

Grade 10 Numeracy Assessment

Sample Assessment Student-Choice Questions: Marking Guide and Student Exemplars



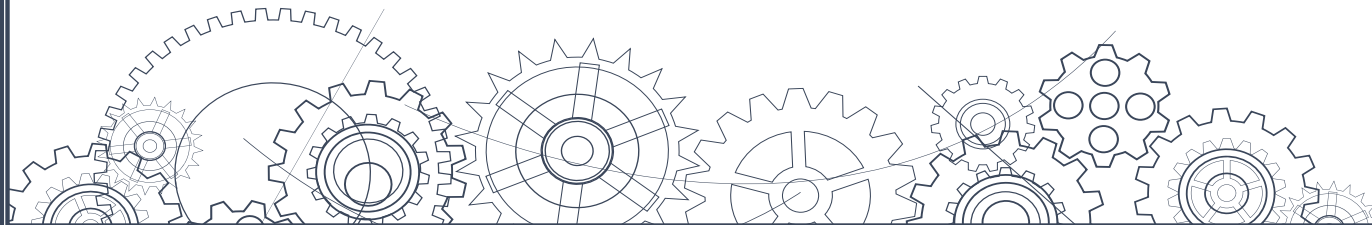
Ministry of
Education and
Child Care

Form A



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Rubric and Elaborations



Marking Rubric (Student Choice Question)

Snapshot*	1	2	3	4
	Student's response demonstrates a limited understanding of the situation. Solution contains an ineffective approach and/or fundamental mathematical errors. Reasoning shows an attempt to engage with an aspect of the problem.	Student's response demonstrates a basic understanding of the situation where aspect(s) of the problem are considered. Solution is incomplete but on the right track; calculations may contain errors. Reasoning may be unclear or inconsistent.	Student's response demonstrates a sensible understanding of the situation where most aspects of the problem are addressed. Solution is reasonable; calculations may contain errors. Reasoning can be followed.	Student's response demonstrates extensive understanding of the situation where all aspects of the problem are addressed. Solution is effective and comprehensive, calculations are relevant, and errors do not hinder reasonableness within the given context. Reasoning is clearly communicated.
NR	No response (answer sheet is blank or title only)			
0**	Student's response work described by one or more of the following statements: • Information simply recopied from the problem. • Diagrams or calculations are unrelated to the problem. • Any answer without supporting work. • Response does not engage with an aspect of the problem. • All work is erased or crossed out.			

* Errors in transcription do not take away from the level of proficiency.

** Inappropriate responses (e.g., profanity or concerning language) should be sent to chair.

Rubric and Elaborations



Elaborations

	1	2	3	4
Interpret	Limited reasoning skills in determining the relevance of situational information in the task context.	Basic reasoning skills in determining the relevance of situational information in the task context.	Effective reasoning skills in determining the relevance of situational information in the task context.	Advanced reasoning skills in determining the relevance of situational information in the task context.
Apply	Limited success in relating the context into mathematical language; contains fundamental errors in approach.	Partial success in relating the context into mathematical language but may contain errors in approach.	Success in relating the context into mathematical language; errors in approach are minor and do not hinder understanding.	Success in relating the context into mathematical language using a clear and logical approach.
Solve	Limited use of mathematical concepts and skills; solution contains mostly incorrect calculations.	Basic use of mathematical concepts and skills; solution is missing essential calculations or contains major errors.	Effective use of mathematical concepts and skills; solution is appropriate to context but may contain minor errors.	Advanced use of mathematical concepts and skills; solution is reasonable and appropriate to context.
Analyze	Reasoning or justification of solution is absent or fundamentally incorrect.	Reasoning or justification of solution is partially complete; or solution may not be reasonable in context.	Reasoning or justification of solution is evident.	Reasoning or justification of solution is complete and comprehensive.
Communicate	Limited use of mathematical language (e.g., graphs, symbols) to express solution, supported by limited evidence.	Basic use of mathematical language (e.g., graphs, symbols) to express solution, supported by evidence that contains inconsistencies or is difficult to follow.	Effective use of mathematical language (e.g., graphs, symbols) to express solution, supported by relevant evidence.	Advanced use of mathematical language (e.g., graphs, symbols) to express solution, supported by insightful or logical evidence.

MAPLE SYRUP

First Nations peoples were the first humans to tap maple trees and make maple syrup in Canada. Tree trunks were tapped by making a cut and then inserting a reed or piece of bark. Sap dripped through the tap into wooden buckets. Hot rocks were used to cook the sap. The sap was then boiled until only maple syrup was left.

Hupacasath First Nations have lived on their traditional territory on central Vancouver Island for generations. They are among the first to make maple syrup on a commercial scale from bigleaf maple trees growing on their ancestral lands. The Hupacasath are pioneers in the economic development world with “Kleekhoot Gold Bigleaf Maple Syrup.”



In one season, one tree makes 57 L of sap



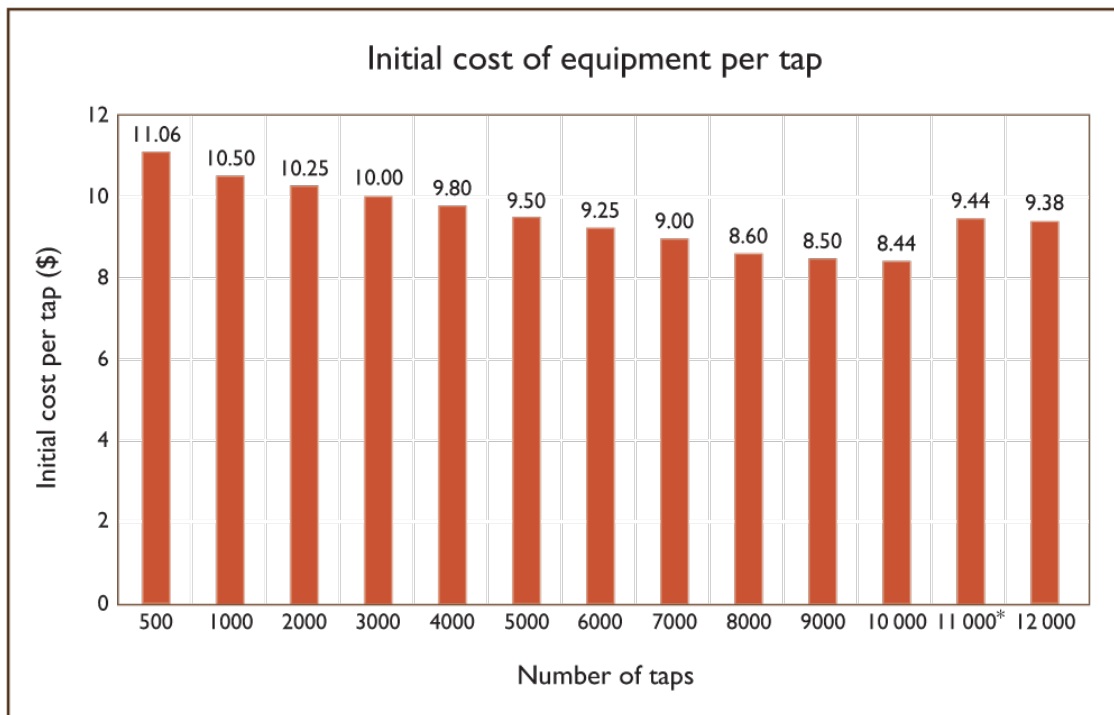
40 L of tree sap = 1 L of syrup

Maple Syrup

After visiting the Hupacasath's operation, Brennan, a member of another First Nation, wants to explore tapping maple trees and making syrup on the traditional territories where he lives. He counted over 5000 maple trees on their ancestral lands.

Brennan has researched the costs involved in syrup production. The costs include buying equipment to collect and process the tree sap, as well as operating the taps for one season.

Brennan plans to make a presentation to Chief and Council for permission to start operating on a small number of trees. Each tree will require one tap.



*Additional equipment needed for 11 000 and above.

Cost of operating taps for one season	
Number of taps	Operational cost (per tap)
500	\$6.50
2000	\$3.40
4000	\$2.88
6000	\$2.68
8000	\$2.62
10 000	\$2.58
12 000	\$2.85

Maple Syrup

Answer this question on the indicated response sheet.

Brennan's First Nations community has accepted his business plan and offered him access to one of three plots of land with different maple tree densities. He agrees to pay \$5000 for each hectare (ha) of land he uses for one season.

His options are:

Plot	Area	Tree Density
A	2 ha	1 000 trees/ha
B	8 ha	500 trees/ha
C	16 ha	375 trees/ha

He plans to sell the syrup at \$15/L. He already owns the equipment needed to collect and process the tree sap.

Considering only the land lease, operating costs, and profit, which area should Brennan choose?

Explain and justify your solution. Be sure to include any calculations, estimations, and assumptions you used.

Marking Guide

Question Aspects of a Coherent Solution (Interpretation of the problem and application of logic)

- Determines the money generated from the sales of the syrup
 - Number of trees based on tree density per hectare
 - Volume of sap and the corresponding volume of syrup
 - Money generated selling the syrup
- Determines the cost of producing the syrup (operating costs)
 - Production cost (taps)
 - Cost of the land (based on rate per hectare)
- Determines the profit
 - Identify total profit of each plot by subtracting the costs from the sales
- Identifies the most profitable plot
 - Select a preferred plot (with supporting logic)

Maple Syrup

There are many possible solutions; several solutions are given.

Possible Solutions

Components of an Ideal Solution (Mathematical Analysis and Problem-Solving Strategies)

Plot 1: # trees $1000 \frac{\text{trees}}{\text{ha}} \times 2 \text{ ha} = 2000 \text{ trees}$

• **Sap** $2000 \text{ trees} \times 57 \frac{\text{L sap}}{\text{tree}} = 114\,000 \text{ L sap}$

• **Syrup** $114\,000 \text{ L sap} \div 40 \frac{\text{L sap}}{\text{L syrup}} = 2850 \text{ L syrup}$

• **Sales of the Syrup** $2850 \text{ L syrup} \times \frac{\$15}{\text{L syrup}} = \$42\,750$

• **Operating Costs: Taps** $\frac{\$3.40}{\text{Tap}} \times 2000 \text{ trees} = \6800 **Land** $\frac{\$5000}{\text{ha}} \times 2 \text{ ha} = \$10\,000$

Total \$16 800

• **Profit = sales - costs** **\$42 750 - \$16 800 = \$25 900**

Plot 2: # trees $500 \frac{\text{trees}}{\text{ha}} \times 8 \text{ ha} = 4000 \text{ trees}$

• **Sap** $4000 \text{ trees} \times 57 \frac{\text{L sap}}{\text{tree}} = 228\,000 \text{ L sap}$

• **Syrup** $228\,000 \text{ L sap} \div 40 \frac{\text{L sap}}{\text{L syrup}} = 5700 \text{ L syrup}$

• **Sales of the Syrup** $5700 \text{ L syrup} \times \frac{\$15}{\text{L syrup}} = \$85\,500$

• **Operating Costs: Taps** $\frac{\$2.88}{\text{Tap}} \times 4000 \text{ trees} = \$11\,520$ **Land** $\frac{\$5000}{\text{ha}} \times 8 \text{ ha} = \$40\,000$

Total \$51 520

• **Profit = sales - costs** **\$85 500 - \$51 520 = \$33 980**

Maple Syrup

Plot 3: # trees $375 \frac{\text{trees}}{\text{ha}} \times 16 \text{ ha} = 6000 \text{ trees}$

• **Sap** $6000 \text{ trees} \times 57 \frac{\text{L sap}}{\text{tree}} = 342\,000 \text{ L sap}$

• **Syrup** $342\,000 \text{ L sap} \div 40 \frac{\text{L sap}}{\text{L syrup}} = 8550 \text{ L syrup}$

• **Sales of the Syrup** $8550 \text{ L syrup} \times \frac{\$15}{\text{L syrup}} = \$128\,250$

• **Operating Costs: Taps** $\frac{\$2.68}{\text{Tap}} \times 6000 \text{ trees} = \$16\,080$ **Land** $\frac{\$5000}{\text{ha}} \times 16 \text{ ha} = \$80\,000$

Total \$96 080

• **Profit = sales - costs** $\$128\,250 - \$96\,080 = \$32\,170$

Plot 2 would bring in the largest profit

Maple Syrup

Exemplar #1 – Score: 4

- ✓ Response showcases an extensive understanding of the situation.
- ✓ Strategy communicated clearly with all work supported by calculations.

