Grade 10 Numeracy Assessment

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

BRITISH COLUMBIA | Ministry of Education and Child Care

Form A

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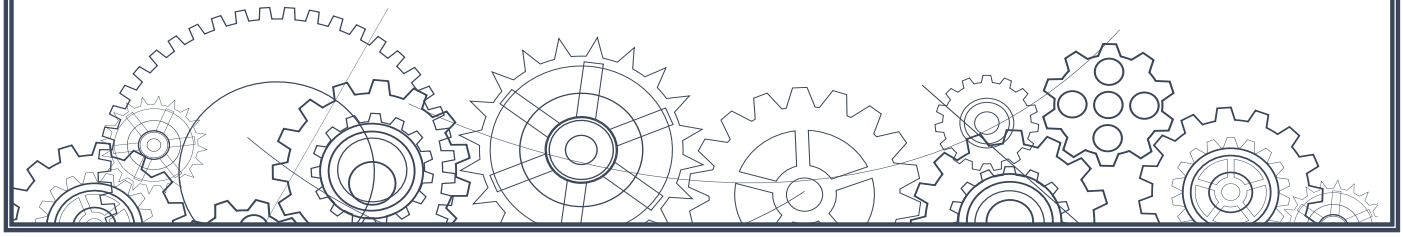


Rubric and Elaborations

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

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

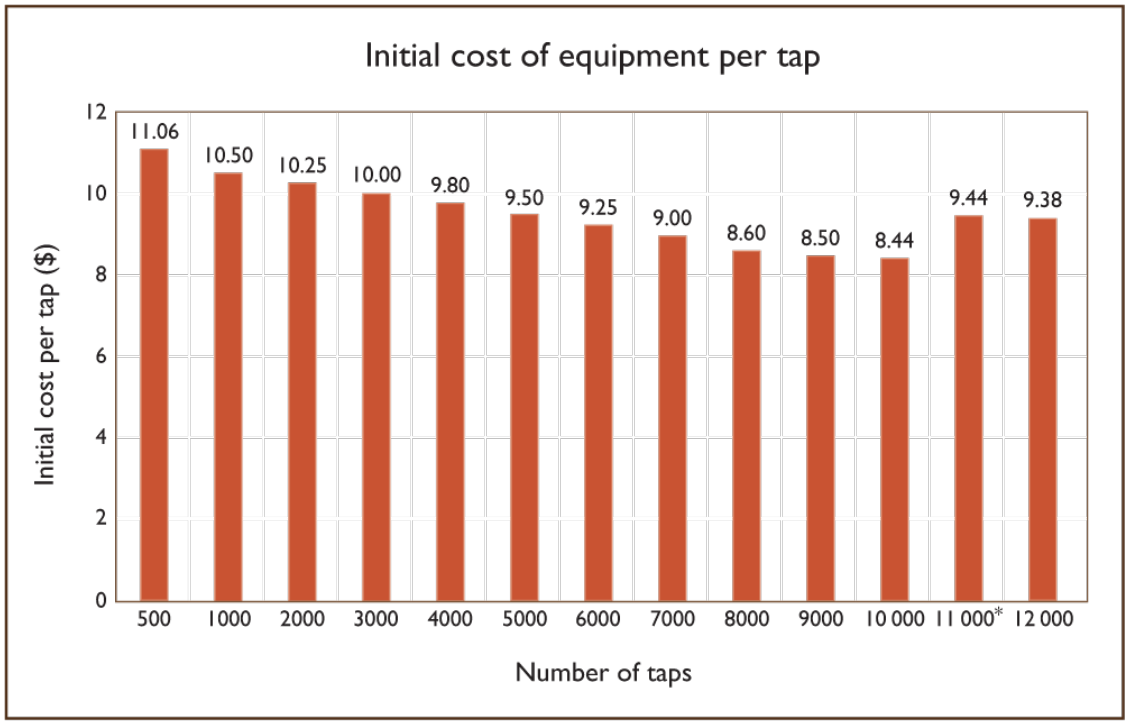
40 L of tree sap = 1 L of syrup

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** $\frac{\$5000}{\text{ha}} \times 16 \text{ ha} = \$80\,000$

