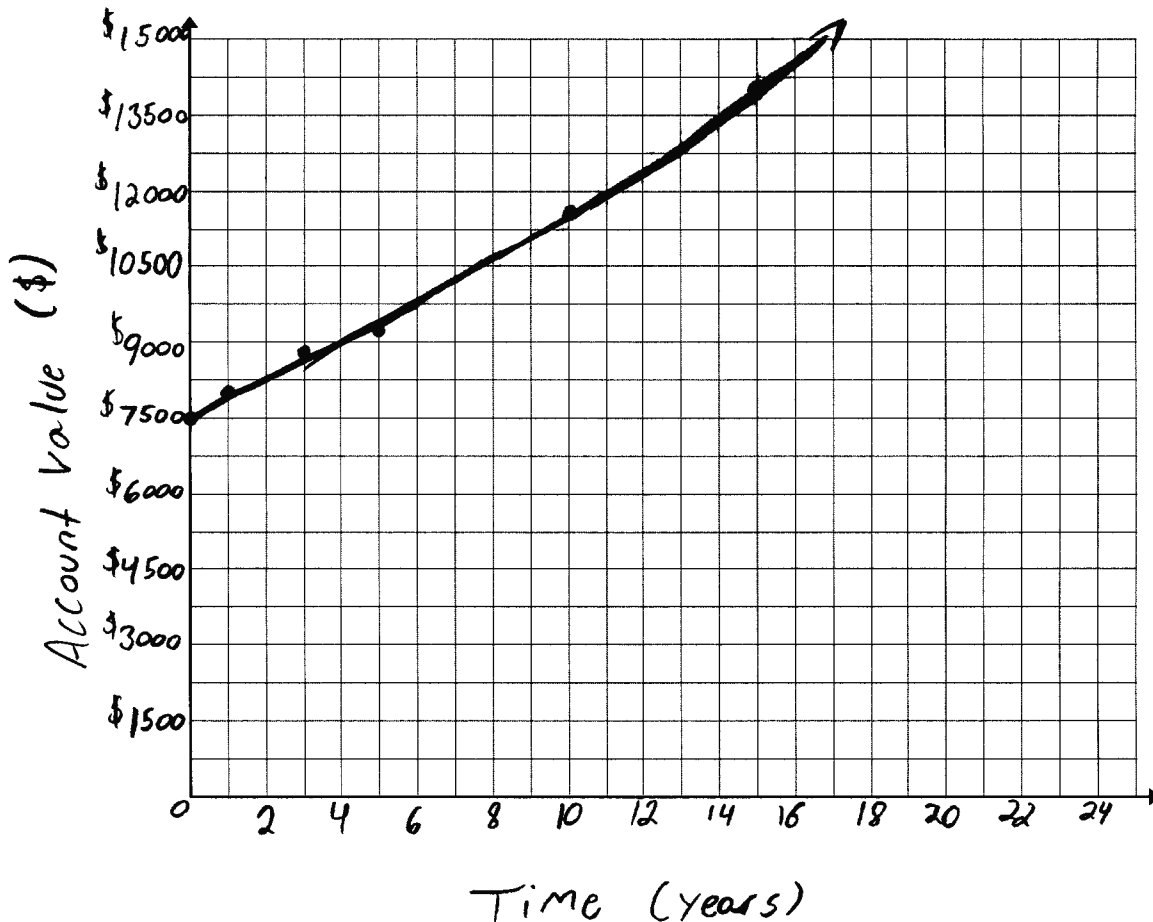
When Jennika was 22 years old, she received $7500.00 from her grandmother. She invested the money and the following data was collected throughout the term (rounded to the nearest dollar).

Time (years)	0	1	3	5	10	15
Account Value ($)	7500	7827	8523	9281	11 486	14 215

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

(3 marks)

b) Determine the exponential equation that best models the data in this situation.
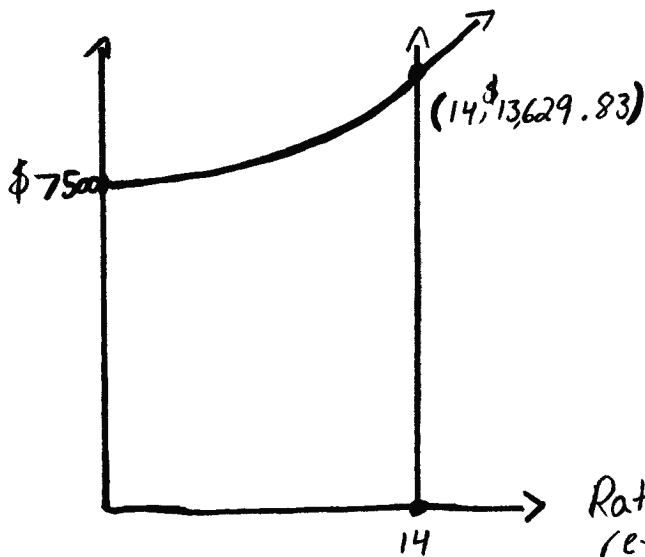
(1 mark)

$$y = 9.43x^2 + 304.98x + 7511.08$$

Marking Exemplar 1 (continued)

c) Determine the rate of return of Jennika's investment when she is 36 years old. Show your work.

(2 marks)

$$36 - 22 = 14$$

$(14, \$13,629.83)$

$\$7500$

14

Rate of return $= \dfrac{\$13,629.83 - \$7500}{\$7500} \times 100$

$$\therefore \; = 81.73\%$$

Marking Exemplar 2

**Question 5**   **Total: 6 marks**

When Jennika was 22 years old, she received $7500.00 from her grandmother. She invested the money and the following data was collected throughout the term (rounded to the nearest dollar).

Time (years)	0	1	3	5	10	15
Account Value ($)	7500	7827	8523	9281	11 486	14 215

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

(3 marks)

JENNIKA'S ACCOUNT VALUE
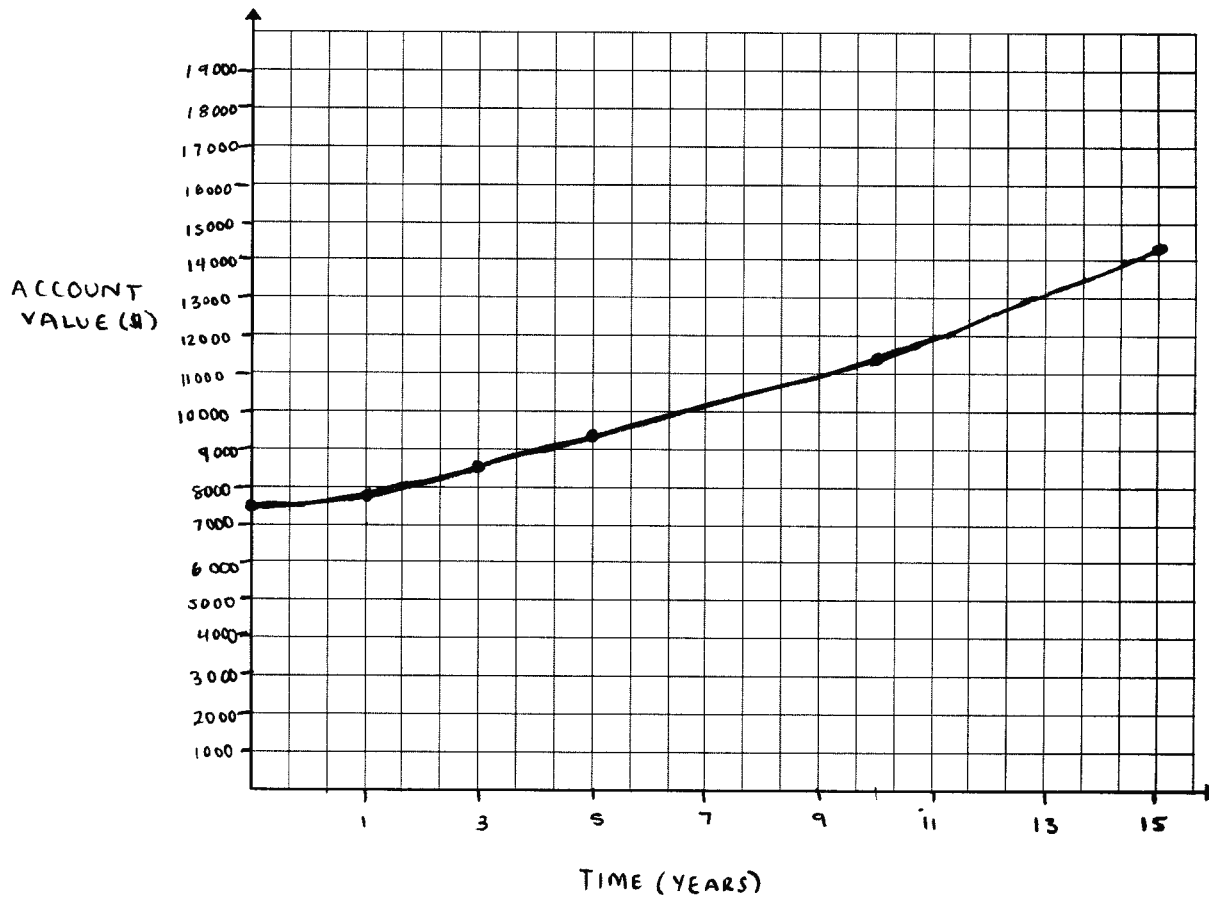
b) Determine the exponential equation that best models the data in this situation.

(1 mark)

$$y = ab^x$$
$$y_1 \sim ab^{x_1}$$
$$\boxed{y = 7499.92(1.04)^x}$$

Marking Exemplar 2 (continued)

c) Determine the rate of return of Jennika's investment when she is 36 years old. Show your work.

(2 marks)

$$\text{Rate of Return (\%)} = \frac{\text{Current Value} - \text{Previous Value}}{\text{Previous Value}} \cdot 100$$

$$\text{Rate of Return (\%)} = \frac{14\,215 - 7500}{7500} \cdot 100$$

$$\boxed{\text{Rate of Return (\%)} = 89.53\%}$$

4 marks:
❶ → 1 mark for communicating the context of the graph with appropriate title and/or labels in (a)
❸ → 1 mark for plotting the data in (a)
❹ → 1 mark for equation in (b)
❼ → 1 mark for consistent rate of return in (c)

Training Exemplar 1

Question 5   **Total: 6 marks**

When Jennika was 22 years old, she received $7500.00 from her grandmother. She invested the money and the following data was collected throughout the term (rounded to the nearest dollar).

Time (years)	0	1	3	5	10	15
Account Value ($)	7500	7827	8523	9281	11 486	14 215

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

account value as a function of time

account value ($)

7499.99

time (years)

b) Determine the exponential equation that best models the data in this situation.
(1 mark)

$$y = 7499.997 \cdot 1.04^x$$

Training Exemplar 1 (continued)

c) Determine the rate of return of Jennika's investment when she is 36 years old.
Show your work.