Plot 1: ① the payment of hectare: $2 \text{ ha} \times 5000 \$/\text{ha} = 10000 \$$
 ② the cost of operating taps: $2 \text{ ha} \times 1000 \text{ trees}/\text{ha} = 2000 \text{ trees}$
 $2000 \text{ trees} \times 3.4 \$/\text{tree} = 6800 \$$
 ③ the profit: $\frac{2000 \text{ trees} \times 57 \text{ L sap}/\text{tree}}{40 \text{ L sap}} = 2850 \text{ L syrup}$
 $2850 \text{ L syrup} \times 15 \$/\text{L} = 42750 \$$
 $\therefore 42750 \$ - 6800 \$ - 10000 \$ = 25950 \$$

Plot 2: ① hectare: $8 \text{ ha} \times 5000 \$/\text{ha} = 40000 \$$
 ② Operating cost: $8 \text{ ha} \times 500 \text{ tree}/\text{ha} = 4000 \text{ trees}$
 $4000 \text{ trees} \times 2.88 \$ = 11520 \$$
 ③ Profit: $\frac{4000 \text{ trees} \times 57 \text{ L sap}}{40 \text{ L sap}} = 5700 \text{ L syrup}$
 $5700 \text{ L syrup} \times 15 \$/\text{L} = 85500 \$$
 $\therefore 85500 \$ - 40000 \$ - 11520 \$ = 33980 \$$

Plot 3: ① hectare: $16 \text{ ha} \times 5000 \$/\text{ha} = 80000 \$$
 ② Operating cost: $16 \text{ ha} \times 375 \text{ tree}/\text{ha} = 6000 \text{ trees}$
 $6000 \text{ trees} \times 2.68 \$/\text{tree} = 16080 \$$
 ③ Profit: $\frac{6000 \text{ trees} \times 57 \text{ L sap}}{40 \text{ L sap}} = 8550 \text{ L syrup}$
 $8550 \text{ L syrup} \times 15 \$/\text{L} = 128250 \$$
 $\therefore 128250 \$ - 16080 \$ - 80000 \$ = 32170 \$$

$\therefore 33980 \$ > 32170 \$ > 25950 \$$
 $\therefore$ Brennan should choose Plot 2.

Maple Syrup

Exemplar #2 – Score: 4

- ✓ Response demonstrates an effective and comprehensive solution.
- ✓ Communication clear and easy to follow.

Plot number 2 would be the best option			
In total Plot 1 gives 2000 trees \$10,000 (2x1000) (2x5000)			
Plot number 2	gives 7000 trees	for \$90,000	(8x500) (8x5000)
Plot number 3	gives 6000 trees	for \$80,000	(16x375) (16x5000)
			trees cost
this amounts to: Plot 1: 1000 trees / 5000 dollars			
Plot 2: 1000 trees / 10000 dollars			
Plot 3: 1000 trees / 1333.33 dollars			
at this point plot 1 gives the most trees for the money			
however operating cost impacts this			
Plot 1:			
\$3.40 per tree to operate in total for Plot 1 you spend			
$3.40 \times 2000 = \$6800 + \10000			
\$16800 for land and operation costs			
You make \$42750			
$2000 \times 57L = 114000 \text{ Litres} \div 40 L = 2850 L \times 15 = 42750$			
	(number of trees) (L per tree)	number of litres to make syrup	price per litre
42750 → money made			
-16800 → costs			
\$25950.00 → total profit → worst profit			

Maple Syrup

\$2.88 per tree to operate	in total for Plot 2 you spend
$\hookrightarrow 2.88 \times 4000 = \$11520 + 90,000$	\$51,520 in land and operations
you make \$85,500.00	
$\hookrightarrow 4000 \times 57 = 228000 \div 40 = 5700 \times 15 = \$85,500$	
85500	
$-51,520$	
\$33,980 $\rightarrow$ total Profit	<u>Best Profit</u>
Plot 3:	
\$2.68 per tree to operate	in total for Plot 2 you
$\hookrightarrow 2.68 \times 6000 = \$16,080 + 80,000$	spend \$96,080 for land and operations
you make \$128,250	
$\hookrightarrow 6000 \times 57 = 342,000 \div 40 = 8550 \times 15 = 128,250$	
128250	
-96080	
\$32170 $\rightarrow$ total Profit	2nd best Profit

Maple Syrup

Exemplar #3 – Score: 3

- ✓ Initial start up (equipment) costs were mistakenly considered, leading to an incorrect answer.
- ✓ Otherwise, solution demonstrates a strong understanding of situation.

Plot 1: $2 \text{ ha} \cdot 1000 \text{ ha} = 2000 \text{ trees}$
Plot 2: $8 \text{ ha} \cdot 500 \text{ ha} = 4000 \text{ trees}$
Plot 3: $16 \text{ ha} \cdot 375 \text{ ha} = 6000 \text{ trees}$

Plot 1: $2000 \text{ trees} \times 57 \text{ L sap} = 11400 \div 40 = 2850 \text{ L syrup} \times \$15 = \$42750 - \10000
 $\begin{array}{r} \$10500 \\ 6800 \end{array}$
 $\$32750 - (10.25 \cdot 2000) - (3.40 \cdot 2000) = \5450 profit

Plot 2: $4000 \text{ trees} \times 57 \text{ L sap} = 228000 \div 40 = 5700 \text{ L syrup} \times \$15 = \$85500 - \40000
 $\begin{array}{r} 34200 \\ 11520 \end{array}$
 $\$45500 - (9.80 \times 4000) - (2.88 \times 4000) = \-5220 profit

Plot 3: $6000 \text{ trees} \times 57 \text{ L sap} = 342000 \div 40 = 8550 \text{ L syrup} \times \$15 = \$128250 - \80000
 $\begin{array}{r} 55500 \\ 16000 \end{array}$
 $\$48250 - (9.25 \cdot 6000) - (2.68 \cdot 6000) = \-23330 profit

Brennan should choose Plot 1, it has the highest tree density per hectare and paired with cost of operation, he gains the most profit.

Maple Syrup

Exemplar #4 – Score: 3

- ✓ This response demonstrates a strong understanding of the situation. It addresses all aspects of the problem, but incorrectly calculates operational costs by using the number of litres of syrup rather than the number of trees.
- ✓ Strategy is viable; overall approach is sensible and well organized.
- ✓ For a score of 4, calculate operating costs correctly.

\$5000 for each hectare (ha) of land use for 3 seasons

Plot	Area	Tree density	Cost
Plot 1	7ha	1000 trees/ha	\$15/L
Plot 2	8ha	500 trees/ha	
Plot 3	16ha	275 trees/ha	

Plot 1: 7ha → \$10,000
 ↳ 1000 trees/ha = 2000 trees
 $2000 \times 57L = 114,000L$
 $\frac{114,000L}{40L} = 2850$
 $2850 \times \$15 = \$42,750$
 operational cost $2850 \times \$5.4 = \$15,390$
 $\begin{array}{r} 42,750 \\ - 15,390 \\ \hline 27,360 \end{array}$

Plot 2: 8ha = \$40,000
 ↳ 500 trees/ha = 4000 trees
 $4000 \times 57 = 228,000L$
 $\frac{228,000L}{40L} = 5700$
 $5700 \times \$15 = \$85,500$
 $5700 \times \$2.80 = 16,416$
 $\begin{array}{r} 85,500 \\ - 16,416 \\ \hline 69,084 \end{array}$

Plot 3: 16ha = \$80,000
 ↳ 275 trees/ha = 4400 trees
 $4400 \times 57 = 250,800L$
 $\frac{250,800L}{40L} = 6270$
 $6270 \times \$15 = \$94,050$
 $6270 \times \$2.80 = \$17,556$
 $\begin{array}{r} 94,050 \\ - 17,556 \\ \hline 76,494 \end{array}$

Brenna should use plot 2 for his business plan, he will learn more money with the plot 2. After making the products and paying for the bills he will still have \$29,084

Maple Syrup

Exemplar #5 – Score: 2

- ✓ Response correctly calculates the gross sales from the syrup from each plot and makes a choice comparing all three plots.
- ✓ Student demonstrates only a basic understanding of the situation. Land and operational costs not calculated; as a result, no profit was determined.
- ✓ To improve score, need to consider operating costs and land costs.

Plot 1: $1000 \times \frac{2 \times 57}{40} \times 15$
 $= \$42750$

Plot 2: $500 \times 8 \times 57 \div 40 \times 15$
 $= \$85500$

Plot 3: $375 \times 16 \times 57 \div 40 \times 15$
 $= \$128250$

So Brennan need choose Plot 3, because $\$128250 > \$85500 > \$42750$

Maple Syrup

Exemplar #6 – Score: 2

- ✓ This solution demonstrates a basic understanding of the situation.
- ✓ Correctly calculated total revenue from maple syrup sales for each plot and operating costs.
- ✓ The student disregarded land costs which affected the profit calculations. A final comparison of plots was also absent. Hence, the question was not answered.
- ✓ To improve score, consider land costs, and address the question by comparing the three plots.

Plot 1 $\rightarrow$ 2000 trees $\rightarrow$ cost $2000 \times 3.40 = \$6800$

Plot 2 $\rightarrow$ 4000 trees $\rightarrow$ cost $4000 \times 2.88 = \$11520$

Plot 3 $\rightarrow$ 6000 trees $\rightarrow$ cost $6000 \times 2.68 = \$16080$

Plot 1: $2000 \times 57L = \frac{114000L \text{ of sap}}{40}$

$= 2850L \text{ of syrup} \times .15$

$= \$42750 + \6800

$\boxed{= \$49550}$

Plot 2: $4000 \times 57L = \frac{228000L}{40L}$

$= 5700 \times 15$

$= 85500 + 11520$

$\boxed{= \$97020}$

Plot 3: $6000 \times 57 = \frac{342000L}{40}$

$= 8550 \times 15$

$= 128250 + 16080$

$\boxed{= \$144330}$

Maple Syrup

Exemplar #7 – Score: 1

- ✓ Student's response demonstrates a limited understanding of the situation. They took the initial step of calculating the number of trees per plot and calculated the sales for one plot they chose. The equation provides a correct calculation for Plot 3 but is poorly communicated (e.g., include units in equation).
- ✓ To improve score, student should consider operating cost and profit for each plot. A comparison can then be made and a plot chosen for a final answer.

Handwritten student work on grid paper:

$$\begin{aligned} 2 \times 1000 &= 2000 \text{ trees} \\ 8 \times 500 &= 4000 \text{ trees} \\ 16 \times 375 &= 6000 \text{ trees} \\ \text{So choose Plot 3.} \\ 16 \times 375 \times 57 \div 40 \times 15 &= 128250 \end{aligned}$$

Exemplar #8 – Score: 0

- ✓ Example of an answer without supporting work.

Handwritten student work on grid paper:

Brennan should choose the land with the highest tree density to maximize the amount of potential sap that he can have

Solar Energy Project

The following information can be found on a typical energy bill.