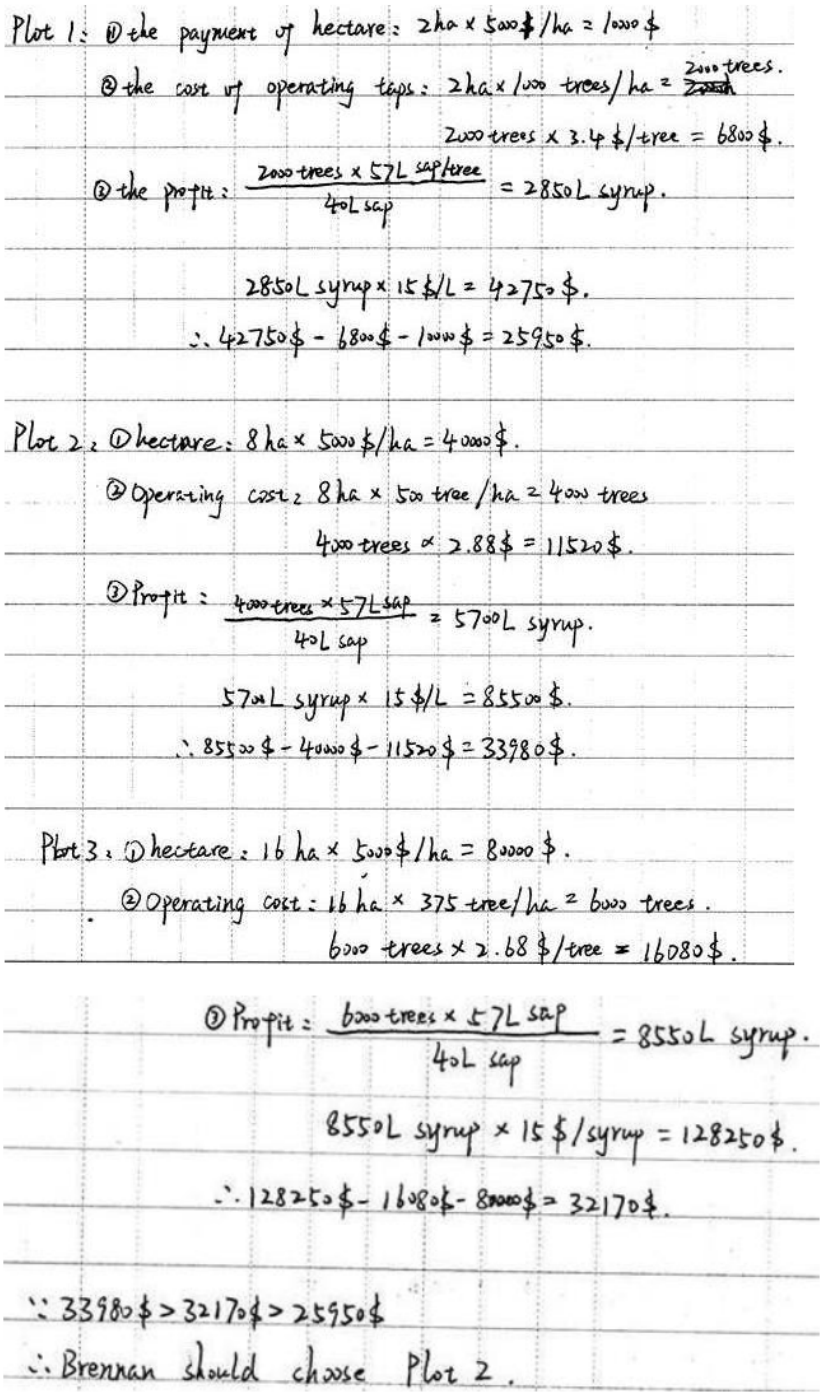
  Total $96 080
- **Profit = sales - costs** **$128 250 - $96 080 = $32 170**