(2 marks)

Training Exemplar 2

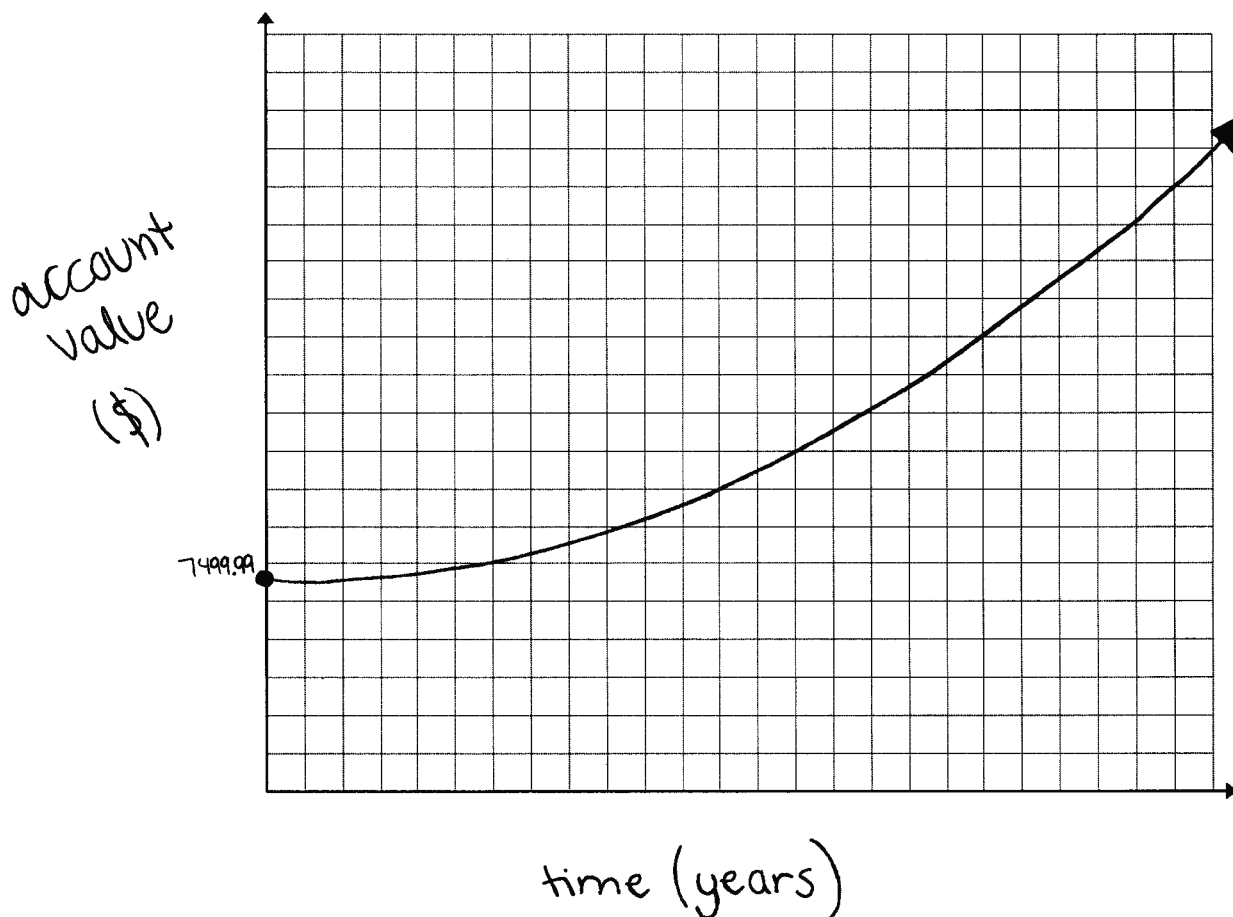**Question 5**   **Total: 6 marks**

When Jennika was 22 years old, she received $7500.00 from her grandmother. She invested the money and the following data was collected throughout the term (rounded to the nearest dollar).

Time (years)	0	1	3	5	10	15
Account Value ($)	7500	7827	8523	9281	11 486	14 215

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

(3 marks)

b)   Determine the exponential equation that best models the data in this situation.

(1 mark)

$$Y = 7499.9973 (1.04135)^x$$

Training Exemplar 2 (continued)

c) Determine the rate of return of Jennika's investment when she is 36 years old.
Show your work.

(2 marks)

$$FV = \$13613.05$$
$$P = 7500$$
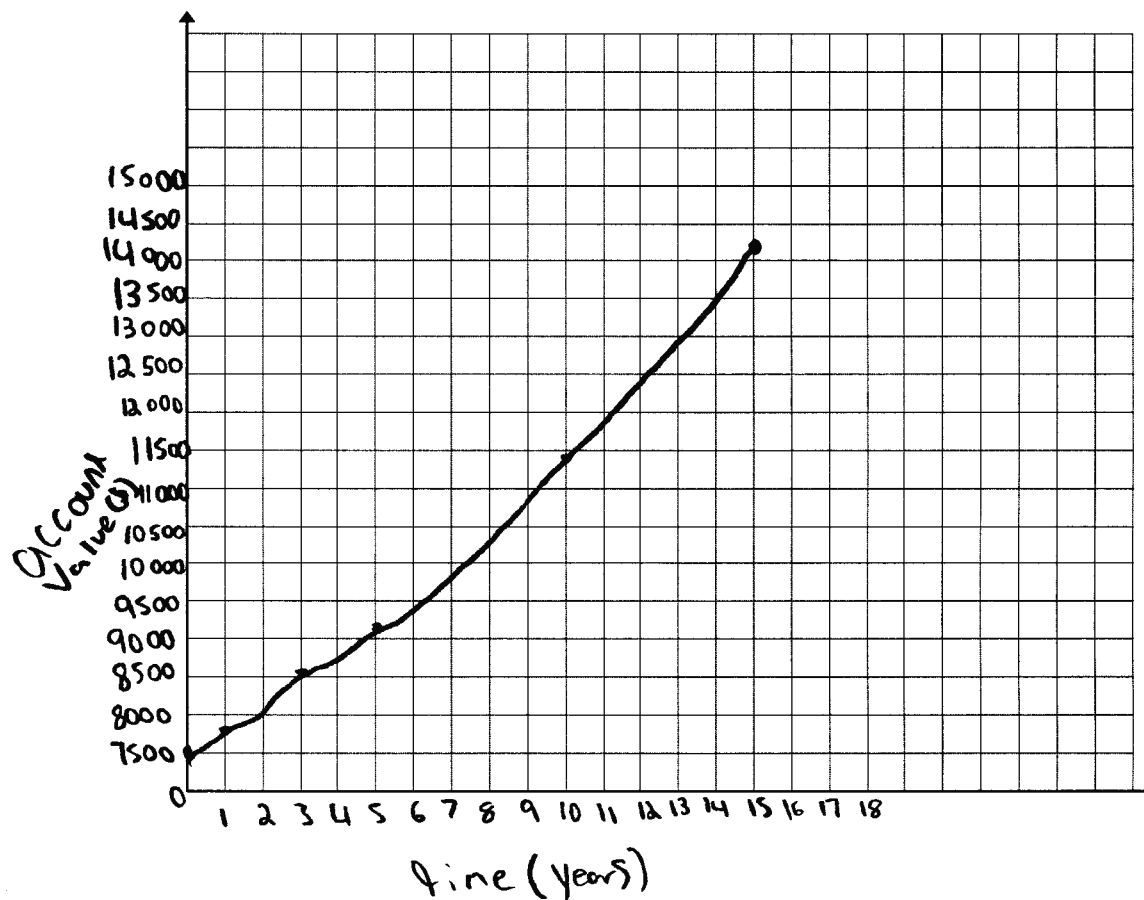
$$r = \frac{13613.05 - 7500}{7500} \times 100$$

$$r = 81.51\%$$

Marking Exemplar 1

Question 6   **Total: 5 marks**

Georgio has two options when investing $15 000.00.

Option 1: He can invest the money at an interest rate of 6.50%, compounded monthly for 5 years.

Option 2: He can invest the money in an account that earns simple interest for 5 years.

a) Determine the value of the investment if he chooses Option 1. Show your work.

(2 marks)

$$N \quad 5 \times 1$$
$$I \quad 6.5$$
$$PV \; -15000$$
$$AMT \; 0 \to 20\,742.26$$
$$FV \; ?$$
$$PY \; 1$$
$$CY \; 12$$

$$\$20\,742.26$$

b) Georgio wants to earn the same amount of interest as he did in (a). Determine the simple interest rate, as a percent, that he would need if he chooses Option 2. Show your work.

(2 marks)

$$r = \frac{I}{(P)(T)} \qquad r = \frac{15000}{15000(5)} = 0.2 \; \boxed{20\%}$$

c) Explain why the simple interest rate in (b) is higher than 6.50%.

(1 mark)

Because he is earning extra when put into an account

> **3 marks:**
> ❶ → 1 mark for appropriate work in (a)
> ❷ → 1 mark for consistent value of investment in (a)
> ❹ → 1 mark for consistent simple interest rate in (b)

Marking Exemplar 2

Question 6   Total: 5 marks

Georgio has two options when investing $15 000.00.

> **Option 1:** He can invest the money at an interest rate of 6.50%, compounded monthly for 5 years.

> **Option 2:** He can invest the money in an account that earns simple interest for 5 years.

a) Determine the value of the investment if he chooses Option 1. Show your work.

(2 marks)

$$N : 5 \cdot 12$$
$$I : 6.50$$
$$PV : -15\ 000$$
$$PMT : 0$$
$$FV : 0?\ \text{Alpha enter} \rightarrow \$733\ 278.58$$
$$P/Y : 01$$
$$C/Y : 12$$

b) Georgio wants to earn the same amount of interest as he did in (a). Determine the simple interest rate, as a percent, that he would need if he chooses Option 2. Show your work.

(2 marks)

$$7\ 33\ 278.58$$
$$-15\ 000$$
$$\underline{718\ 278.58}$$
$$(5 \cdot 12) = \quad = \$11\ 971.31/\text{month}.$$

~~15000~~

$$\frac{100}{15000} \times 11{,}971.31 = \% = 79.81\% \text{ simple interest rate}$$

c) Explain why the simple interest rate in (b) is higher than 6.50%.

(1 mark) Because to earn the same amount of money in both cases the simple interest rate must be higher, the compounded interest grows with each payment. The simple interest rate stays the same.