Billing Date: January 15

Account Number:

78654321

Pay By: February 06

Meter Reading Information

Meter #	5620624
Dec 01	7305
Dec 31	8020
31 days	715

Daily Average Comparison

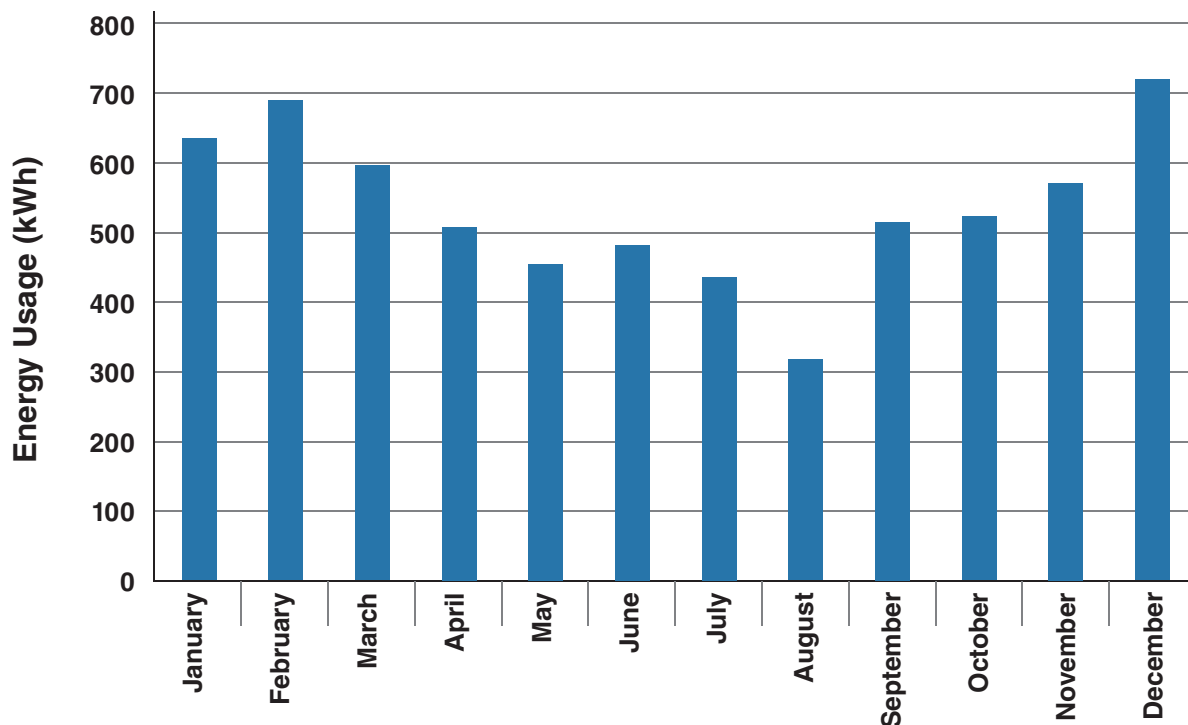
Last Dec:	19 kWh
This Dec:	25 kWh

Electric Charges (Dec 01 to Dec 31)

Basic charge: 31 days @ \$0.18350 / day	\$5.69
Energy charge:	
Step 1: 644 kWh @ \$0.08290 / kWh	53.39
Step 2: 71 kWh @ \$0.12430 / kWh	8.83
Temporary delivery surcharge @ 5.0%	3.11
Regional transit levy: 31 days @ \$0.06240 / day	1.93
GST (5%)	3.65
Total	\$76.60

Balance payable **\$76.60**

Monthly Energy Usage



Solar Energy Project



Solar panels can help to reduce environmental impact and save money on electricity by converting the sun's energy into electrical energy.

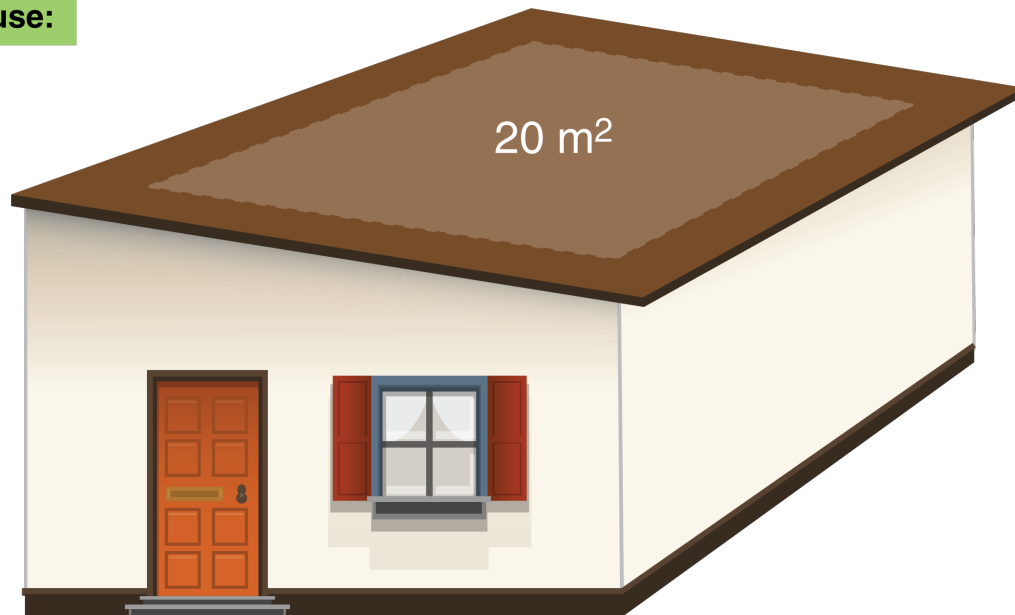
Depending on conditions and sunlight, one panel can generate up to 1.5 kWh per day.

Solar Energy Project

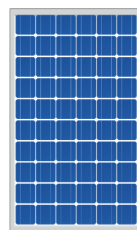
Answer this question on the indicated response sheet.

The roof of a house has an available area of 20 m^2 for solar panel installation.

House:



Solar panel:

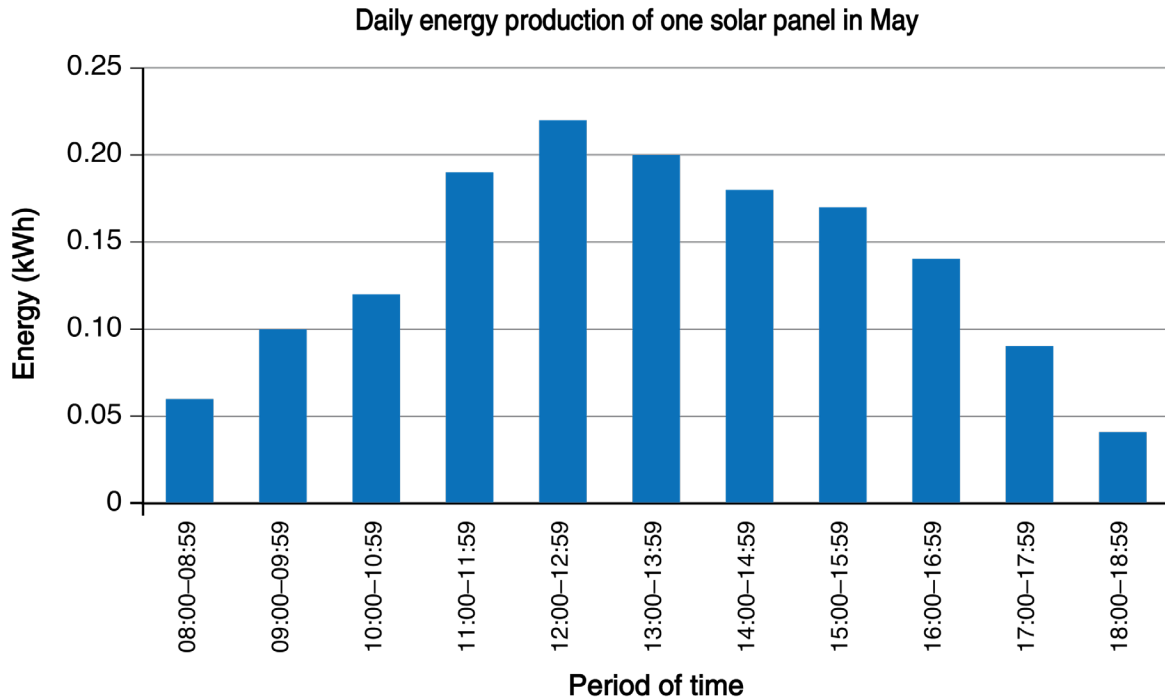


165 cm

100 cm

Solar Energy Project

Consider the following information for a new solar energy system on the roof:



Based on the information in the energy bill, would the roof area fit the number of panels needed to produce enough energy for May?

Explain and justify your solution. Be sure to include any calculations, estimations, labels, and assumptions you made.

Marking Guide

Question Aspects of a Coherent Solution (Interpretation of the problem and application of logic)

► **Determines the relevant areas**

- Calculate the area of 1 solar panel
- Calculate the number of panels that will fit on the roof

► **Determines the energy production and energy use**

- Calculate energy production per day and/or for the month of May (31 days)

► **Determines if there is sufficient Energy generated using a comparison**

- Compare the daily (or monthly) amount of energy required to the amount produced

OR

- The comparison/response aligns with their energy calculations

Solar Energy Project

There are many possible solutions; several solutions are given.

Possible Solutions

Components of an Ideal Solution (Mathematical Analysis and Problem-Solving Strategies)

Determine the energy use/required in May

- energy required (May) $\simeq 450 \frac{\text{kWh}}{\text{month}}$
- daily energy required $= 450 \frac{450 \frac{\text{kWh}}{\text{month}}}{31 \text{ days}} = 14.5 \frac{\text{kWh}}{\text{day}}$

Determine the energy produced by the solar panels (per day or per month)

- Each panel has a surface area of 1.65 m^2
- Energy generated by one panel per day (range 1.4 - 1.7 kWh/day)
- $\# \text{panels} = \frac{\text{roof area}}{\text{area per panels}} = \frac{20 \text{ m}^2}{1.6 \frac{\text{m}^2}{\text{panels}}} \simeq 12 \text{ panels (range 10-12 panels)}$
- daily energy produced $= (12 \text{ panels}) \times (1.5 \frac{\text{kWh}}{\text{panel}}) = 18 \frac{\text{kWh}}{\text{day}}$
- energy produced in May $= (31 \text{ days}) \times (18 \frac{\text{kWh}}{\text{day}}) = 558 \text{ kWh}$

Compare the energy produced to the energy required

- daily: supply $(18 \frac{\text{kWh}}{\text{day}}) \geq \text{demand } (14.5 \frac{\text{kWh}}{\text{day}})$
- monthly: supply $(558 \text{ kWh}) \geq \text{demand } (450 \text{ kWh})$
- There is enough energy produced to meet the needs in May.

Solar Energy Project

Exemplar #1 – Score: 4

- ✓ Student response shows an alternate strategy that demonstrates an extensive understanding of the situation.
- ✓ Approach is effective and comprehensive.
- ✓ Reasoning is clearly communicated.
- ✓ Note: A unit error (area of the roof = 20 cm²) is correctly represented later in the response.

1 m = 100 cm
panel dimensions = $1.00 \times 1.65 = 1.65 \text{ m}^2$
the area of the roof = 20 cm^2
432 kw·h = kw·h needed in may
31 days in may $\therefore \frac{432}{31} = 14.56 \approx 14.6$
14.6 kw·h need to be produced to meet need
one panel produces 1.5 kw·h per day
 $\therefore \frac{14.6}{1.5} = 9.66 \therefore 10$ panels are needed
to produce the energy needed in the
month of may.
Will they fit the roof?
 $1.65 \text{ m}^2 \times 10 = 16.5 \text{ m}^2$
 $\therefore$ Based on the information the
Panels will produce enough energy needed
for the month as 10 panels will
produce enough energy and fit
within the area of the roof.
This is all assuming per day the panel
creates 1.5 kw·h.