Plot 2 would bring in the largest profit

Maple Syrup

Exemplar #1 – Score: 4

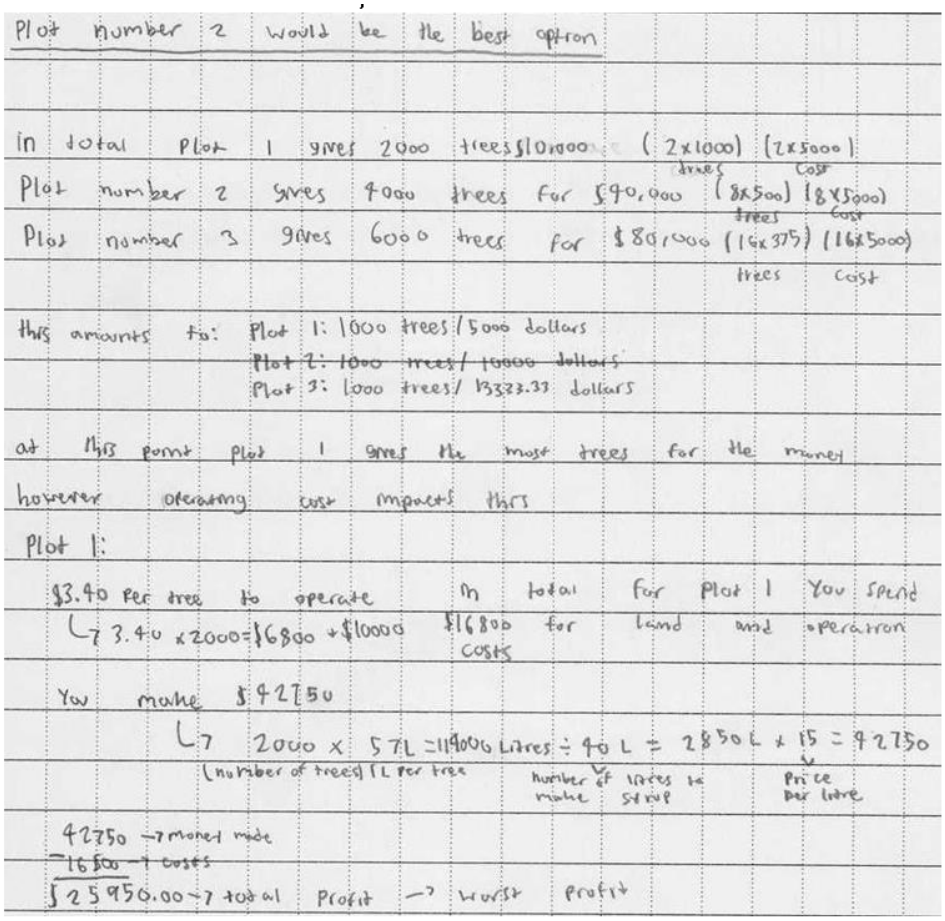
- ☑ Response showcases an extensive understanding of the situation.
- ☑ Strategy communicated clearly with all work supported by calculations.