> **3.5 marks:**
> ❷ → 1 mark for consistent value of investment in (a)
> ❸ → 1 mark for consistent amount of interest in (b)
> ❹ → 1 mark for consistent simple interest rate in (b)
> ❺ → 1 mark for appropriate explanation in (c)
> ❶c → 0.5 mark deduction for lack of clarity in (c)

Training Exemplar 1

Question 6   **Total: 5 marks**

Georgio has two options when investing $15 000.00.

    Option 1: He can invest the money at an interest rate of 6.50%, compounded monthly for 5 years.

    Option 2: He can invest the money in an account that earns simple interest for 5 years.

   a) Determine the value of the investment if he chooses Option 1. Show your work.

(2 marks)

$P = 15000$

$r = 6.5\% \text{ or } 0.065$

$n = 12$

$t = 5$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$ or $$A = 15000\left(1 + \frac{0.065}{12}\right)^{12 \times 5} =$$

$$\boxed{\$20\ 742.26 \text{ after 5 years}}$$

   b) Georgio wants to earn the same amount of interest as he did in (a). Determine the simple interest rate, as a percent, that he would need if he chooses Option 2. Show your work.

(2 marks)

$$I/pt = r \qquad r = \frac{5742.26}{(15 \cdot 5)} = \boxed{76.56}$$

$$I = A - P$$

$$20\ 742.26 - 15000 = \boxed{5742.26}$$

simple interest rate = 76.56

   c) Explain why the simple interest rate in (b) is higher than 6.50%.

(1 mark)

because the amount by which the investment increases is always compounded based on the initial investment amount so if you want to get the same amount that you would get with the compound interest your interest rate must be infinitely higher.

Training Exemplar 2

Question 6   **Total: 5 marks**

Georgio has two options when investing $15 000.00.

Option 1: He can invest the money at an interest rate of 6.50%, compounded monthly for 5 years.

Option 2: He can invest the money in an account that earns simple interest for 5 years.

a)   Determine the value of the investment if he chooses Option 1. Show your work.

(2 marks)

$$PV = {}^\${15000}$$
$$pmt = {}^\${0}$$
$$fv = \boxed{\$20\,742.26}$$
$$rate\% = 6.5$$
$$periods = 60 \; monthly$$
$$Compounding = monthly$$

He would have made
$5742.26.

I came to this answer
using technology.

b)   Georgio wants to earn the same amount of interest as he did in (a). Determine the simple interest rate, as a percent, that he would need if he chooses Option 2. Show your work.

(2 marks)

$$I = P \cdot r \cdot T$$
$$I = 15000 \cdot \qquad .5$$

c)   Explain why the simple interest rate in (b) is higher than 6.50%.

(1 mark)

It is higher because

Marking Exemplar 1

Question 7   **Total: 5 marks**

Luke and Autumn want to buy a house. The bank offers them a mortgage with the following terms:

- an interest rate of 2.85%, compounded semi-annually
- an amortization period of 20 years

a) Luke and Autumn want to make

- a down payment of $18 000.00
- monthly payments of $1450.00

Given the terms above, determine the maximum house price they can afford.
Show your work.

(2.5 marks)

N= 240
I%= 2.85
PV= -18000
PMT= -1450
FV= ?
P\Y= 12
C\Y= 2

FV=$499 165.43

b) Luke and Autumn find a house they want to buy that is valued at $343 000.00. The bank offers the same mortgage terms. They have $18 000.00 saved for a down payment. Determine the monthly mortgage payment.

(1 mark)

N= 240
I%= 2.85
PV= -325 000
PMT= ?
FV= 0
P/Y= 12
C/Y= 2

PMT=$1775.43

Marking Exemplar 1 (continued)

c) The house in (b) is in a neighbourhood where

- the average monthly property taxes are $280.00
- the monthly heating costs are $345.00

Luke and Autumn have an annual gross income of $83 000.00. Based on their gross debt service ratio (GDSR), would the bank lend them money? Explain.

(1.5 marks)

$$GDSR = \frac{1775.43 + 280 + 345}{83\ 000} \times 100$$

$$= 2.89\%$$

yes because their GPSR is less than 32%

3.5 marks:
❷ → 1 mark for consistent mortgage value in (a)
❸ → 0.5 mark for consistent maximum house price in (a)
❹ → 1 mark for consistent answer in (b)
❻ → 0.5 mark for consistent GDSR in (c)
❼ → 0.5 mark for appropriate explanation in (c)

Marking Exemplar 2

Question 7	Total: 5 marks

Luke and Autumn want to buy a house. The bank offers them a mortgage with the following terms:

- an interest rate of 2.85%, compounded semi-annually
- an amortization period of 20 years

a) Luke and Autumn want to make

- a down payment of $18 000.00
- monthly payments of $1450.00

Given the terms above, determine the maximum house price they can afford.
Show your work.

(2.5 marks)

$$N = 240$$
$$I = 2.85\%$$
$$■ PV = \$265428.71$$
$$PMT = -1450$$
$$FV = 0$$
$$P/Y = 12$$
$$C/Y = 2$$

b) Luke and Autumn find a house they want to buy that is valued at $343 000.00. The bank offers the same mortgage terms. They have $18 000.00 saved for a down payment. Determine the monthly mortgage payment.

(1 mark)

$$N = 240$$
$$I = 2.85$$
$$PV = 325000$$
$$■ PMT = \$1775.43$$
$$FV = 0$$
$$P/Y = 12$$
$$C/Y = 2$$

Marking Exemplar 2 (continued)

c) The house in (b) is in a neighbourhood where

- the average monthly property taxes are $280.00
- the monthly heating costs are $345.00

Luke and Autumn have an annual gross income of $83 000.00. Based on their gross debt service ratio (GDSR), would the bank lend them money? Explain.

(1.5 marks)

$$\frac{(1775.43 + 280 + 345)}{6916.66} \times 100 = 34.70\% \quad \text{(E6)}$$

NO because there GDSR is to high

---

4 marks:
❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent mortgage value in (a)
❹ → 1 mark for consistent answer in (b)
❺ → 0.5 mark for substitution in (c)
❻ → 0.5 mark for consistent GDSR in (c)

....

(E6) → rounds incorrectly in (c)

Training Exemplar 1

Question 7   **Total: 5 marks**

Luke and Autumn want to buy a house. The bank offers them a mortgage with the following terms:

- an interest rate of 2.85%, compounded semi-annually
- an amortization period of 20 years

a) Luke and Autumn want to make

- a down payment of $18 000.00
- monthly payments of $1450.00

Given the terms above, determine the maximum house price they can afford.
Show your work.

(2.5 marks)

$$PV = \$18,000$$
$$PmT = \$1450$$
$$fV = \boxed{\$499,165.43}$$
$$rate = 2.85\%$$
$$periods = 240 \text{ monthly } (12 \times 20)$$
$$compounding \text{ Semi annually}$$

b) Luke and Autumn find a house they want to buy that is valued at $343 000.00. The bank offers the same mortgage terms. They have $18 000.00 saved for a down payment. Determine the monthly mortgage payment.

(1 mark)

$$\$1,775.43$$

Training Exemplar 1 (continued)

c) The house in (b) is in a neighbourhood where

- the average monthly property taxes are $280.00
- the monthly heating costs are $345.00

Luke and Autumn have an annual gross income of $83 000.00. Based on their gross debt service ratio (GDSR), would the bank lend them money? Explain.

(1.5 marks)

$$\frac{1775.43 + 280 + 345}{6916.66} \times 100 = 34.7\%$$

— the bank wouldn't lend them money because their GDSR is over 32%.

Marking Exemplar 1

Question 8   **Total: 6 marks**

It is Joelyn's 18th birthday and she is planning for retirement.

- Her grandparents gave her $10 000.00.
- She will retire when her investment reaches $500 000.00.

Option 1:   She invests $10 000.00 initially and will make regular monthly deposits at 5% interest, compounded monthly.

Option 2:   She invests $1500.00 initially and makes regular monthly deposits of $200.00. She receives a 5% interest rate, compounded monthly.

a)   If she selects Option 1, determine how much she will have to invest monthly to retire at age 60. Show your work.

(2 marks)

$$60 - 18 = 42$$

N 42 × 12
I 5%.
PV −10 000
→ PMT = 49,439 ← **PE**
FV 500 000
PY 12
CY 12

$49,441/month

b)   If she selects Option 2, determine how old she will be when she retires. Show your work.

(3 marks)

→N 593.2700
I 5%.
PV 1500
PMT −200
FV 500 000
PY 12
CY 12

593.27 months /12
= 49.44 + 18

= 67.44 years old

Marking Exemplar 1 (continued)

c) Explain which option you would recommend.

(1 mark)

Option 1, b/c it's less to invest monthly AND she'll retire sooner.

4.5 marks:
❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent answer in (a)
❹ → 1 mark for consistent number of payments in (b)
❺ → 0.5 mark for consistent number of years in (b)
❻ → 0.5 mark for consistent age in (b)
❼ → 1 mark for appropriate explanation in (c)
🅟🅔 → 0.5 mark deduction for procedural error in (a)

Marking Exemplar 2

Question 8   **Total: 6 marks**

It is Joelyn's 18th birthday and she is planning for retirement.

- Her grandparents gave her $10 000.00.
- She will retire when her investment reaches $500 000.00.

Option 1: She invests $10 000.00 initially and will make regular monthly deposits at 5% interest, compounded monthly.

Option 2: She invests $1500.00 initially and makes regular monthly deposits of $200.00. She receives a 5% interest rate, compounded monthly.

a) If she selects Option 1, determine how much she will have to invest monthly to retire at age 60. Show your work.

(2 marks)

$\$ 153.74$ per mnth

$N = 720$

$I\% = 5$

$PV = 10000$

$PMT = -153.74 \leftarrow$

$FV = 500000$

$P/Y = 12$

$C/Y = 12$

b) If she selects Option 2, determine how old she will be when she retires. Show your work.

(3 marks)

594 months

$= 50$ years   **E6**

$N = 593.27$

$I\% = 5$

$PV = 1500$

$PMT = -200$

$FV = 500000$

$P/Y = 12$

$C/Y = 12$

Marking Exemplar 2 (continued)

c) Explain which option you would recommend.

(1 mark)

I would go for option (b) so I can live life at 50. and to pay more and leave early,

---

3 marks:

❷ → 1 mark for consistent answer in (a)

❹ → 1 mark for consistent number of payments in (b)

❺ → 0.5 mark for consistent number of years in (b)

❼ → 1 mark for appropriate explanation in (c)

Ⓛⓒ → 0.5 mark deduction for lack of clarity in (c)

··

Ⓔⓖ → does not express the answer to the appropriate number of decimal places in (b)

Training Exemplar 1

Question 8   **Total: 6 marks**

It is Joelyn's 18th birthday and she is planning for retirement.

- Her grandparents gave her $10 000.00.
- She will retire when her investment reaches $500 000.00.

Option 1: She invests $10 000.00 initially and will make regular monthly deposits at 5% interest, compounded monthly.