Solar Energy Project

Exemplar #2 – Score: 4

- ✓ This response demonstrates an extensive understanding of the situation.
- ✓ The steps are clear and laid out in a logical order.
- ✓ Answer is clearly communicated and supported by calculations.

May monthly energy usage: 450 Kwh

$450 \div 31 = 14.5 \text{ kwh}$
average daily usage in May

I figured out how much the daily usage is in May (average)

$.06 + .1 + .12 + .19 + .22 + .2 + .18 + .17 + .14 + .09 + .04 = 1.51 \text{ Kwh/solar panel}$
figured out how many Kwh solar panel produces per day in May

Roof = 20 m^2
solar panel = 1.65 m^2

number of panels roof can fit
 $20 \div 1.65 = 12.12 \approx 12$

figured out how many panels fit on roof

$12 \times 1.51 \text{ kwh} = 18.12 \text{ kwh}$

averages $\rightarrow 18.12 \text{ kwh} > 14.5 \text{ kwh}$

answer: the roof can fit enough solar panels to supply power for May

Solar Energy Project

Exemplar #3 – Score: 3

- ✓ Obtained solution was compared to 452 kWh but no work was shown for some components (e.g., area of roof, total number of solar panels).
- ✓ Good strategy but should not be estimating daily production (by “roughly” adding graph points) to estimate daily production of energy.

AREA OF ROOF = 20m^2 , AREA OF SOLAR PANELS = 1.65m^2 Each.

ROOF CAN FIT 12 SOLAR PANELS.

$12 \times \text{Energy produced per day} \times 31$

$= 12 \times 1.96 \text{ Kw}\cdot\text{h} \times 31 = 729.12 \text{ Kw}\cdot\text{h}$

↑ ↑ ↑ THEORETICAL

MAX ROUGH DAYS OUTPUT

NUMBER OF NUMBER IN FOR MONTH

SOLAR FROM ADDING MAY OF MAY

PANELS GRAPH POINTS

THE ENERGY BILL CLAIMS THAT ONLY $452 \text{ Kw}\cdot\text{h}$ IS USED DURING

THE MONTH OF MAY. $729.12 \text{ Kw}\cdot\text{h} > 452 \text{ Kw}\cdot\text{h}$ WHICH MEANS

THAT THERE WILL, INDEED, BE ENOUGH ENERGY TO GET THROUGH MAY.

Solar Energy Project

Exemplar #4 – Score: 3

- ✓ Student's response demonstrates a sensible understanding of the situation. The use of guess and check is used as a tool to find out how many panels can fit on the roof ($1.65 \times 12 = 19.8$).
- ✓ Each of the steps in the process is communicated and works towards the final decision. However, the final comparison is incorrect (confusion about solar panels consuming rather than producing energy in the house).
- ✓ All other aspects needed to solve the problem were addressed correctly.

$165\text{cm} \rightarrow 1.65\text{m}$
 $100\text{cm} \rightarrow 1.0\text{m}$
 $A = 165 \times 100 = 16500\text{cm}^2 \rightarrow 165\text{m}^2$
 $1\text{m} \times 1.65 = 1.65\text{m}^2$
 $1.65 \times 12 = 19.8 \rightarrow 20\text{m}^2$ (roof of the house)
 one panel
 We need 12 panels to complete the roof
 May monthly energy usage $\rightarrow 452\text{ (Kwh)}$ on the bill
 Average solar panel energy in one day: $0.06 + 0.10 + 0.12 + 0.06 + 0.10 + 0.12 + 0.18 + 0.22 + 0.20 + 0.17 + 0.16 + 0.13 + 0.08 + 0.04 = 1.46$
 $1.46 \times 12 = 17.52\text{ (Kwh)}$ (number of panels) $17.52 \times 30 = 526\text{ Kwh}$ (days)
 No the roof area won't fit the number of panels needed to produce enough energy. Because the monthly energy usage for May on the bill is 452 Kwh $\rightarrow$ back continue...

But for a 20m^2 roof area, we need 12 panel and they use 526 Kwh-h in a month.

Solar Energy Project

Exemplar #5 – Score: 2

- ✓ Exemplar shows student calculated energy production per day for one panel but incorrectly calculated area. The incorrect area was then used in their energy production per month calculation. The rest of the calculations are correct (i.e., an accurate comparison was made from incorrect calculations). Had the correct area been used, the answer would have been correct.
- ✓ The response demonstrates a basic understanding of the situation and the response is on the right track. Communication is unclear (e.g., how the value 45.57 was obtained) and work not presented in a logical order.

$may = 452 \text{ Kw/h}$
 $100 \text{ cm} = 1 \text{ m}$

 1.65 m
 1 m
 $= 2.72 \text{ m}^2$
 $20 \text{ m}^2 \div 2.72 \text{ m}^2 = 7.35$
 $1 \text{ Panel} = 45.57 / \text{month}$
 $45.57 \times 7 = 318.99$
 $0.06 + 0.10 + 0.12 + 0.18$
 $+ 0.22 + 0.20 + 0.17 + 0.16 + 0.14$
 $+ 0.08 + 0.04 = 1.47 \text{ Kw/h}$

it would not make enough power for month of may because the solar panels would make 318.99 Kw/h and they used 452 Kw/h

Solar Energy Project

Exemplar #6 – Score: 2

- ✓ Correctly calculate how much one panel produces in a month but did not consider energy produced by total number of panels, nor did it consider energy consumption needs in May.
- ✓ The approach is unclear, as is the reasoning. The student's comparison is not clearly stated.
- ✓ To improve score, determine total energy produced by the 12 solar panels. Compare this value to the energy needs for May. Make a final determination if there will be enough energy generated to meet the needs.

Handwritten student work on grid paper:

$$100\text{ cm} = 1\text{ m} \quad 165\text{ cm} = 1.65\text{ m}$$
$$20 \div (1 \times 1.65) \approx 12 \text{ solar panels}$$
$$0.06 + 0.1 + 0.13 + 0.18 + 0.22 + 0.2 + 0.17 + 0.16 + 0.13 + 0.08 + 0.04$$
$$= 1.47 \text{ KW-h}$$
$$\text{May} = 31 \text{ days} \quad 31 \times 1.47 = 45.57 \text{ KW-h/month}$$

The roof area didn't fit the # of panels needed produce enough energy for May.

Solar Energy Project

Exemplar #7 – Score: 1

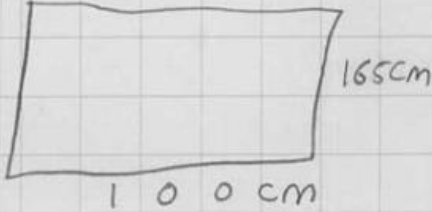
- ✓ Correctly calculates area of one panel and how many panels would fit on the roof.
- ✓ To improve score, student should determine the total energy produced by the panels and if it will be sufficient for the month.

In May, the energy usage is 452 kWh. The solar panel is 100 cm in length and its width is 165 cm. Of the 31 days in May, during 12:00 to 1:00 PM, produces the most energy kilowatt per hour. I am trying to solve is the area that is 20m² fit the number of panels needed to produce the enough energy for May.

Area = Length X Width

1 Solar panel = L X W
 $= 100\text{cm} \times 165\text{cm}$
 $= 16500\text{cm}^2$

cm to m $= 16500\text{cm}^2 / 10,000$
 $= 1.65\text{m}^2$



roof has an available area of 20m².

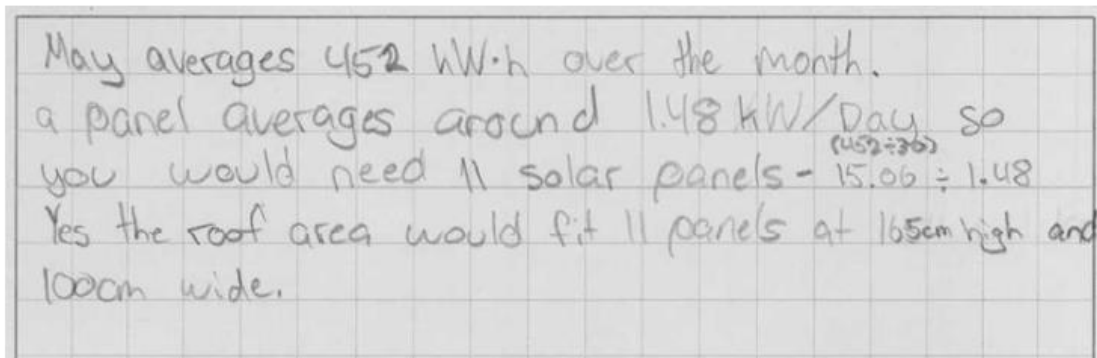
Therefore we need to use this evaluation
 roof area divide the meters squared area of the solar panel

Estimate $= 20\text{m}^2 \div 1.65\text{m}^2$
 Estimate $= 12.12121212$ panels $\rightarrow$ which rounds to
 12 panels that would fit on the roof.

Solar Energy Project

Exemplar #8 – Score: 1

- ✓ Correctly determined energy need, although the number of solar panels needed was miscalculated (May has 31 days in the month).
- ✓ Insufficient work when determining: (1) the number of panels that would fit on the roof; and (2) the daily energy consumption, resulting in score of 1 despite a reasonable final answer. To improve score, show the possible total energy production from the panels and make a comparison.



Solar Energy Project

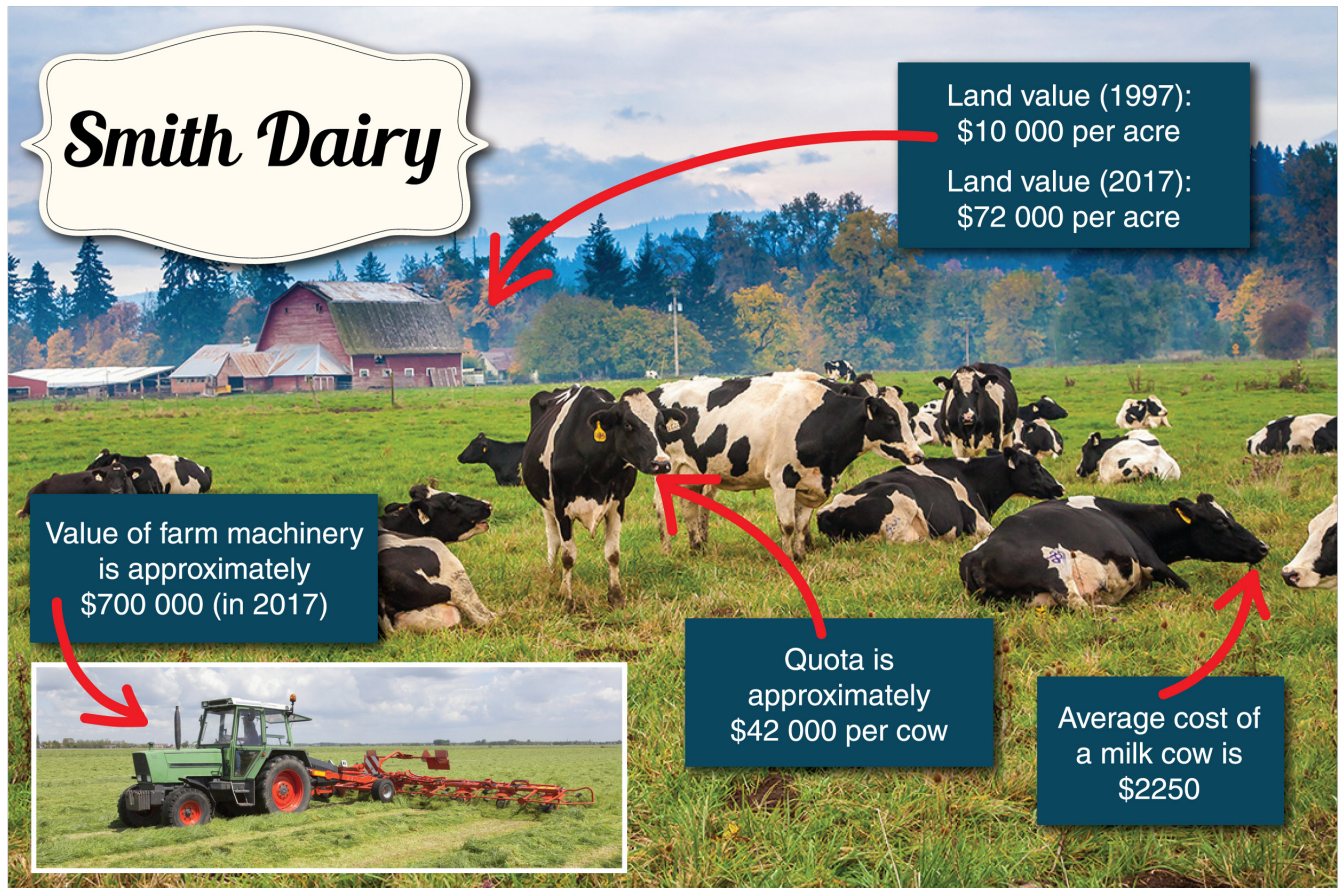
Exemplar #9 – Score: 0

- ☒ Solution provided with no supporting work.