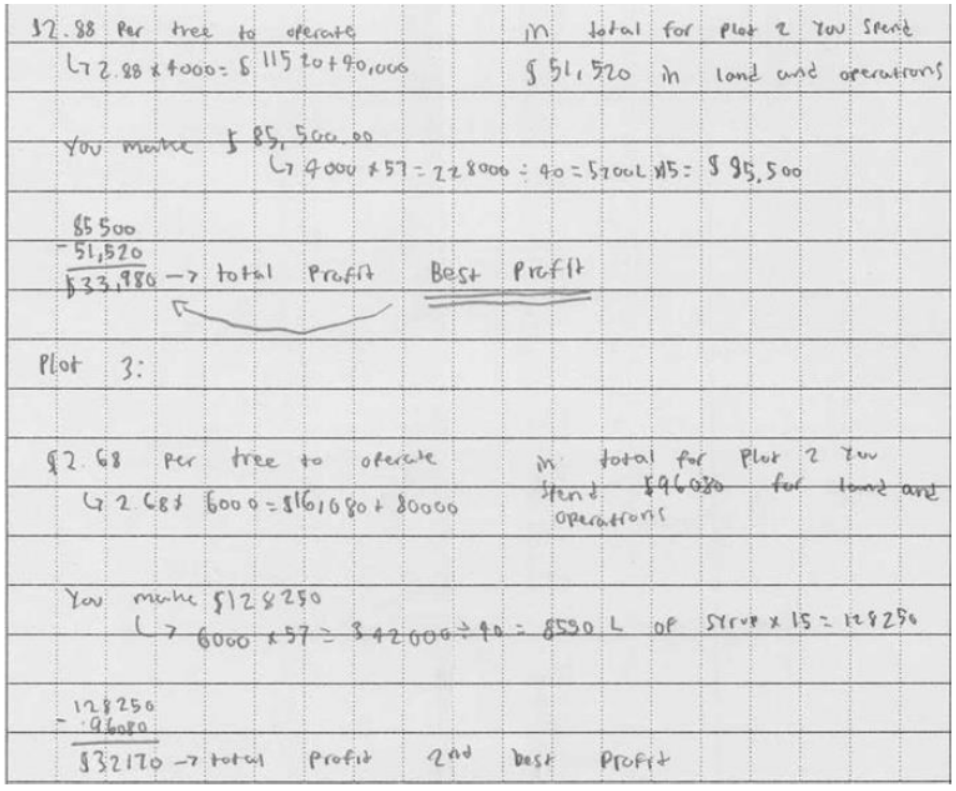
Maple Syrup

Exemplar #2 – Score: 4

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



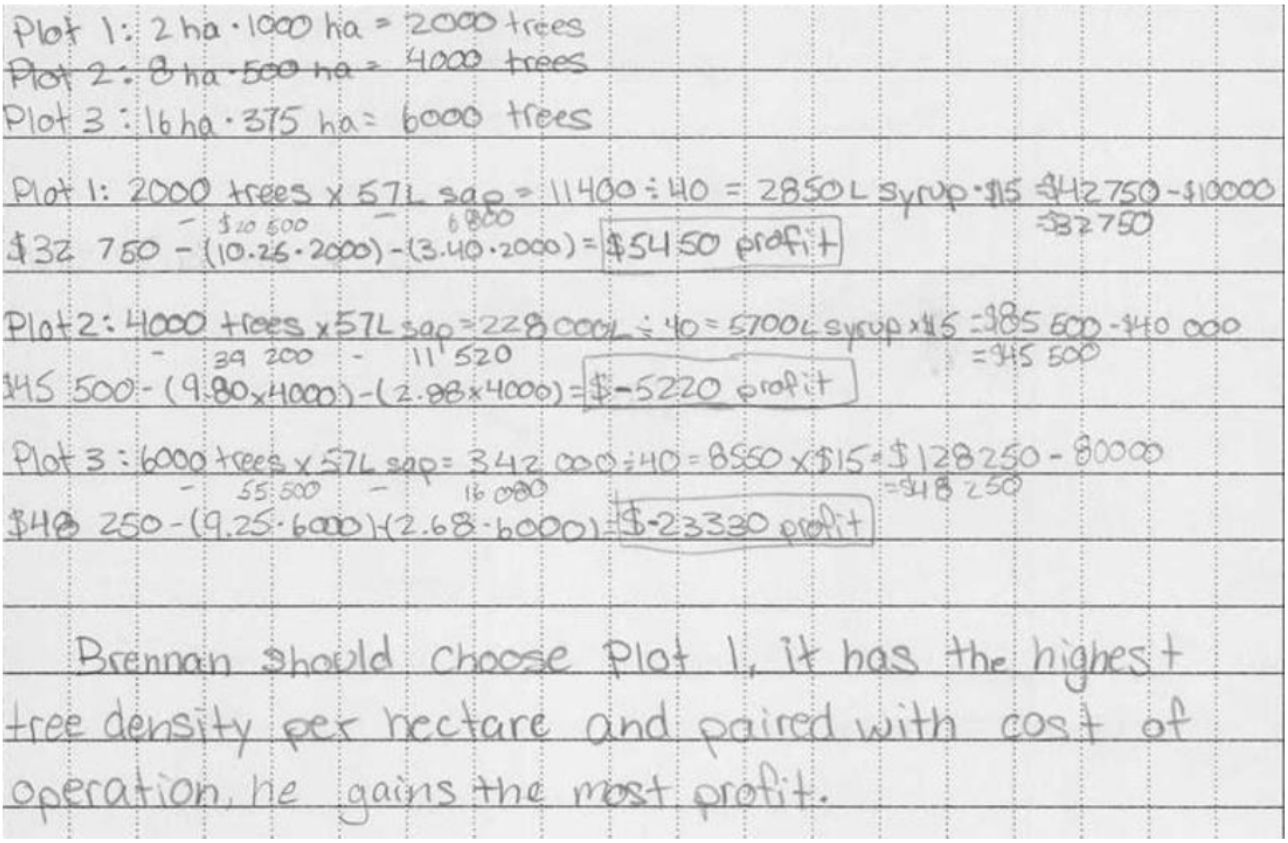
Maple Syrup


$2.88 per tree to operate
↳ 2.88 x 4000 = $11520 + 40,000
in total for plot 2 you spent
$51,520 in land and operations
You make $85,500.00
↳ 4000 x 57 = 228000 ÷ 40 = 5700L x 15 = $85,500
$85500
- 51,520
$33,980 → total Profit
Best Profit
Plot 3:
$2.68 per tree to operate