Option 2: She invests $1500.00 initially and makes regular monthly deposits of $200.00. She receives a 5% interest rate, compounded monthly.

a) If she selects Option 1, determine how much she will have to invest monthly to retire at age 60. Show your work.

(2 marks)

$N = (60 \times 12) = 720$
$I = 5.00$
$PV = -10\,000.00$
$PMT = -200.00$
$*FV = 1109\,722.877$
$P/Y = 12$
$C/Y = 12$
End

$$\$1\,109\,722.88$$

b) If she selects Option 2, determine how old she will be when she retires. Show your work.

(3 marks)

$*N = 578.2339464$
$I = 5.00$
$PV = -1500.00$
$PMT - 200.00$
$FV = 500\,000.00$
$P/Y = 12$
$C/Y = 12$
End

$$\frac{578.2339464}{12} = 48.17$$

≈ 48 years

$48 + 18 = 66.00$ years old

Training Exemplar 1 (continued)

c) Explain which option you would recommend.

(1 mark)

I would recommend that she choose option #2 because it is a lesser initial investment, but still has a high return.

She will still be able to spend money before retirement, and will have money saved up.

Training Exemplar 2

It is Joelyn's 18th birthday and she is planning for retirement.

- Her grandparents gave her $10 000.00.
- She will retire when her investment reaches $500 000.00.

Option 1: She invests $10 000.00 initially and will make regular monthly deposits at 5% interest, compounded monthly.

Option 2: She invests $1500.00 initially and makes regular monthly deposits of $200.00. She receives a 5% interest rate, compounded monthly.

a) If she selects Option 1, determine how much she will have to invest monthly to retire at age 60. Show your work.

(2 marks)

N 504
I 5%.
PV -1500
PMT 0
FV 500 000
P/y 12
C/y 12

=441

b) If she selects Option 2, determine how old she will be when she retires. Show your work.

(3 marks)

N 588
I 5%.
PV -1500
PMT -200
FV 500 000
P/y 12
C/y 12

She will be 67 years old

Training Exemplar 2 (continued)

c) Explain which option you would recommend.

(1 mark)

second one

Marking Exemplar 1

Question 9 **Total: 1 mark**

Describe a situation with two events where the probability of the second event is dependent on the first event.

From a deck of 52 cards, two are drawn, the probability of picking a jack of clubs is dependent on the first pick.

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

Marking Exemplar 2

Describe a situation with two events where the probability of the second event is dependent on the first event.

The results of a baseball game that depend on rain

rain (70%) wins 80%

does not win 20%

no rain (30%) wins 50%

does not win 50%

1 mark:
❶ → 1 mark for answer

Training Exemplar 1

Describe a situation with two events where the probability of the second event is dependent on the first event.

Event 1: I pick a spade

Event 2: I pick a king

* event 2 depends on the first because I could

pick a king of spades

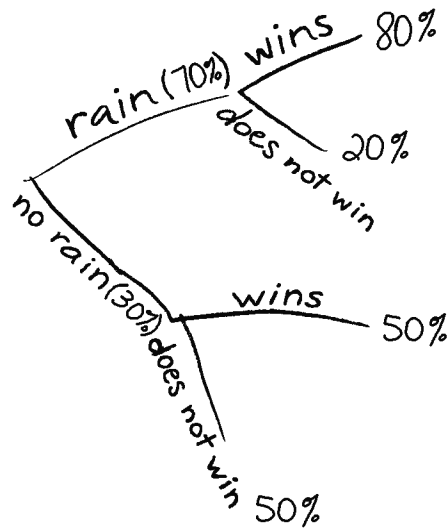# Training Exemplar 2

Describe a situation with two events where the probability of the second event is dependent on the first event.

1 - The probability of the weather (cold/hot) and then the probability that a car starts

2 - The probability that a person drinks coffee after 11 p.m. and then the probability that they sleep after/before midnight.

Marking Exemplar 1

Question 10   **Total: 1 mark**

There were 12 students at a camp. Over the course of the weekend

- 4 students went swimming
- 9 students went biking

Is participation in these events over the course of the weekend mutually exclusive?
Justify your answer.

NO

0 marks:
→ no criteria met

Marking Exemplar 2

Question 10   **Total: 1 mark**

There were 12 students at a camp. Over the course of the weekend

- 4 students went swimming
- 9 students went biking

Is participation in these events over the course of the weekend mutually exclusive?
Justify your answer.

yes, participation in these events are mutally exclusive because they cannot occur at the same time.

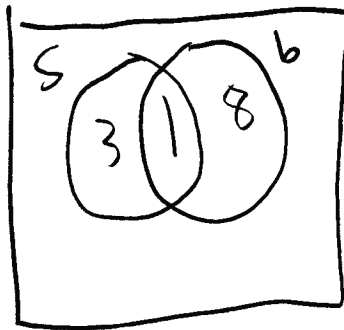| **0 marks:** |
| → no criteria met |

Training Exemplar 1

Question 10
Total: 1 mark

There were 12 students at a camp. Over the course of the weekend

- 4 students went swimming
- 9 students went biking

Is participation in these events over the course of the weekend mutually exclusive?
Justify your answer.

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Marking Exemplar 1

A food inspector has 5 cafeterias and 4 restaurants to inspect.

Determine how many ways he can choose 3 places to inspect today if he must go to at least one restaurant. Show your work.

Cases:

4 c 1 r: $_5C_4 \cdot {_4}C_1 = 20$

3 c 2 r: $_5C_3 \cdot {_4}C_2 = 60$

2 c 3 r: $_5C_2 \cdot {_4}C_3 = 40$

1 c 4 r: $_5C_1 \cdot {_4}C_4 = \underline{5}$

$\qquad\qquad\qquad\qquad\qquad\qquad\quad 125$

1.5 marks:	

❷ → 0.5 mark for $_5C_1 \times {_4}C_2$

❸ → 0.5 mark for $_5C_0 \times {_4}C_3$

❹ → 0.5 mark for consistent sum

Marking Exemplar 2

Question 11   **Total: 2 marks**

A food inspector has (5 cafeterias) and (4 restaurants) to inspect.

Determine how many ways he can choose (3) places to inspect today if he must go to <u>at least one</u> <u>restaurant</u>. Show your work.

at least

1) $9C_3 = 84$ ⎫
2) $9C_2 = 36$ ⎬ 129 ways he
3) $9C_1 = 9$ ⎭ can choose

┌─────────────────────────────────────┐
│ **0.5 mark:**   │
│ ❹ → 0.5 mark for consistent sum   │
└─────────────────────────────────────┘

Training Exemplar 1

A food inspector has 5 cafeterias and 4 restaurants to inspect.

Determine how many ways he can choose 3 places to inspect today if he must go to at least one restaurant. Show your work.

$$\frac{8}{\text{any where}} \cdot \frac{7}{\text{any where}} \cdot \frac{4}{R.} = 224 \text{ places to pick from}.$$

Training Exemplar 2

Question 11   **Total: 2 marks**

A food inspector has 5 cafeterias and 4 restaurants to inspect. *(9 total)*

Determine how many ways he can choose 3 places to inspect today if he must go to at least one restaurant. Show your work.

$$\frac{5C_2 \cdot 4C_1}{9C_3} = 0.47 = 47.62\%$$

Marking Exemplar 1

Question 12   **Total: 2 marks**

Serena has a collection of 17 superhero books. Superman defeats Batman in 11 of these books.

a) If Serena randomly chooses a book from these 17 books, determine the odds in favour of choosing a book in which Superman defeats Batman.

(1 mark)

$11/17 \rightarrow$ 11 batman out of 17 superhero books

Odds of choosing a Superman defeats batman book

$\rightarrow$ $\boxed{11:5}$

$\uparrow$

AE

b) Serena buys 4 more books to add to her collection. Among these 4 books, Superman defeats Batman in 3 of them. Determine the odds against randomly choosing a book from her collection in which Superman defeats Batman.

(1 mark)

21 books
14 Superman defeats batman

$14/21 \rightarrow 7:14$

> **1.5 marks:**
> ❶ → 1 mark for answer in (a)
> ❷ → 1 mark for answer in (b)
> **AE** → 0.5 mark deduction for arithmetic error in (a)

Marking Exemplar 2

Question 12   **Total: 2 marks**

Serena has a collection of 17 superhero books. Superman defeats Batman in 11 of these books.

(21 written above 17)   *(14 written above 11)*

a) If Serena randomly chooses a book from these 17 books, determine the odds in favour of choosing a book in which Superman defeats Batman.

(1 mark)

$$P(A) : P(A')$$

$$\frac{11}{17} \; : \; \frac{6}{17}$$

b) Serena buys 4 more books to add to her collection. Among these 4 books, Superman defeats Batman in 3 of them. Determine the odds against randomly choosing a book from her collection in which Superman defeats Batman.

(1 mark)

$$P(A') : P(A)$$

$$\frac{7}{21} \; : \; \frac{14}{21}$$

Training Exemplar 1

Question 12   **Total: 2 marks**

Serena has a collection of 17 superhero books. Superman defeats Batman in 11 of these books.

a) If Serena randomly chooses a book from these 17 books, determine the odds in favour of choosing a book in which Superman defeats Batman.

(1 mark)

$$11/6$$

b) Serena buys 4 more books to add to her collection. Among these 4 books, Superman defeats Batman in 3 of them. Determine the odds against randomly choosing a book from her collection in which Superman defeats Batman.

(1 mark)

$$7/14$$

Training Exemplar 2

Question 12   **Total: 2 marks**

Serena has a collection of 17 superhero books. Superman defeats Batman in 11 of these books.

a)   If Serena randomly chooses a book from these 17 books, determine the odds in favour of choosing a book in which Superman defeats Batman.

(1 mark)

$$\frac{11}{17} = 64.71\% \text{ chances}$$

b)   Serena buys 4 more books to add to her collection. Among these 4 books, Superman defeats Batman in 3 of them. Determine the odds against randomly choosing a book from her collection in which Superman defeats Batman.

(1 mark)

$$\frac{7}{21} = 33.\overline{33}\%$$

Marking Exemplar 1

A teacher asks her students: "How many ways can the 11 letters of the word PROBABILITY be arranged?"

A student provides the following incorrect solution:

$$\frac{11!}{4!} = 1\ 663\ 200$$

There are 1 663 200 ways.

Correct the student's work.

$$\frac{11!}{2!2!}$$

He added $2!$ and $2!$ to make $4!$ but you cannot do that.

← right answer

1 mark:
❶ → 1 mark for $\dfrac{11!}{2!2!}$

Marking Exemplar 2

Question 13
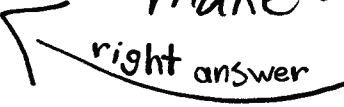<div align="right">

Total: 1 mark
</div>

A teacher asks her students: "How many ways can the 11 letters of the word PROBABILITY be arranged?"