No, the panels wouldn't produce enough energy per day because in may, it uses $452 \text{ km} \cdot \text{h}$ and if the house were to do it this way, they would only produce around $300 \text{ km} \cdot \text{h}$. It is not producing enough energy for how much it is using.

Dairy Farm

The Smith family runs a dairy farm in the Fraser Valley. Farmers purchase a license (called a *quota*) that permits them to sell a fixed volume of milk. A farmer only pays for quota once, and can be transferred to a family member or sold. The value of one quota has changed very little over time. Each cow produces about one quota of milk.



Mr. and Mrs. Smith bought their farm in 1997, which included 160 acres of land (with buildings) and 135 cows. They also bought 135 units of quota, at \$42 000 per unit.

It costs about \$5.50 per day to feed a cow. The cows are replaced as they age so that the farm's overall milk production stays constant.

Farms also use machinery. A typical farm has about \$700 000 of machinery. The machinery needs to be regularly maintained but will continually decrease in value over time.

Dairy Farm

Answer this question on the indicated response sheet.

In 2018, Mr. and Mrs. Smith are ready to retire and would like to share their assets with their children, Brad and Casey. The Smiths received an offer to sell their farm land and buildings at \$72 000 per acre. The buyers would also like to buy the cows, but do not need the quota nor the machinery.

Brad is not interested in farming. Casey, however, would like to start a smaller farm in a different area of the province. She would like to keep the machinery, which has a current value of \$600 000 and about 90 units of quota. The parents have indicated that the value of the farm's total assets be shared fairly between Brad, Casey, and themselves.

Propose a fair settlement. Be sure to include any calculations, estimations, labels, and assumptions you made.

Marking Guide

Question Aspects of a Coherent Solution (Interpretation of the problem and application of logic)

- ▶ **Determines the total value of the farm assets, including land and buildings, cows, quota and machinery.**
 - Determine the monetary value of each of the farm assets
 - Calculate the total value
- ▶ **Determines the plan which divides the farm assets fairly, considering the sale of the land, cows, and remaining assets, while attending the wishes of the Smith Family members.**
 - Determine the allotment of quota and the machinery
 - Determine the fair distribution for the remainder of the cash after the sale of the assets (including the remaining 45 quota)
 - Determine if the assets will be divided by three or four depending on whether parents are given one share or two

Dairy Farm

There are many possible solutions; several solutions are given.

Possible Solutions

Components of an Ideal Solution (Mathematical Analysis and Problem-Solving Strategies)

A. Determines the total value of the farm assets, including land and buildings, cows, quota and machinery.

Sale of the land and building:	$160 \text{ acres} \times \$72\,000 =$	\$11 520 000
Sale of cows:	$135 \times \$2\,250 =$	\$303 750
Value of Machinery:		\$600 000
Cash Value of Quotas:	$135 \times \$42\,000 =$	\$5 670 000
Total Value:		\$18 093 750 (or approx. \$18 000 000)

Assumptions: all assets will have a cash value; if assumptions state a valid rationale for distributing assets differently, no penalty, but the values shown below would change accordingly

B. Determines the plan which divides the farm assets fairly, considering the sale of the land, cows and remaining assets, while attending the wishes of the Smith Family members.

Casey:	Machinery	\$600 000
	90 units of quota:	$90 \times \$42\,000 =$ \$3 780 000
	Receives the difference between her full share and these assets	$\$6\,031\,250 - \$4\,380\,000 =$ \$1 651 250
Brad:	No requests/interest in farming: cash	\$6 031 250
Mr. & Mrs. Smith:	Retired: cash	\$6 031 250

ALTERNATE: divide the assets between four people:	Cash to Brad, to Mr, and to Mrs. Smith	\$4 523 400
	Cash to Casey, after assets	\$143 400

Dairy Farm

Exemplar #1 – Score: 4

- ✓ Student's response demonstrates an extensive understanding of the situation.
- ✓ The reasoning is clearly communicated for all aspects of the problem including value of total assets, and these assets were shared proportionally between all family members using the given criteria.

I'm assuming that Mr. and Mrs. Smith can sell their quota somewhere else than to the buyers and that way they can get their money back:

If they sold the farm to the buyers they could get:

$$160 \text{ acres} \times 72000 \text{ dollars} = 11\,520\,000 \text{ dollars}$$

for land plus for cows:

$$135 \times 2250 \text{ dollars} = 303\,750 \text{ dollars}$$

so total of 11 823 750 dollars

$$\begin{aligned} & (72000 \cdot 160) + \\ & (42000 \cdot 135) + \\ & 600\,000 + \\ & (135 \cdot 2250) = \\ & = 18\,093\,750 \end{aligned}$$

~~Casey wants the machinery~~

If the total value for the farm is 18 093 750 dollars, then every family member should receive $(18\,093\,750 : 4)$ 4 523 437.5 dollars.

Casey wants the machinery and 90 units of quota that is in total worth:

$$600\,000 + (90 \times 42\,000) = 4\,380\,000 \text{ dollars}$$

so if she's to receive a fair share she should get 143 437.5 dollars more

$$\begin{aligned} \rightarrow 4\,523\,437.5 - 4\,380\,000 &= \\ &= 143\,437.5 \end{aligned}$$

Dairy Farm

Exemplar #2 – Score: 4

- ✓ Student demonstrates an extensive understanding of the situation.
- ✓ All critical and pertinent aspects are fully addressed.

What I know:

- give brad money only
- Casey keep machinery + 90 quotas
- Parents want in too (fair share)
- Brad, Casey, and parents are to have fair deal

Asset	Calculation	Value (\$)
Land	\$72000 per acre X 160 acre	11 520 000
Cows	\$2250 per cow X 135 cow	303 750
Quota	\$42 000 per quota X 135 quota	5 670 000
Machine		600 000

Total = land + cow + quota + machine

= \$180 937 50

This should be split among the kids, and parents

180 937 50 / 3 ways = 60 312 50 per party

Dairy Farm

However, Casey wants machines and 90 quota.
So we need to reduce that value from her money.

Casey money - machine - quota = new money for Casey

$$6031250 - 600000 - (90 \text{ quota} \times \$42000 \text{ per quota})$$

$$= \$1651250 \text{ cash for Casey}$$

$$135 \text{ quotas} - 90 \text{ quotas for Casey} = 45 \text{ quotas left.}$$

Because the parents are done farming, Brad doesn't want to farm, and Casey only needs 90 quotas, nobody needs to use the remaining 45 quotas. Therefore, I suggest they sell the remaining 45 quotas and get the money. I've already added this cash amount into the total family assets.

Brad gets \$6031250 cash

Parents gets \$6031250 cash

Casey gets \$1651250 cash, 90 quotas, and the machines.

Everyone has either the same amount of assets that have a total value of that amount.

Dairy Farm

Exemplar #3 – Score: 3

- ✓ Student's response demonstrates a sensible understanding of the situation by determining the value of most of the assets, except the remaining 45 quota units are not addressed. The distribution of assets is reasonably shared between three parties from the total value of assets, including the additional cash that Casey would receive.
- ✓ To improve score, consider the remaining 45 quota units after Casey has taken her share.

assumptions: Mr and Mrs Smith and Brad will not take any machinery of quota, Casey would like it all.
the value of the farm will shared equally

land: 160 acres, \$72000 per acre. $72000 \times 160 = 11520000$ dollar.

cow: 135 cows, \$2250 each. $135 \times 2250 = \$303750$

quota: 90 units, \$42000 each. $90 \times 42000 = \$3780000$

machinery: \$600000

total: $11520000 + 303750 + 3780000 + 600000 = \16203750

shared: $16203750 \div 3 = \$5401250$

Since: Casey took quotas and machinery.
 $5401250 - (3780000 + 600000) = \1561250

So Mr and Mrs Smith get \$5401250, Brad gets \$5401250 and Casey gets quotas and machinery and \$1561250.

Dairy Farm

Exemplar #4 – Score: 3

- ✓ Correctly calculated the appropriate overall value for each person but did not fully answer question by explaining how Casey will get her value (e.g., in form of machinery, quota).
- ✓ To improve score, include a breakdown of Casey's share of assets.

$$\begin{aligned}
 (72,000)(160) &= 11,520,000 \text{ value of the land} \\
 (135)(2,250) &= 303,750 \text{ value of cows} \\
 \text{machinery} &= 700,000 \\
 (135)(42,000) &= 5,670,000 \text{ value of quotas} \\
 &= 18,193,750 \text{ total value of the farm} \\
 \frac{18,193,750}{4} &= 4,548,437.5\# \text{ per person}
 \end{aligned}$$

Mem and Dad Keep 9,096,937.5# worth of assets	Brad Keeps 4,548,437.5 worth of assets	Casey Keeps 4,548,437.5 of the assets (includes the machinery)
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Dairy Farm

Exemplar #5 – Score: 2

- ✓ Exemplar accurately includes calculated values of cows and land, however, the quotas were excluded entirely from the calculations.
- ✓ Student attempted to deal with value of machinery by subtracting from Casey's share and sharing it with the other two groups.
- ✓ To improve score, student needs to consider all aspects of question (i.e., include quota and machinery) prior to division of assets and to clearly communicate the rationale.

Sell the farm at \$72000 per acre but keep machinery, also they can sell the cows and split the money they make, Casey will get \$600000 less as she wants the machinery.

$$\begin{aligned} \text{acres and } 72000 \times 160 &= \$11,520,000 \\ \text{Cows } 135 \times 2250 &= 303,750 \\ &\$11,823,750 \end{aligned}$$

Mrf / Mrs Smith	Blad	Casey	÷ 3
3941250	3941250	3941250	3 941250
+ 300000	+ 300000	- 600000	
\$4241250	\$4241250	\$3341250 + Machine	

Approximate money for everyone

Dairy Farm

Exemplar #6 – Score: 2

- ✓ Equal division was conducted. (In a Share question involving division of resources, equal division is not an appropriate strategy.)
- ✓ Calculation error when determining value of cows.
- ✓ To improve score, response needs to consider the value of the wishes of each family member.