↳ 2.68 x 6000 = $16080 + 80000
in total for plot 2 you spent $96080 for land and operations
You make $128250
↳ 6000 x 57 = $342000 ÷ 40 = 8550 L of syrup x 15 = 128250
128250
- 96080
$32170 → total Profit 2nd Best Profit

Maple Syrup

Exemplar #3 – Score: 3

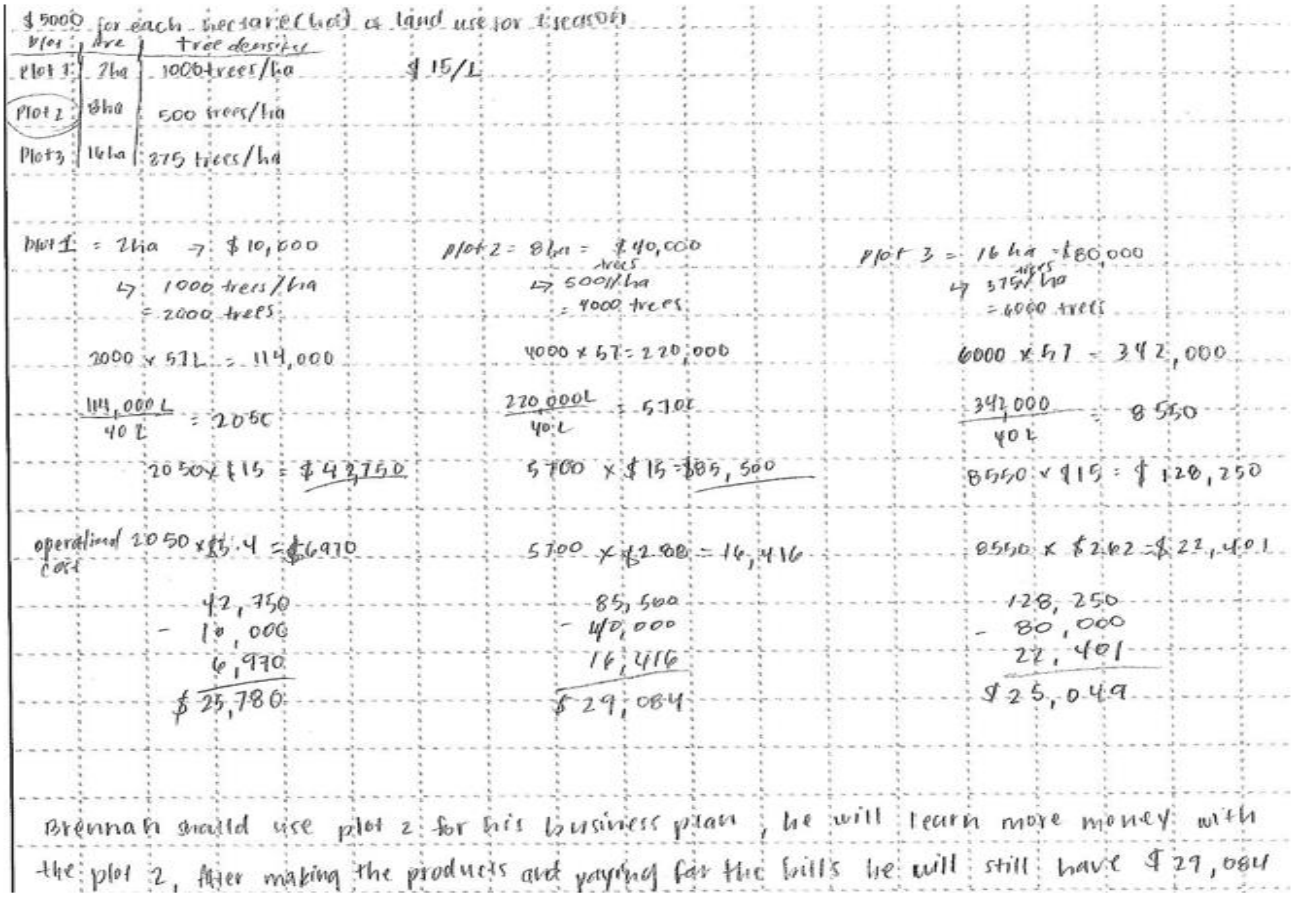
- ☑ Initial start up (equipment) costs were mistakenly considered, leading to an incorrect answer.
- ☑ Otherwise, solution demonstrates a strong understanding of situation.