A student provides the following incorrect solution:

$$\frac{11!}{4!} = 1\ 663\ 200$$

$2!.2!.$ There are 1 663 200 ways.

Correct the student's work.

$$\frac{11!}{2!\cdot 2!} = 3\,99\,/\,6800 \text{ ways}$$

PE

<table>
<tr><td align="center">0.5 mark:</td></tr>
<tr><td>❶ → 1 mark for $\dfrac{11!}{2!2!}$</td></tr>
<tr><td>**PE** → 0.5 mark deduction for procedural error</td></tr>
</table>

Training Exemplar 1

A teacher asks her students: "How many ways can the 11 letters of the word PROBABILITY be arranged?"

A student provides the following incorrect solution:

$$\frac{11!}{4!} = 1\,663\,200$$

There are 1 663 200 ways.

Correct the student's work.

There are some repeating letters

Here is the solution: $\dfrac{11!}{2! \cdot 2!} = 9\,979\,200$ ways

Training Exemplar 2

Question 13   **Total: 1 mark**

A teacher asks her students: "How many ways can the 11 letters of the word PROBABILITY be arranged?"

A student provides the following incorrect solution:

$$\frac{11!}{4!} = 1\ 663\ 200$$

There are 1 663 200 ways.

Correct the student's work.

$$\frac{11!}{2!} = 19958400$$

Marking Exemplar 1

Question 14   **Total: 3 marks**

Arjun has 5 extra concert tickets to give away. He has 9 friends who would like to go to the concert.

a)   Determine how many ways he can choose to give away the tickets to his friends.

(1 mark)

$$9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \quad = 15120 \text{ ways.}$$

b)   Paul is one of the 9 friends. If Arjun gives one of the tickets to Paul, determine how many ways Arjun can choose to give away the remaining tickets to his other friends.

(1 mark)

$$8 \cdot 7 \cdot 6 \cdot 5 = 1680 \text{ ways.}$$

c)   Determine the probability that Arjun chooses to give Paul a ticket.

(1 mark)

$$\frac{1680}{15120} = \frac{1}{9}$$

> **2 marks:**
> ❷ → 1 mark for answer in (b)
> ❸ → 1 mark for consistent answer in (c)

Marking Exemplar 2

Question 14   **Total: 3 marks**

Arjun has 5 extra concert tickets to give away. He has 9 friends who would like to go to the concert.

   a)   Determine how many ways he can choose to give away the tickets to his friends.

(1 mark)

$$9c_5 = 126$$

   b)   Paul is one of the 9 friends. If Arjun gives one of the tickets to Paul, determine how many ways Arjun can choose to give away the remaining tickets to his other friends.

(1 mark)

$$8c_4 = 70$$

   c)   Determine the probability that Arjun chooses to give Paul a ticket.

(1 mark)

$$\frac{1}{4} = 0.\overline{1} \times 100$$

$$= 11.11\%$$

> **2 marks:**
> ❶ → 1 mark for answer in (a)
> ❷ → 1 mark for answer in (b)

Training Exemplar 1

Question 14 — Total: 3 marks

Arjun has 5 extra concert tickets to give away. He has 9 friends who would like to go to the concert.

a) Determine how many ways he can choose to give away the tickets to his friends.

(1 mark)

$$9C_4 = 126 \text{ ways}$$

b) Paul is one of the 9 friends. If Arjun gives one of the tickets to Paul, determine how many ways Arjun can choose to give away the remaining tickets to his other friends.

(1 mark)

$$8C_3 = 56 \text{ ways}$$

c) Determine the probability that Arjun chooses to give Paul a ticket.

(1 mark)

$$\frac{56}{126}$$

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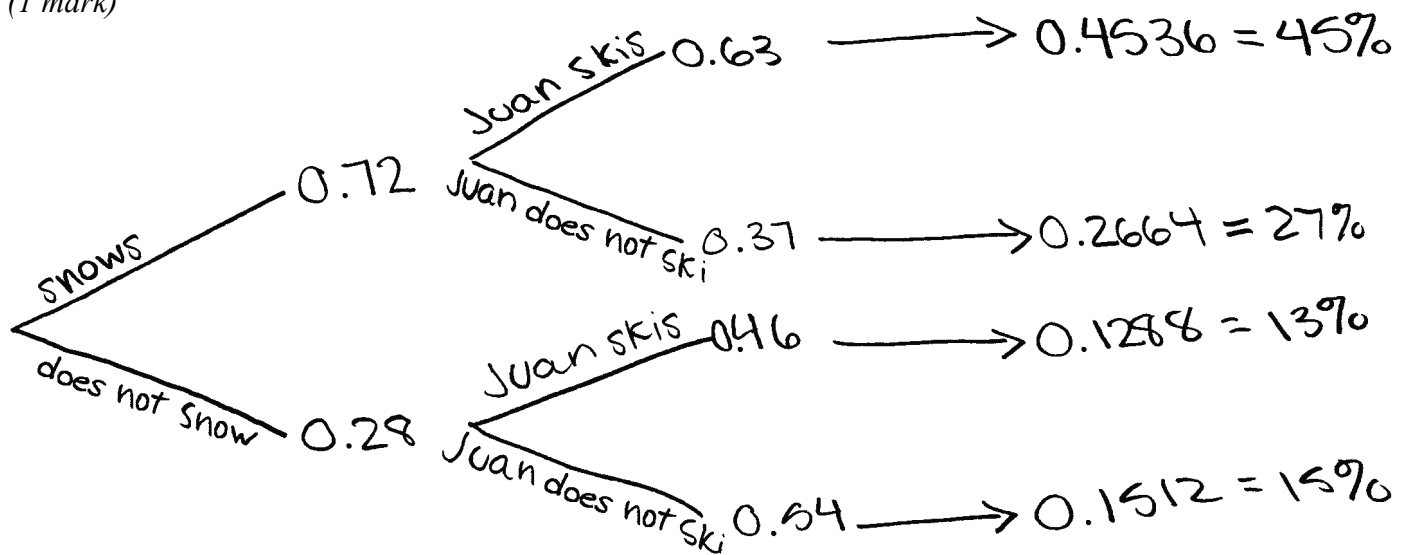
Marking Exemplar 1

Question 15　　　　　　　　　　　　　　　　　　　　　　　**Total: 3 marks**

The weather report calls for a 72% probability of snow tomorrow. If it snows, the probability that Juan will go skiing tomorrow is 63%. If it does not snow, the probability that Juan will go skiing tomorrow is 46%.

a) Use a graphic organizer to show all possible outcomes for this situation.

(1 mark)

Juan skis 0.63 $\longrightarrow$ 0.4536 = 45%

0.72 Juan does not ski 0.37 $\longrightarrow$ 0.2664 = 27%

snows

does not snow 0.28

Juan skis 0.46 $\longrightarrow$ 0.1288 = 13%

Juan does not ski 0.54 $\longrightarrow$ 0.1512 = 15%

b) Determine the probability that Juan goes skiing tomorrow. Show your work.

(2 marks)

$$0.4536 + 0.1512 = 0.6048 = 61\%$$

E6

2.5 marks:

❶ → 1 mark for appropriate graphic organizer in (a)
❷ → 0.5 mark for P(snow, ski) in (b)
❹ → 1 mark for consistent sum in (b)

....

E6 → does not express the answer to the appropriate number of decimal places in (b)
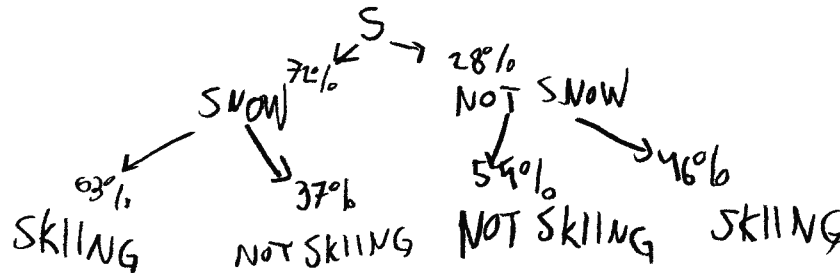
Marking Exemplar 2

Question 15　　　　　　　　　　　　　　　　　　　　**Total: 3 marks**

The weather report calls for a 72% probability of snow tomorrow. If it snows, the probability that Juan will go skiing tomorrow is 63%. If it does not snow, the probability that Juan will go skiing tomorrow is 46%.

a)　Use a graphic organizer to show all possible outcomes for this situation.

(1 mark)

S

SNOW 72%　　　28% NOT SNOW

63% SKIING　37% NOT SKIING　54% NOT SKIING　46% SKIING

b)　Determine the probability that Juan goes skiing tomorrow. Show your work.

(2 marks)

$$(63 + 46) - (37 + 54)$$

$$= 18\%$$

| **1 mark:** |
| ❶ →　1 mark for appropriate graphic organizer in (a) |

Training Exemplar 1

Question 15   **Total: 3 marks**

The weather report calls for a 72% probability of snow tomorrow. If it snows, the probability that Juan will go skiing tomorrow is 63%. If it does not snow, the probability that Juan will go skiing tomorrow is 46%.

a)   Use a graphic organizer to show all possible outcomes for this situation.

(1 mark)

Snow + skiing

Snow + no skiing

no snow + skiing

no snow + no skiing

b)   Determine the probability that Juan goes skiing tomorrow. Show your work.

(2 marks)

Snow + skiing: 0.72 × 0.63 = 0.4536

no snow + skiing: 0.28 × 0.46 = 0.1288

+ 0.5824

58% probability Juan will ski

Training Exemplar 2

Question 15   **Total: 3 marks**

The weather report calls for a 72% probability of snow tomorrow. If it snows, the probability that Juan will go skiing tomorrow is 63%. If it does not snow, the probability that Juan will go skiing tomorrow is 46%.

a) Use a graphic organizer to show all possible outcomes for this situation.

(1 mark)

snow   ski
0.72   0.63   yes yes
        0.37   yes no
    0.28 0.46   no yes
        0.54   no no
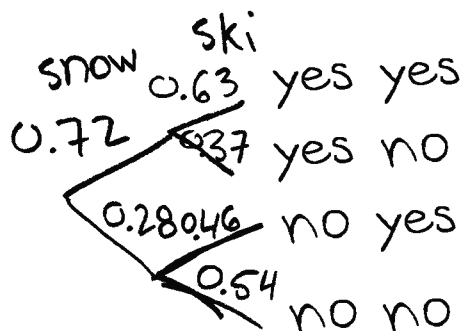
b) Determine the probability that Juan goes skiing tomorrow. Show your work.