The Buyers

$$\text{Land} = 72,000 \times 160 = 11,520,000$$
$$\text{Cows} = 2,250 \times 135 = 303,750$$
$$\text{Total Profit} = 11,520,000 + 303,750$$
$$= 11,823,750$$

Smith Family fair share

$$\text{Machinery} = 4600,000 \div 4 = 1150,000$$
$$\text{Quota} = \frac{135 \times 42,000}{4} = 1,417,500$$
$$\text{Cows} = \frac{135 \times 2,250}{4} = 75,937.50$$
$$\text{Land} = \frac{72,000 \times 160}{4} = 2,880,000$$
$$\text{Total} = 1150,000 + 1,417,500 + 2,880,000 + 75,937.50$$
$$= 4,521,437.50$$

each family member holds \$4,521,437.50 of the farm assets, in conclusion they should not sell it and keep the farm

Dairy Farm

Exemplar #7 – Score: 1

- ✓ Total value of assets calculated but did not apply a sharing process for these assets.
- ✓ Did not consider that buyers were purchasing a portion of assets, nor the share parents will get.
- ✓ To improve score, include calculations to divide assets.

160 acres of land - value = \$11,520,000		6,573,750
Machinery = \$600,000	total = 18,093,705	2,473
135 units of quota = \$5,670,000	9,046,852.5 each	
135 cows = \$303,750	- 6,573,750	
	= 2,473,102 / 42,000	
$(90 \times 42,000) + (600,000) = 4,380,000$		= 59
Casey should receive the machinery, all 135 units of quota, All 135 cows, because of her interest in farming along with 59 acres of land to be fair. And Brad should receive the remaining 101 acres of land which he can sell due to lack of interest.		

Dairy Farm

Exemplar #8 – Score: 1

- ✓ Division does not follow criteria provided in the question and not supported by calculations. No explanation for the 3 million for Brad and Casey. The other 45 quota are unaccounted for.
- ✓ To improve score, calculate total value by considering all aspects (machinery and remaining quota) and ensuring all parties are getting their wishes.

$- 72000 \times 160 \text{ acres} \quad 11520,000$
 $- 2250 \times 135 \text{ cows} \quad 303,750$
 $\$11,823,750 \text{ for the land}$
the assets they still have
 $600,000 + (42000 \times 90)$
 $= 4,380,000$
in total they have 16,203,750

The parents split that 50-50
 $5,101,875$ for each of them

then gave the 2 kids 3 million each
Then they are left with 16,203,750

Dairy Farm

Exemplar #9 – Score: 0

- ☒ Student's response demonstrates an attempt to distribute some assets but without supporting work.

Casey should pay Brad ~~18~~ 100000
because they's half the value of the machinery

Exemplar #10 – Score: 0

- ☒ Response does not address the purpose of the task. Information recopied from the problem.

offer to sell the land for \$72 000 per acre

cows = \$2250

Casey would like to keep the machinery that has a current value of \$600 000 and 90 units of quota

I don't think that the parent's idea is a good one because Brad isn't interested in farming and Casey has everything she needs to start her own farm in another province.

Ice Cream Shop



You rented a storefront and opened an ice cream shop that will be in business during the weekends of the summer tourist season. You looked over sales data collected between the Canada Day and B.C. Day weekends (Table 1).

Date		Maximum Daily Temperature	Sales
June 30	Canada Day Weekend	19°C	\$215
July 1		21°C	\$327
July 2		17°C	\$185
July 7		20°C	\$332
July 8		24°C	\$406
July 14		27°C	\$522
July 15		24°C	\$413
July 21		18°C	\$202
July 22		22°C	\$408
July 28		23°C	\$421
July 29		28°C	\$445
August 4	B.C. Day Weekend	31°C	\$559
August 5		30°C	\$598
August 6		20°C	\$319

Ice Cream Shop

Answer this question on the indicated response sheet.

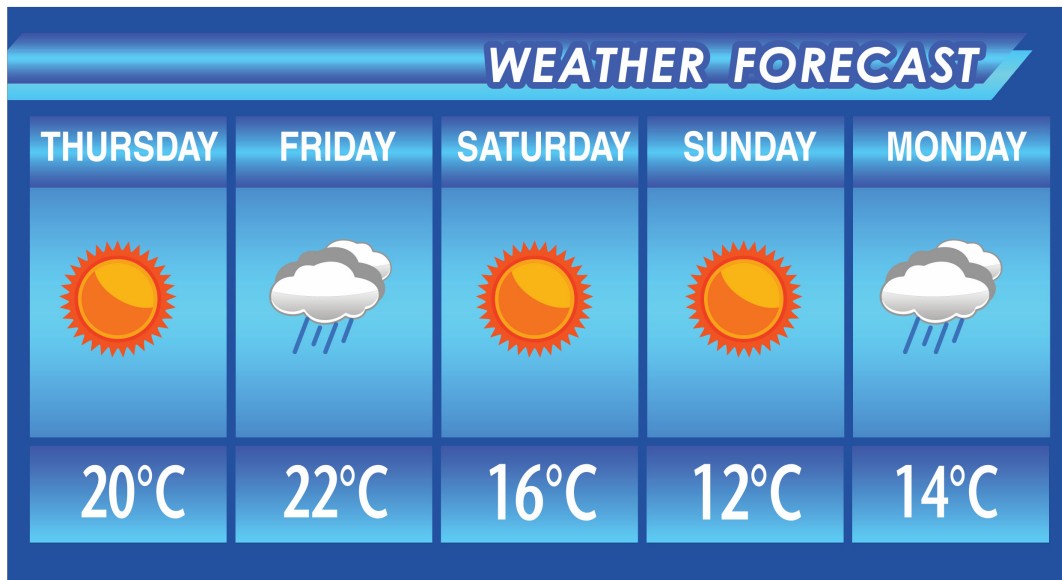
The students have returned to school, the town is seeing fewer tourists, and while it has been sunny, the forecast is rain. You will use early fall sales data to predict sales of the Thanksgiving weekend before closing for the season.

Other ice cream stores in the area experience an average 40% decrease in sales on rainy days to sunny days at the same temperature.

Graph the data in Table 2. **Using this graph and the weather forecast, predict through extrapolation and interpolation** your ice cream sales for the five days.

Table 2. Temperature and daily ice cream sales
on sunny September days

Temperature (°C)	Sales (\$)
25°	\$511
23°	\$430
24°	\$376
17°	\$253
21°	\$440
18°	\$311
15°	\$319
15°	\$217



Explain and justify your solution. Be sure to include any calculations, estimations, labels, and assumptions you made.

Marking Guide

Question Aspects of a Coherent Solution (Interpretation of the problem and application of logic)

► **Creates a scatter plot**

- Title and labels on axes
- Axes appropriately scaled
- 8 data points from table 2 plotted
- Draws line of fit

► **Extrapolation/Interpolation**

- Uses line of fit to find predicted sales for provided temperatures
- *May or may not find the equation for the line of fit*

► **Determines predicted ice cream sales for five days**

- Lists predicted sales for Thursday through Monday
- Uses 40% average decrease in sales for rainy days – shows calculations
- Provides the total sales for the final five days of the season

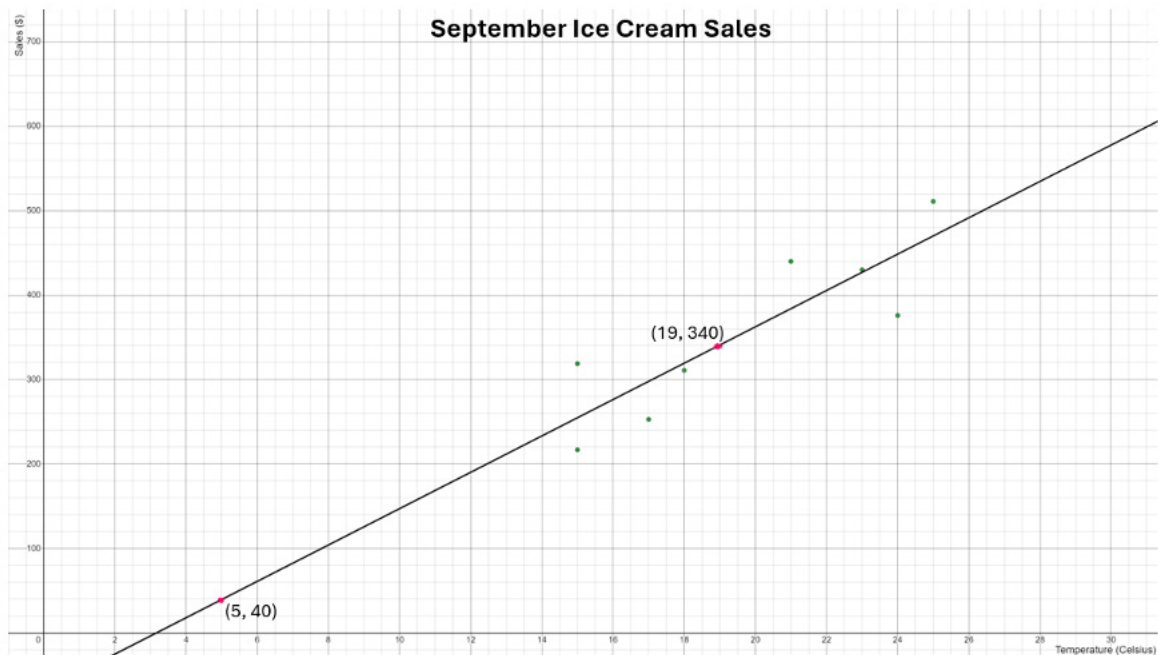
Ice Cream Shop

There are many possible solutions; several solutions are given.

Possible Solutions

Components of an Ideal Solution (Mathematical Analysis and Problem-Solving Strategies)

Creates a scatter plot



Extrapolation/Interpolation

Determines predicted ice cream sales for five days

- Line of fit equation:

$$m = \frac{340 - 40}{19 - 5} = 21.43$$

$$340 = 21.43(19) + b$$

$$340 = 407.17 + b$$

$$-67.17 = b$$

$$y = 21.43x - 67.17$$

- Rainy Days: 40% decrease means 60% of predicted sales

Day	Calculations	Predicted Sales (\$)
Thursday	$y = 21.43(20) - 67.17 = 361.43$	361
Friday	$y = 21.43(22) - 67.17 = 404.29$ $Rainy = 404.29(0.6) = 242.57$	243
Saturday	$y = 21.43(16) - 67.17 = 275.71$	276
Sunday	$y = 21.43(12) - 67.17 = 189.99$	190
Monday	$y = 21.43(14) - 67.17 = 232.85$ $Rainy = 232.85(0.6) = 139.71$	140
Total		1210

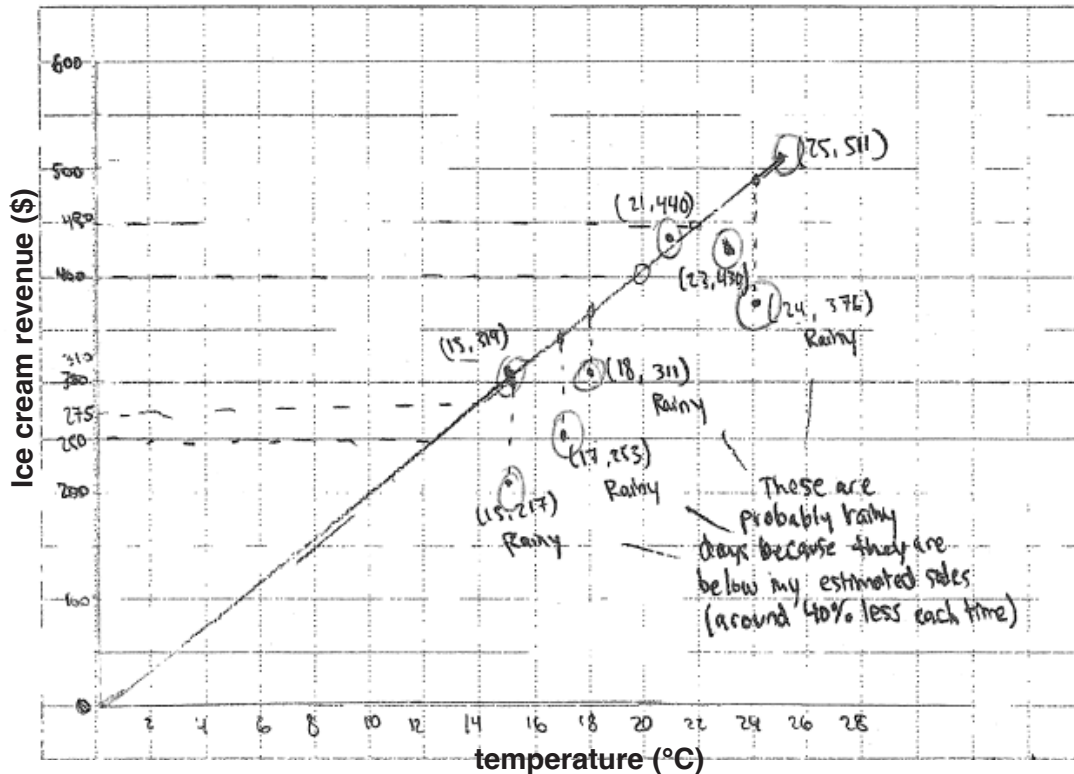
Using my line of fit to average sales based on temperature, the sales for the last weekend of the season at the ice cream shop should total around \$1210.