Maple Syrup

Exemplar #4 – Score: 3

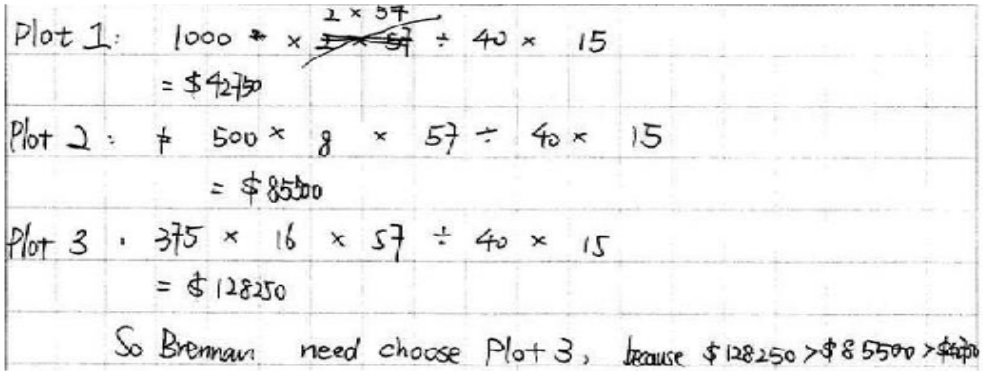
- This response demonstrates a strong understanding of the situation. It addresses all aspects of the problem, but incorrectly calculates operational costs by using the number of litres of syrup rather than the number of trees.
- Strategy is viable; overall approach is sensible and well organized.
-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