(2 marks)

$$0.72 \cdot 0.63 = 0.4536$$

$$0.28 \cdot 0.46 = 0.1288 \quad = 0.0584 \times 100$$

$$= 5.84\%$$

Marking Exemplar 1

Question 16   **Total: 2 marks**

Using the digits 0 through 9, Haaziq needs to create a 4-digit or 5-digit code for his new bank card. Determine the total number of codes possible if repetition is allowed. Show your work.

$$\underline{9} \cdot \underline{9} \cdot \underline{9} \cdot \underline{9} \cdot \underline{9} = 59\,049$$

$$+$$

$$\underline{9} \cdot \underline{9} \cdot \underline{9} \cdot \underline{9} = 6561$$

$$\boxed{= 65\,610}$$

possible codes.

Marking Exemplar 2

Using the digits 0 through 9, Haaziq needs to create a 4-digit or 5-digit code for his new bank card. Determine the total number of codes possible if repetition is allowed. Show your work.

$$10 \cdot 10 \cdot 10 \cdot 10 = 10000$$

or

$$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 100000$$

$$1000 + 100\,000 = 101\,000 \text{ ways}$$

ⓔ₃

<div style="border:1px solid black; padding:10px;">

2 marks:

❶ → 0.5 mark for number of 4-digit codes

❷ → 0.5 mark for number of 5-digit codes

❸ → 1 mark for consistent sum

- -

Ⓔ₃ → makes a transcription error (inaccurate transferring of information)

</div>

Training Exemplar 1

Using the digits 0 through 9, Haaziq needs to create a 4-digit or 5-digit code for his new bank card. Determine the total number of codes possible if repetition is allowed. Show your work.

$$10 \times 10 \times 10 \times 10 = 10\,000 \quad (4 \text{ digits})$$

$$10 \times 10 \times 10 \times 10 \times 10 = 100\,000 \quad (5 \text{ digits})$$

Training Exemplar 2

Question 16   **Total: 2 marks**

Using the digits 0 through 9, Haaziq needs to create a 4-digit or 5-digit code for his new bank card. Determine the total number of codes possible if <u>repetition is allowed</u>. Show your work.

$$_{10}P_4 \quad + \quad _{10}P_5$$

$$= 5040 \quad + \quad 30240$$

$$\boxed{= 35280}$$

Marking Exemplar 1

Question 18   **Total: 3 marks**

A food company sells soup in a cylindrical container with a radius of 3.3 cm and a height of 9.8 cm.

a)   Calculate the surface area of the soup container.

(1 mark)

$$Sa = 2\pi r^2 + 2\pi rh$$
$$Sa = 2\pi(3.3)^2 + 2\pi(3.3)(9.8)$$
$$\boxed{Sa = 271.62 \ cm^2}$$

b)   The aluminum used to make the containers costs \$0.10 per 1000 cm², taxes included. The company wants to make 4500 soup containers. Determine the total cost (ignore waste). Show your work.

(2 marks)

$$\frac{271.62 \ cm^2}{1000 \ cm^2} = 0.278 m^2 \cdot 0.10 \cdot 4500 \cdot 1.13$$

$$\frac{271.62 \ cm^2 \cdot 0.10 \cdot 4500}{1000 \ cm^2} = 1222.29$$

(E5)   (PE)

2.5 marks:
❶ → 1 mark for surface area in (a)
❷ → 0.5 mark for consistent total surface area in (b)
❸ → 0.5 mark for consistent amount of aluminum in (b)
❹ → 1 mark for consistent total cost in (b)
(PE) → 0.5 mark deduction for procedural error in (b)

....

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

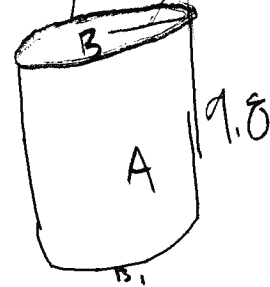# Training Exemplar 1

Question 18   Total: 3 marks

A food company sells soup in a cylindrical container with a radius of 3.3 cm and a height of 9.8 cm.

a)   Calculate the surface area of the soup container.

(1 mark)

$$101.53$$
$$+ \ \ 34.21$$
$$\overline{135.74}$$

$$10.36 \times 9.8$$

$$A = 10.36 \times 9.8 = 101.53$$
$$B = \pi 3.3^2 = 34.21$$
$$C = 10.36_{3.3}$$

$$SA = 135.74 \ cm^2$$

b)   The aluminum used to make the containers costs \$0.10 per 1000 cm^2, taxes included. The company wants to make 4500 soup containers. Determine the total cost (ignore waste). Show your work.

(2 marks)

$$135.74 \times 4500 = 610 \ 830 \ / 1000 = 610.83 \times 0.10$$

$$= 61.08 \times 1.13 = 69.02$$

Marking Exemplar 1

Question 19   **Total: 6 marks**

Madelaine and Ryan both want to change the flooring in their bedrooms. They both have bedrooms that are 14 feet long and 8 feet wide.

a) Madelaine is using vinyl planks. The planks are sold in cases. Each case can cover 24 ft^2 and costs $47.50, taxes included. Calculate the cost of Madelaine's flooring. Show your work.

(2 marks)

$$14 \cdot 8 = 112 ft^2$$
$$\div 24$$
$$4.66 \ldots$$
$$\rightarrow 5 \times 47.50 = \boxed{\$237.50}$$

b) Ryan is using sheet vinyl. Rolls are 12 feet wide and can be cut to any length. Ryan wants to lay the vinyl as one single rectangular sheet. The vinyl costs $23.88 per linear foot, taxes included. Calculate the cost of Ryan's flooring. Show your work.

(1 mark)

$$12 \times 14 = 168 ft^2$$
$$\times 23.88$$
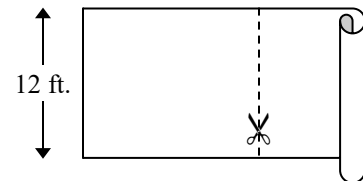$$\boxed{\$4\ 011.84}$$

12 ft.

Diagram is not drawn to scale.

Marking Exemplar 1 (continued)

c) Calculate the amount of waste (unused material) in each bedroom, in square feet. Show your work.

(2 marks)

a) $8 ft^2$

$(5 \times 24) \to \begin{array}{r} 120 \\ -112 \\ \hline 8 \end{array}$

b) $56 ft^2$

$\begin{array}{r} 168 \\ -112 \\ \hline 56 \end{array}$

d) Madelaine's flooring costs $1.98 per square foot and Ryan's flooring costs $1.99 per square foot. Explain why these unit costs are so close but the total flooring costs are so different.

(1 mark)

because Ryan wants
one big sheet
of vinyl & Madelaine
has multiple small
peices

4.5 marks:
❶ → 0.5 mark for area of bedroom in (a)
❷ → 0.5 mark for consistent number of cases in (a)
❸ → 1 mark for consistent cost of flooring in (a)
❹ → 0.5 mark for length of flooring in (b)
❻ → 0.5 mark for area of the vinyl planks purchased by Madelaine in (c)
❼ → 0.5 mark for consistent waste in Madelaine's bedroom in (c)
❽ → 0.5 mark for area of the sheet vinyl purchased by Ryan in (c)
❾ → 0.5 mark for consistent waste in Ryan's bedroom in (c)

Marking Exemplar 2

**Question 19**   **Total: 6 marks**

Madelaine and Ryan both want to change the flooring in their bedrooms. They both have bedrooms that are 14 feet long and 8 feet wide.

a) Madelaine is using vinyl planks. The planks are sold in cases. Each case can cover 24 ft^2 and costs \$47.50, taxes included. Calculate the cost of Madelaine's flooring. Show your work.

(2 marks)

$8 \times 14 = 112 \text{ ft}^2$

$\dfrac{112}{24} = 4.67$ She will need 5 planks

14ft   8ft
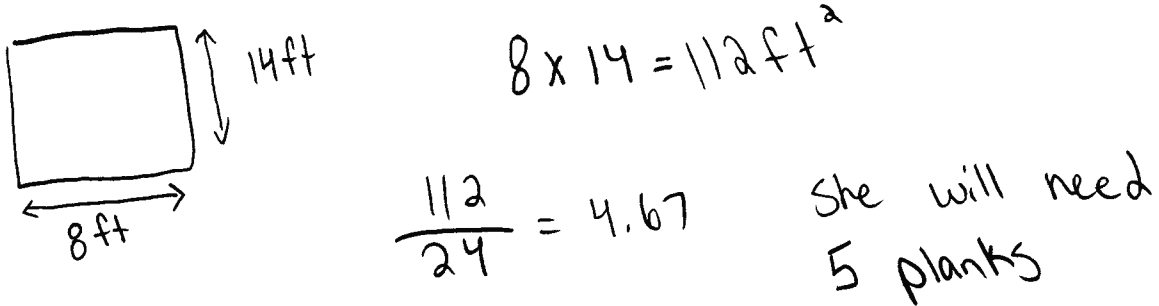
$5 \times 47.50 = 237.5$

$\boxed{\$237.50}$

b) Ryan is using sheet vinyl. Rolls are 12 feet wide and can be cut to any length. Ryan wants to lay the vinyl as one single rectangular sheet. The vinyl costs \$23.88 per linear foot, taxes included. Calculate the cost of Ryan's flooring. Show your work.

(1 mark)

$12 + 14 = 26 \text{ ft}$

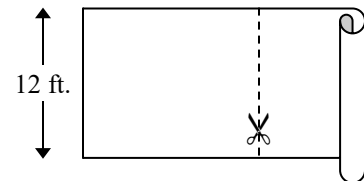$26 \times 23.88 = \boxed{\$620.88}$

12 ft.

Diagram is not drawn to scale.

Marking Exemplar 2 (continued)

c) Calculate the amount of waste (unused material) in each bedroom, in square feet.
Show your work.

(2 marks)

Madelaine

$112ft^2$

$4 \times 24 = 96ft^2$

$112 - 96 = \boxed{16ft^2}$

Ryan

$12 \times 14 = 168$

$8 \times 14 = 112$

$168 - 112 = \boxed{56ft^2}$

d) Madelaine's flooring costs $1.98 per square foot and Ryan's flooring costs $1.99 per square foot. Explain why these unit costs are so close but the total flooring costs are so different.

(1 mark)

The total flooring costs are so different because of how they are sold. Although they have the same bedroom size Ryan had a lot more unused material which he still had to pay for.

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5 marks:
❶ → 0.5 mark for area of bedroom in (a)
❷ → 0.5 mark for consistent number of cases in (a)
❸ → 1 mark for consistent cost of flooring in (a)
❹ → 0.5 mark for length of flooring in (b)
❼ → 0.5 mark for consistent waste in Madelaine's bedroom in (c)
❽ → 0.5 mark for area of the sheet vinyl purchased by Ryan in (c)
❾ → 0.5 mark for consistent waste in Ryan's bedroom in (c)
❿ → 1 mark for appropriate explanation in (d)

Training Exemplar 1

Question 19   Total: 6 marks

Madelaine and Ryan both want to change the flooring in their bedrooms. They both have bedrooms that are 14 feet long and 8 feet wide.

a) Madelaine is using vinyl planks. The planks are sold in cases. Each case can cover 24 ft² and costs $47.50, taxes included. Calculate the cost of Madelaine's flooring. Show your work.