Ice Cream Shop

Exemplar #1 – Score: 4

- ✓ Good labelling of points and line of best fit. Reasonable solution obtained.

Ice cream revenue vs. temperature



$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{511 - 0}{25 - 0} = 20.44$$

$$y = 20.44x$$

My estimated sales on a sunny day: 409.8

Rainy days lose 40% sales

Friday rainy: $449.7 \times 0.6 = 269.82$
 Monday rainy: $286.2 \times 0.6 = 171.72$

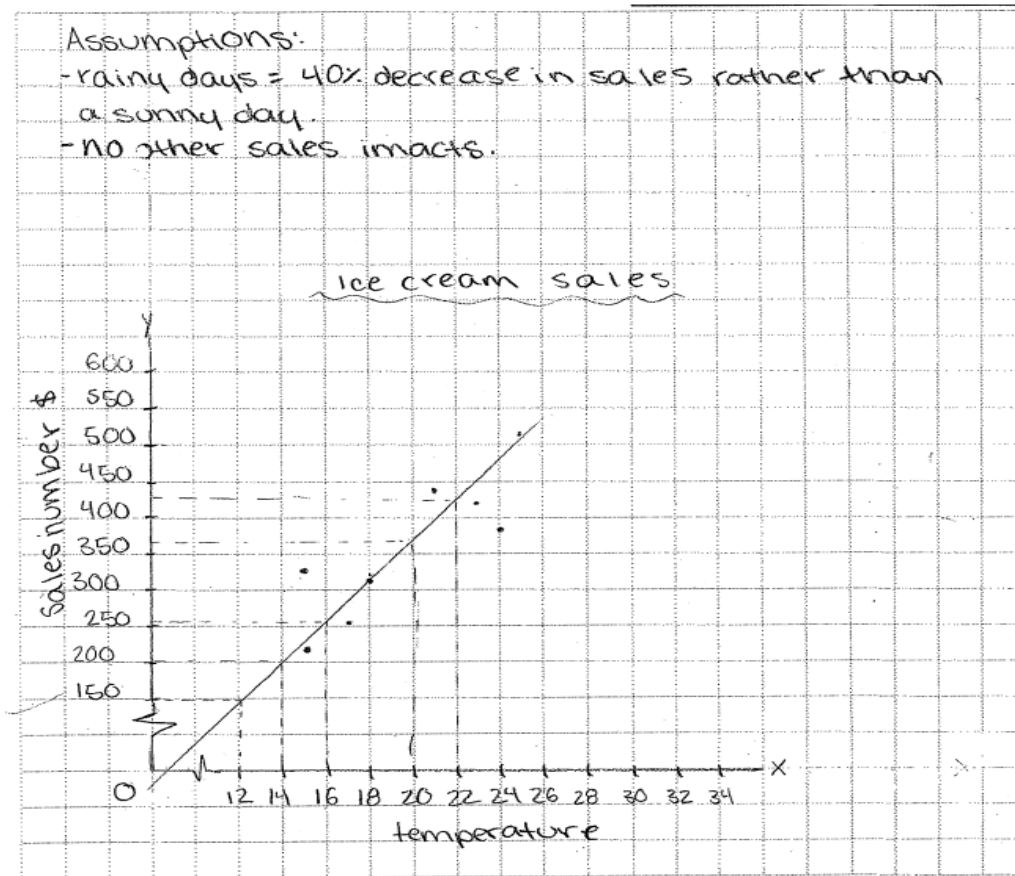
Calculations for sunny days:
 20°C: $y = 20.44(20) = 408.8$
 22°C: $y = 20.44(22) = 449.7$
 16°C: $y = 20.44(16) = 327.0$
 12°C: $y = 20.44(12) = 245.3$
 14°C: $y = 20.44(14) = 286.2$

	Thursday 20°C Sunny	Friday 22°C Rainy	Saturday 16°C Sunny	Sunday 12°C Sunny	Monday 14°C Rainy
Predicted Sales	\$409	\$268	\$327	\$245	\$172

Ice Cream Shop

Exemplar #2 – Score: 4

- ✓ Included assumptions. Good strategy and line of best fit graph.
- ✓ Response considered the weather variable with corresponding adjustments to profit made.



Thurs	Fri	Sat	Sun	Mon
370\$	425\$	255\$	150\$	200\$
	255			120
	425.00	375		0.4 × 200
	40%	-170		= 80
	0.4 × 425	255		-20
	= 170			120

- I used the line of best fit to estimate the next weeks sales. After graphing the previous weeks sales.

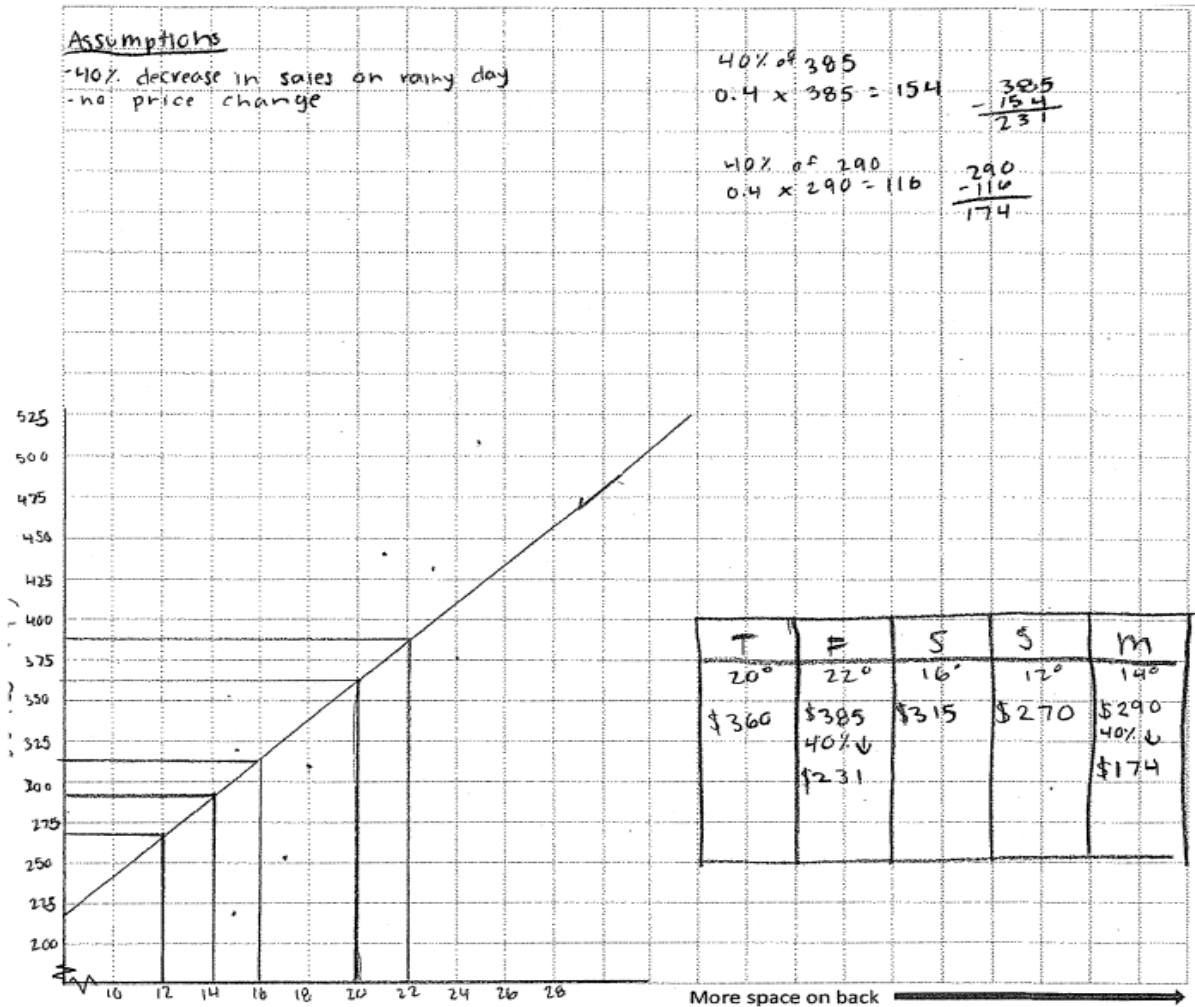
- then I used the average to estimate the coming week.

- I also included the decrease of 40% on rainy days.

Ice Cream Shop

Exemplar #3 – Score: 3

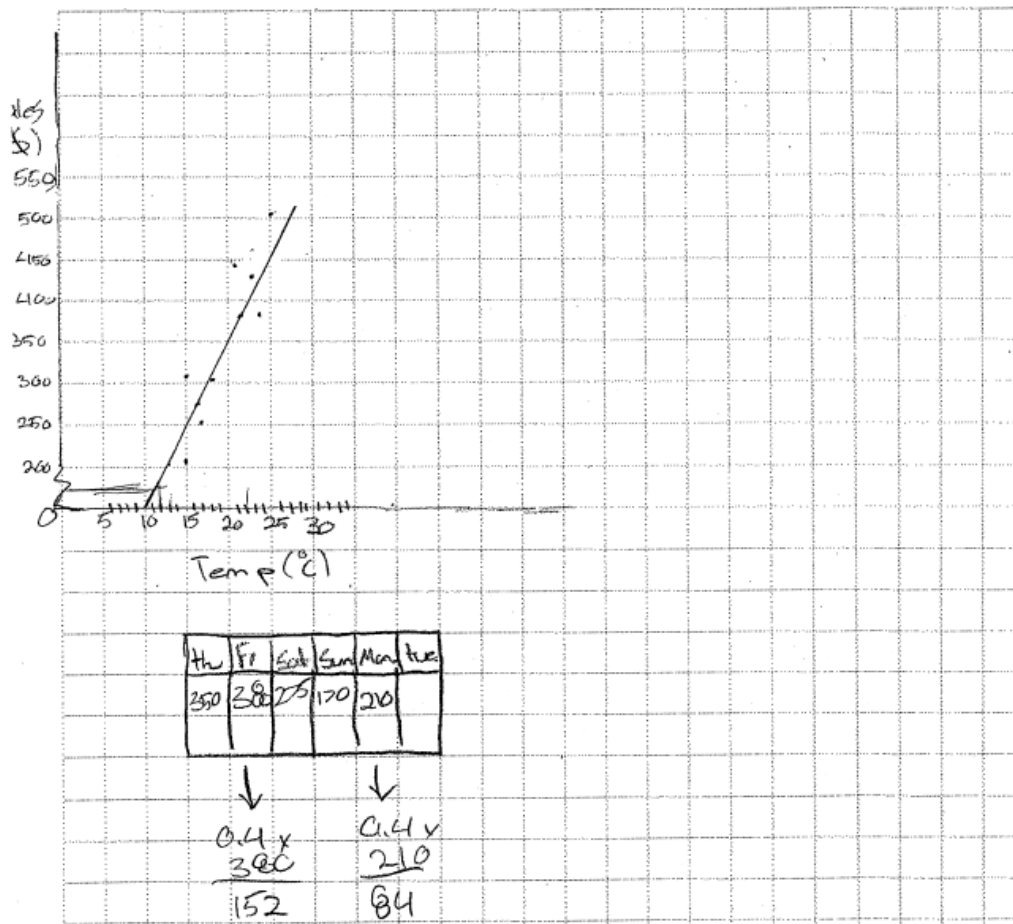
- ✓ Stated assumptions, which demonstrates good communication.
- ✓ Graph is accurately plotted, with adjustments made to sales numbers due to weather.
- ✓ Next steps: labeled axis on graph; line of best fit should reflect all points plotted.