(2 marks)

$112 ft^2$

$\dfrac{112}{24} = 4.6\bar{6}$

5 full tiles

$47.50 \times 5 = 237.5$ $\times .08 = 19$
                             $\times .06 = 14.25$
                                        33.25

#270.75

b) Ryan is using sheet vinyl. Rolls are 12 feet wide and can be cut to any length. Ryan wants to lay the vinyl as one single rectangular sheet. The vinyl costs $23.88 per linear foot, taxes included. Calculate the cost of Ryan's flooring. Show your work.

(1 mark)

$23.88 \times 14 = 334.32$ $\times .08 = 26.7456$
                              $\times .06 = 20.0592$
                                         46.8048
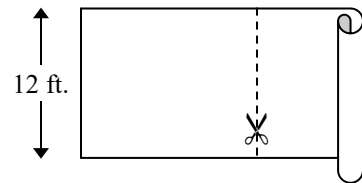
381.1248

or

#382

12 ft.

Diagram is not drawn to scale.

Training Exemplar 1 (continued)

c) Calculate the amount of waste (unused material) in each bedroom, in square feet. Show your work.

(2 marks)

$24 \times 5 = 120 \text{ ft}^2$
$14 \times 8 = \underline{112 \text{ ft}^2}$
$\qquad 8 \text{ ft}^2 \text{ waste}$

Madelaine

$14 \times 12 = 168 \text{ ft}^2$
$14 \times 8 = \underline{112 \text{ ft}^2}$
$\qquad 56 \text{ ft}^2 \text{ waste}$

Ryan

d) Madelaine's flooring costs $1.98 per square foot and Ryan's flooring costs $1.99 per square foot. Explain why these unit costs are so close but the total flooring costs are so different.

(1 mark)

Ryan is has more material left after the job is done and Madelaine had utilized more of the material. For every linear foot, Ryan pays $23.88, and he needs 14 feet of sheet vinyl. For every case, Made pays $17.50, and she needs 5 cases

Training Exemplar 2

Madelaine and Ryan both want to change the flooring in their bedrooms. They both have bedrooms that are 14 feet long and 8 feet wide.

a)   Madelaine is using vinyl planks. The planks are sold in cases. Each case can cover 24 ft^2 and costs $47.50, taxes included. Calculate the cost of Madelaine's flooring. Show your work.

(2 marks)

14×8

$\dfrac{112 ft2}{24}$

4.66 needed

5 needed $\times$ 47.50

$\$237.50$

b)   Ryan is using sheet vinyl. Rolls are 12 feet wide and can be cut to any length. Ryan wants to lay the vinyl as one single rectangular sheet. The vinyl costs $23.88 per linear foot, taxes included. Calculate the cost of Ryan's flooring. Show your work.

(1 mark)

$168 ft2 \times 23.88 = \$4011.84$
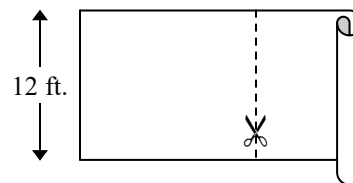
12 ft.

Diagram is not drawn to scale.

Training Exemplar 2 (continued)

c)   Calculate the amount of waste (unused material) in each bedroom, in square feet. Show your work.

(2 marks)

Madelaine wasted 8f of material

Ryan wasted 56ft of material

d)   Madelaine's flooring costs $1.98 per square foot and Ryan's flooring costs $1.99 per square foot. Explain why these unit costs are so close but the total flooring costs are so different.

(1 mark)

Because Ryan had to buy alot extra to fit his floor.

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Marking Exemplar 1

Question 21   **Total: 2 marks**

Given a group of 25 high school students, 13 students attend a country festival and 8 students attend a folk festival.

$$C = \{\text{students who attend the country festival}\}$$
$$F = \{\text{students who attend the folk festival}\}$$

a)   Given $n(C \cup F) = 19$, draw a Venn diagram to represent this situation.

(1.5 marks)

b)   Determine $n(C \cap F)'$.

(0.5 mark)

> **1.5 marks:**
> ❶ → 0.5 mark for number of students attending neither festival in (a)
> ❷ → 0.5 mark for consistent number of students attending the country festival only in (a)
> ❸ → 0.5 mark for consistent number of students attending the folk festival only in (a)
> ··
> (E2) → does not include a box when using a Venn diagram in (a)

Training Exemplar 1

Question 21   Total: 2 marks

Given a group of 25 high school students, 13 students attend a country festival and 8 students attend a folk festival.

$$C = \{\text{students who attend the country festival}\}$$
$$F = \{\text{students who attend the folk festival}\}$$

a)   Given $n(C \cup F) = 19$, draw a Venn diagram to represent this situation.

(1.5 marks)

25 - 19 = 6 Students didn't attend either.

b)   Determine $n(C \cap F)'$.

(0.5 mark)

n(C∩F)' = Students who don't attend
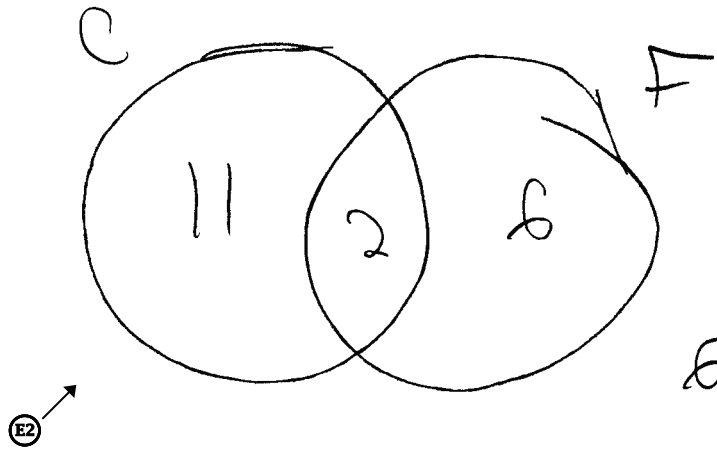the folk or country festival

Training Exemplar 2

Given a group of 25 high school students, 13 students attend a country festival and 8 students attend a folk festival.

$$C = \{\text{students who attend the country festival}\}$$
$$F = \{\text{students who attend the folk festival}\}$$

a) Given $n(C \cup F) = 19$, draw a Venn diagram to represent this situation.

(1.5 marks)

Handwritten work:

$25 - 19 = 6$ (didn't attend anything)

$19 - 8 - 13 = -2$

$13 - 2 = 11$

$8 - 2 = 6$
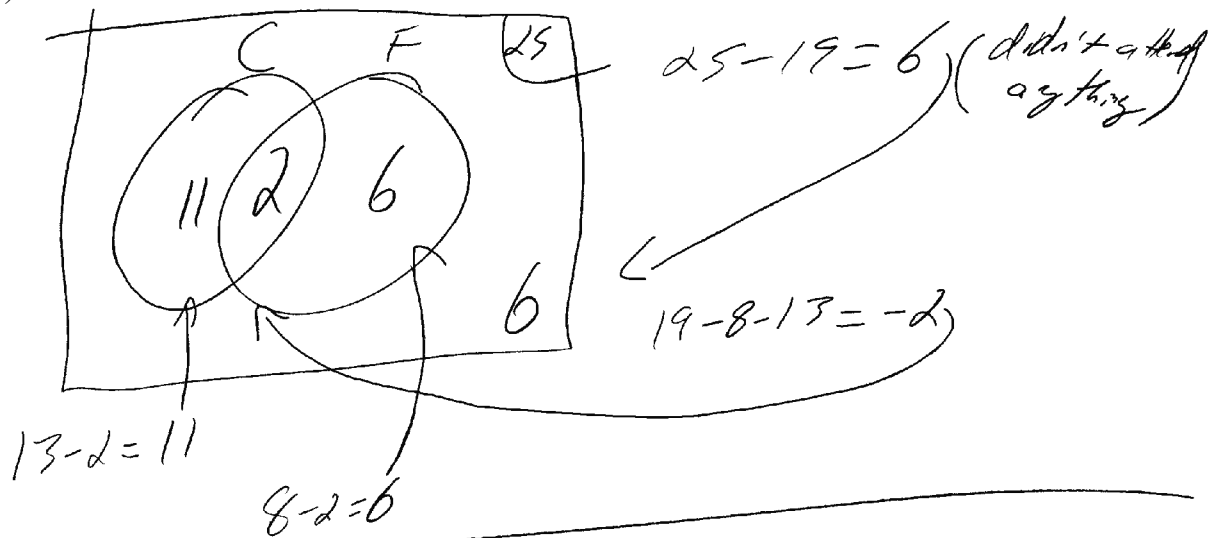
b) Determine $n(C \cap F)'$.

(0.5 mark)

$$n(C \cap F) = 2$$

$$\boxed{n(C \cap F)' = 23}$$

Marking Exemplar 1

Question 22   **Total: 2 marks**

Let *p* represent "a rock is wet" and *q* represent "it is raining outside".

a)   Write a conditional statement based on the following symbolic form:

$$\neg p \Rightarrow \neg q$$

(1 mark)

If a rock is wet then it's raining outside

b)   Provide a counterexample to the statement in (a).

(1 mark)

False: Someone could be washing a vehicle and get a rock wet

> **1 mark:**
> ❷ → 1 mark for consistent answer in (b)

Marking Exemplar 2

Question 22　　　　　　　　　　　　　　　　　　**Total: 2 marks**

Let *p* represent "a rock is wet" and *q* represent "it is raining outside".

a) Write a conditional statement based on the following symbolic form:

$$\neg p \Rightarrow \neg q$$

(1 mark)

"If a rock is <u>not</u> wet, then it is <u>not</u> raining outside"

b) Provide a counterexample to the statement in (a).

(1 mark)

You could give a rock a tiny umbrella while it's raining.

see?

> **2 marks:**
> ❶ → 1 mark for answer in (a)
> ❷ → 1 mark for consistent answer in (b)

Training Exemplar 1

Let *p* represent "a rock is wet" and *q* represent "it is raining outside".

a)   Write a conditional statement based on the following symbolic form:

$$\neg p \Rightarrow \neg q$$

(1 mark)

if a rock is
Net then it is
raining outside

b)   Provide a counterexample to the statement in (a).

(1 mark)

a rock isnt
wet if its inside

Training Exemplar 2

Question 22   **Total: 2 marks**

Let *p* represent "a rock is wet" and *q* represent "it is raining outside".

a)   Write a conditional statement based on the following symbolic form:

$$\neg p \Rightarrow \neg q$$

(1 mark)

"IF a rock is not wet, then it is not raining outside"

b)   Provide a counterexample to the statement in (a).