Ice Cream Shop

Exemplar #4 – Score: 2

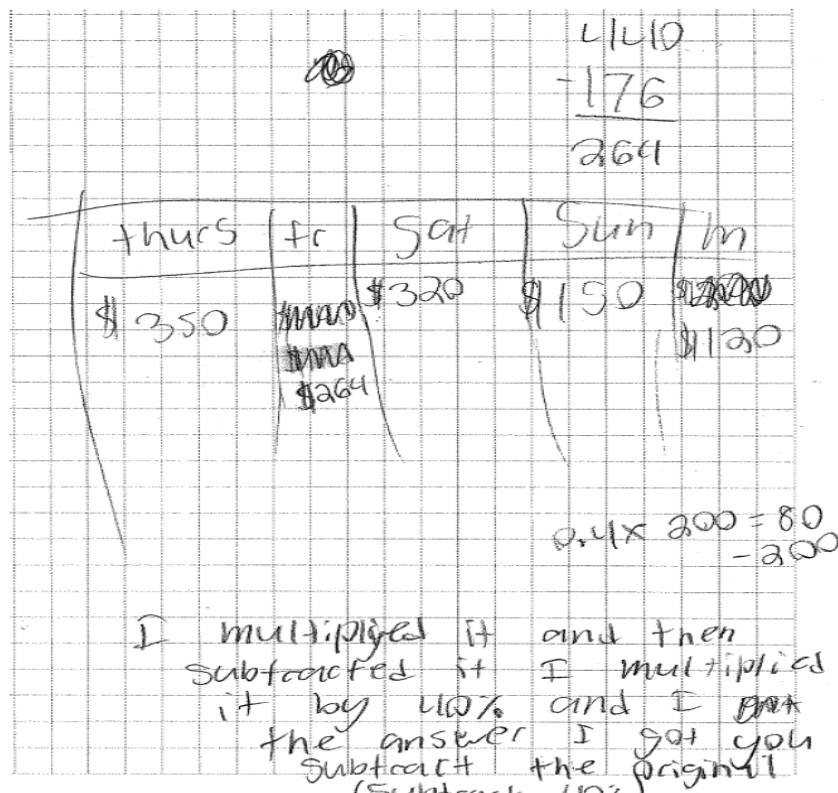
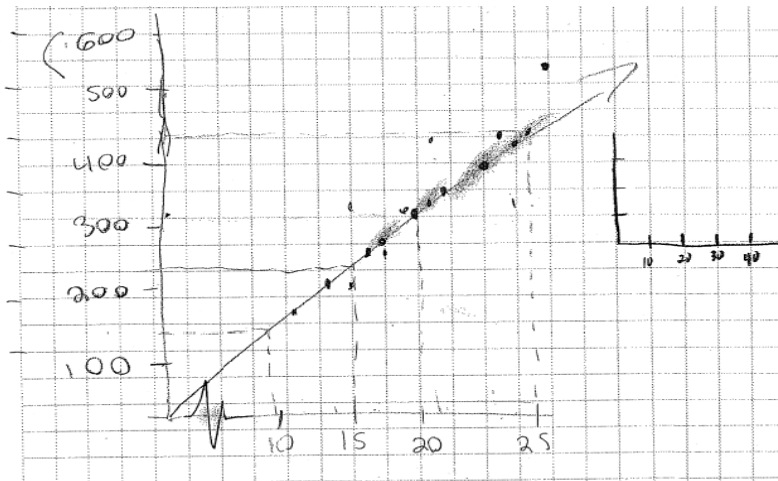
- ✓ Line of best fit attempted.
- ✓ Some calculations on adjusted sales due to weather but did not incorporate this work into revenues.
- ✓ No evidence of how data was attained from graph (interpolation).
- ✓ Next steps: determine weather-adjusted sales and show how future sales were derived from the graph.



Ice Cream Shop

Exemplar #5 – Score: 2

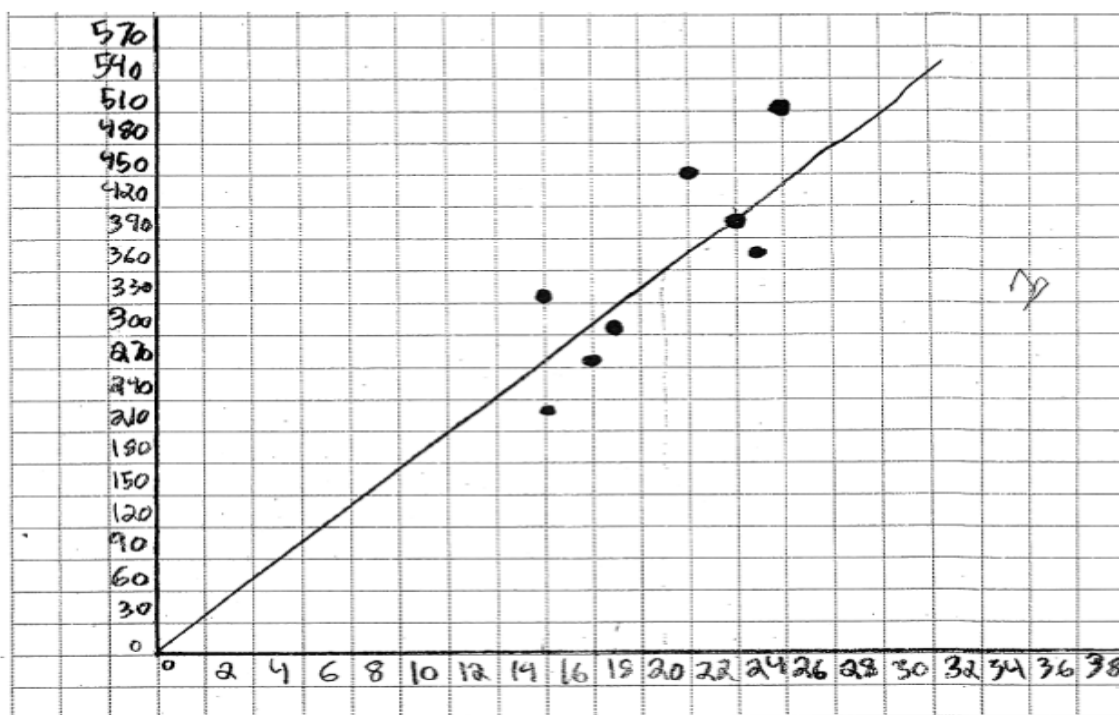
- ✓ Response on right track, with a line of best fit included.
- ✓ Imprecise graph made it difficult to accurately interpolate data (i.e., find values).
- ✓ Attempts to calculate reduced sales for the five days.
- ✓ Next steps: Use an appropriate scale for the graph to improve precision.



Ice Cream Shop

Exemplar #6 – Score: 1

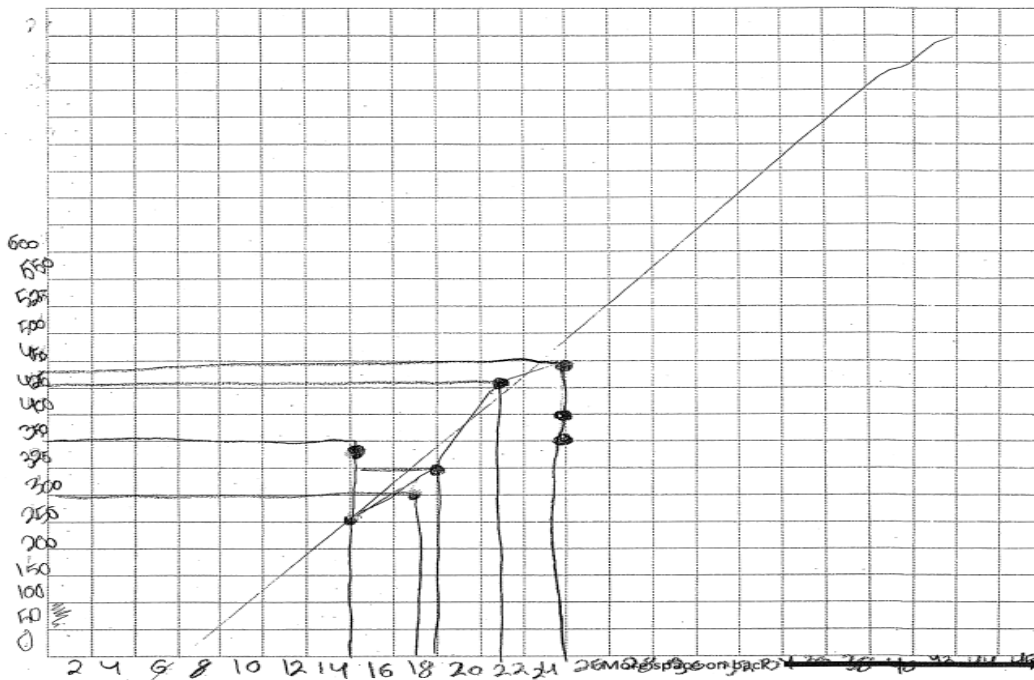
- ✓ Attempted to plot given points with line of best fit.
- ✓ Did not calculate any weather-adjusted sales data.
- ✓ Did not use graph to find values for future sales (i.e., interpolation).
- ✓ Next steps: Label increments of graph on the line. Show interpolated values on the graph.



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Exemplar #7 – Score: 1

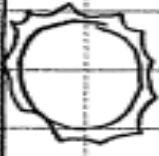
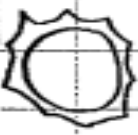
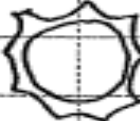
- ✓ Points are plotted incorrectly, although a line of best fit is attempted.
- ✓ Axes incorrectly labelled; values are not consistently labeled at gridlines.
- ✓ Next steps: Create an accurate graph (including labels). Label the data points to show interpolated values.



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Exemplar #8 – Score: 0

- ✓ Answer without supporting work, does not enter the question.
- ✓ Absence of relevant calculations.

Thursday	Friday	Saturday	Sunday	Monday
				
20°C	22°C	16°C	12°C	14°C
\$420	\$460	\$340	\$260	\$300

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Exemplar #9 – Score: 0

- ☒ All work shown is unrelated to solution.

The student's work on grid paper includes the following:

- $$20^{\circ}\text{C} = 129$$
- $$21 = 440$$
- $$18 = 311$$
- 3 difference
- $$\begin{array}{r} 440 \\ - 311 \\ \hline 129 \end{array}$$
- $$\begin{array}{r} 440 \\ - 430 \\ \hline 10 \\ + 319 \\ \hline 329 \end{array}$$
- $$\begin{array}{r} 219 \\ - 311 \\ \hline 102 \end{array}$$
- $$\begin{array}{r} 311 \\ - 319 \\ \hline -8 \\ + 217 \\ \hline 216 \end{array}$$

At the bottom, there is a small calculation: $440 - 211 =$ and an arrow pointing right with the text "More space on back".