(1 mark)

The rock could be hidden under a vehicle or in someones house away from any water, it doesn't mean it's not raining.

Marking Exemplar 1

Question 23   **Total: 2 marks**

Given the following statement:

> "If it takes about 8 years to double your investment,
> then you invest at an annual interest rate of 9%."

a)   Write the converse of this statement.

(1 mark)

You invest at an annual interest rate of 9% ,then it takes about 8 years to double your investment.

b)   Determine if the original conditional statement is true using the Rule of 72.

(1 mark)

$$\frac{72}{9} = 8$$

It's true, because 72 divided by 9 is eight and only 8. (Not a different number).

> **1.5 marks:**
> → 0.5 mark for converse statement without "if" or "then" as per marker note
> ❷ → 1 mark for answer in (b)

Marking Exemplar 2

Question 23   **Total: 2 marks**

Given the following statement:

> "If it takes about 8 years to double your investment,
> then you invest at an annual interest rate of 9%."

a)   Write the converse of this statement.

(1 mark)

if you invest an annual interest
        rate of 9% it will take
          8 years to double your
                investment

b)   Determine if the original conditional statement is true using the Rule of 72.

(1 mark)

This statment is true
  because it is less than
          72% of the rule
              72 original
                  statment

> **0.5 mark:**
> → 0.5 mark for converse statement without
> "if" or "then" as per marker note

Training Exemplar 1

Question 23   **Total: 2 marks**

Given the following statement:

"If it takes about 8 years to double your investment,
then you invest at an annual interest rate of 9%."

a)   Write the converse of this statement.

(1 mark)

If you invest at an annual interest rate of 9%,
then it takes about 8 years to double your
investment.

b)   Determine if the original conditional statement is true using the Rule of 72.

(1 mark)

It is because only rule of 72 can
give you this answer and nothing else.

Training Exemplar 2

Question 23   **Total: 2 marks**

Given the following statement:

> "If it takes about 8 years to double your investment,
> then you invest at an annual interest rate of 9%."

a)   Write the converse of this statement.

(1 mark)

IF you invest an annual interest of 9%,
It takes you 8 years to double your investment.

b)   Determine if the original conditional statement is true using the Rule of 72.

(1 mark)

cause it could be less time then 8years

Training Exemplar Answers

Question 2 **Total: 3 marks**

Training Exemplar 1

Mark(s): 2/3

❶ → 1 mark for answer in (a)
❷ → 1 mark for x-value in (b)

Training Exemplar 2

Mark(s): 1/3

❷ → 1 mark for x-value in (b)

Question 3 **Total: 4 marks**

Training Exemplar 1

Mark(s): 1/4

❷ → 1 mark for consistent answer in (b)

Training Exemplar 2

Mark(s): 2/4

❶ → 1 mark for answer in (a)
❷ → 1 mark for consistent answer in (b)

Question 4 **Total: 3 marks**

Training Exemplar 1

Mark(s): 1.5/3

❷ → 1 mark for consistent answer in (b)
❹ → 0.5 mark for inclusivity of both upper and lower bounds in (c)

Question 5   Total: 6 marks

Training Exemplar 1

Mark(s): 2/6

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

Training Exemplar 2

Mark(s): 5/6

❶ → 1 mark for communicating the context of the graph with appropriate title and/or labels in (a)
❸ → 1 mark for plotting the data in (a)
❹ → 1 mark for equation in (b)
❺ → 0.5 mark for number of years in (c)
❻ → 0.5 mark for consistent value of investment in (c)
❼ → 1 mark for consistent rate of return in (c)

Question 6   Total: 5 marks

Training Exemplar 1

Mark(s): 3/5

❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent value of investment in (a)
❸ → 1 mark for consistent amount of interest in (b)

Training Exemplar 2

Mark(s): 3/5

❶ → 1 mark for appropriate work in (a)
❷ → 1 mark for consistent value of investment in (a)
❸ → 1 mark for consistent amount of interest in (b)

Question 7   Total: 5 marks

Training Exemplar 1

Mark(s): 4/5

- ❷ → 1 mark for consistent mortgage value in (a)
- ❸ → 0.5 mark for consistent maximum house price in (a)
- ❹ → 1 mark for consistent answer in (b)
- ❺ → 0.5 mark for substitution in (c)
- ❻ → 0.5 mark for consistent GDSR in (c)
- ❼ → 0.5 mark for appropriate explanation in (c)
- Ⓔ⑥ → rounds incorrectly in (c)

Question 8   Total: 6 marks

Training Exemplar 1

Mark(s): 3/6

- ❸ → 1 mark for appropriate work in (b)
- ❹ → 1 mark for consistent number of payments in (b)
- ❺ → 0.5 mark for consistent number of years in (b)
- ❻ → 0.5 mark for consistent age in (b)
- ❼ → 1 mark for appropriate explanation in (c)
- Ⓟ⑤ → 0.5 mark deduction for procedural error in (b)
- Ⓛ⑤ → 0.5 mark deduction for lack of clarity in (c)
- Ⓔ⑥ → rounds incorrectly in (b)

Training Exemplar 2

Mark(s): 3/6

- ❷ → 1 mark for consistent answer in (a)
- ❸ → 1 mark for appropriate work in (b)
- ❹ → 1 mark for consistent number of payments in (b)
- ❺ → 0.5 mark for consistent number of years in (b)
- ❻ → 0.5 mark for consistent age in (b)
- Ⓟ⑤ → 0.5 mark deduction for procedural error in (a)
- Ⓟ⑤ → 0.5 mark deduction for procedural error in (b)

Question 9   **Total: 1 mark**

Training Exemplar 1

Mark(s): 0.5/1

❶ → 1 mark for answer

🄛🄬 → 0.5 mark deduction for lack of clarity

Training Exemplar 2

Mark(s): 1/1

❶ → 1 mark for answer

Question 10   **Total: 1 mark**

Training Exemplar 1

Mark(s): 0/1

→ no criteria met

Question 11   **Total: 2 marks**

Training Exemplar 1

Mark(s): 0/2

→ no criteria met

Training Exemplar 2

Mark(s): 0/2

→ no criteria met

Question 12   **Total: 2 marks**

Training Exemplar 1

Mark(s): 2/2

❶ → 1 mark for answer in (a)
❷ → 1 mark for answer in (b)

Training Exemplar 2

Mark(s): 1/2

❷ → 1 mark for answer in (b)

Question 13   **Total: 1 mark**

Training Exemplar 1

Mark(s): 1/1

❶ → 1 mark for $\dfrac{11!}{2!2!}$

Training Exemplar 2

Mark(s): 0/1

→ no criteria met

Question 14   **Total: 3 marks**

Training Exemplar 1

Mark(s): 2/3

❶ → 1 mark for answer in (a)
❸ → 1 mark for consistent answer in (c)

Question 15   Total: 3 marks

Training Exemplar 1

Mark(s): 3/3

❶ → 1 mark for appropriate graphic organizer in (a)
❷ → 0.5 mark for P(snow, ski) in (b)
❸ → 0.5 mark for P(no snow, ski) in (b)
❹ → 1 mark for consistent sum in (b)
Ⓔ6 → does not express the answer to the appropriate number of decimal places in (b)

Training Exemplar 2

Mark(s): 2/3

❶ → 1 mark for appropriate graphic organizer in (a)
❷ → 0.5 mark for P(snow, ski) in (b)
❸ → 0.5 mark for P(no snow, ski) in (b)

Question 16   Total: 2 marks

Training Exemplar 1

Mark(s): 1/2

❶ → 0.5 mark for number of 4-digit codes
❷ → 0.5 mark for number of 5-digit codes

Training Exemplar 2

Mark(s): 1/2

❸ → 1 mark for consistent sum

Question 18   Total: 3 marks

Training Exemplar 1

Mark(s): 1.5/3

❷ → 0.5 mark for consistent total surface area in (b)
❸ → 0.5 mark for consistent amount of aluminum in (b)
❹ → 1 mark for consistent total cost in (b)
Ⓟ🄴 → 0.5 mark deduction for procedural error in (b)
Ⓔ5 → does not include the dollar sign for monetary values in (b)

Question 19   Total: 6 marks

Training Exemplar 1

Mark(s): 5.5/6

❶ → 0.5 mark for area of bedroom in (a)
❷ → 0.5 mark for consistent number of cases in (a)
❸ → 1 mark for consistent cost of flooring in (a)
❹ → 0.5 mark for length of flooring in (b)
❺ → 0.5 mark for consistent cost of flooring in (b)
❻ → 0.5 mark for area of the vinyl planks purchased by Madelaine in (c)
❼ → 0.5 mark for consistent waste in Madelaine's bedroom in (c)
❽ → 0.5 mark for area of the sheet vinyl purchased by Ryan in (c)
❾ → 0.5 mark for consistent waste in Ryan's bedroom in (c)
❿ → 1 mark for appropriate explanation in (d)
PE → 0.5 mark deduction for procedural error in (a) and (b) as per marker note
E6 → rounds incorrectly in (b)

Training Exemplar 2

Mark(s): 5/6

❶ → 0.5 mark for area of bedroom in (a)
❷ → 0.5 mark for consistent number of cases in (a)
❸ → 1 mark for consistent cost of flooring in (a)
❹ → 0.5 mark for length of flooring in (b)
❼ → 0.5 mark for consistent waste in Madelaine's bedroom in (c)
❽ → 0.5 mark for area of the sheet vinyl purchased by Ryan in (c)
❾ → 0.5 mark for consistent waste in Ryan's bedroom in (c)
❿ → 1 mark for appropriate explanation in (d)
E5 → uses incorrect units of measure in (c)

Question 21   Total: 2 marks

Training Exemplar 1

Mark(s): 0.5/2

❶ → 0.5 mark for number of students attending neither festival in (a)

Training Exemplar 2

Mark(s): 2/2

❶ → 0.5 mark for number of students attending neither festival in (a)

❷ → 0.5 mark for consistent number of students attending the country festival only in (a)

❸ → 0.5 mark for consistent number of students attending the folk festival only in (a)

❹ → 0.5 mark for consistent answer for $n\left(C \cap F\right)'$ in (b)

Question 22   Total: 2 marks

Training Exemplar 1

Mark(s): 0/2

→ no criteria met

Training Exemplar 2

Mark(s): 2/2

❶ → 1 mark for answer in (a)
❷ → 1 mark for consistent answer in (b)

Question 23   Total: 2 marks

Training Exemplar 1

Mark(s): 1/2

❶ → 1 mark for answer in (a)

Training Exemplar 2

Mark(s): 0.5/2

→ 0.5 mark for converse statement without "if" or "then" as per marker note