Maple Syrup

Exemplar #5 – Score: 2

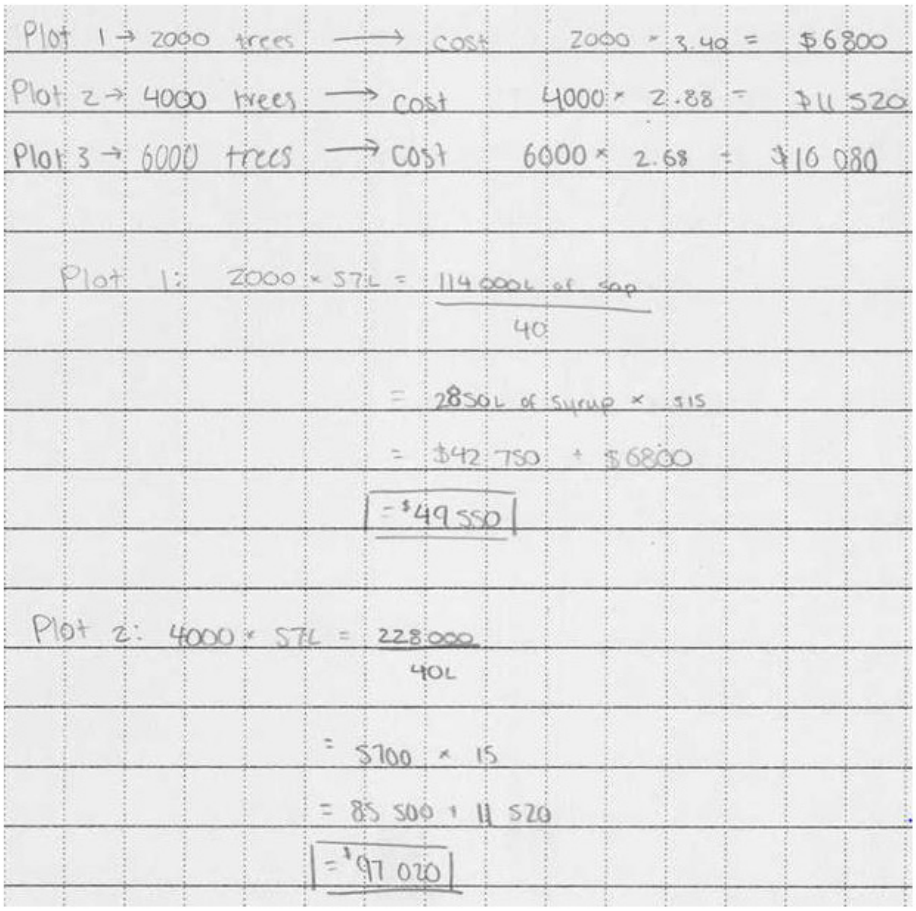
- ☑ Response correctly calculates the gross sales from the syrup from each plot and makes a choice comparing all three plots.
- ☑ Student demonstrates only a basic understanding of the situation. Land and operational costs not calculated; as a result, no profit was determined.
- ☑ To improve score, need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

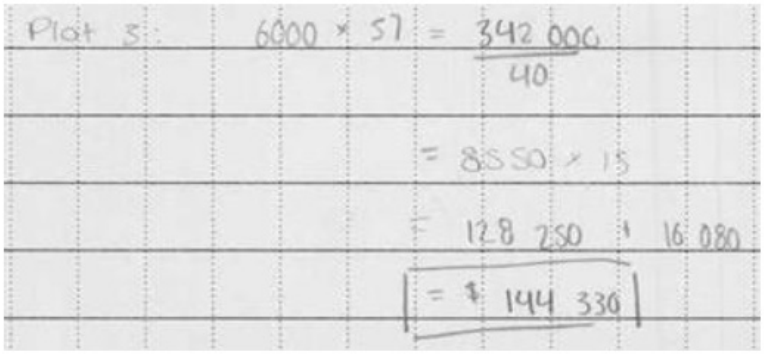


Maple Syrup

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.

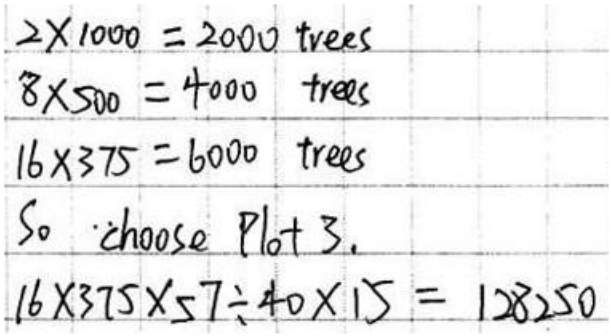




Maple Syrup

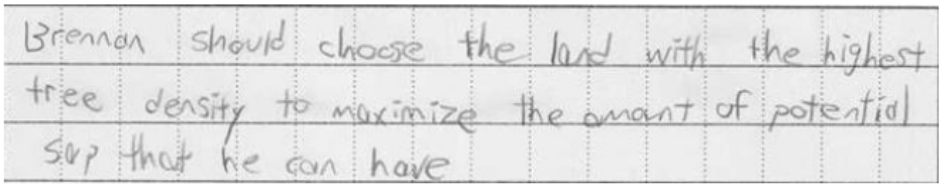
Exemplar #7 – Score: 1

- 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.



Exemplar #8 – Score: 0

- Example of an answer without supporting work.



Solar Energy Project

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

Capital Hydro

Billing Date: January 15

Account Number: 78654321

Pay By: February 06

Meter Reading Information

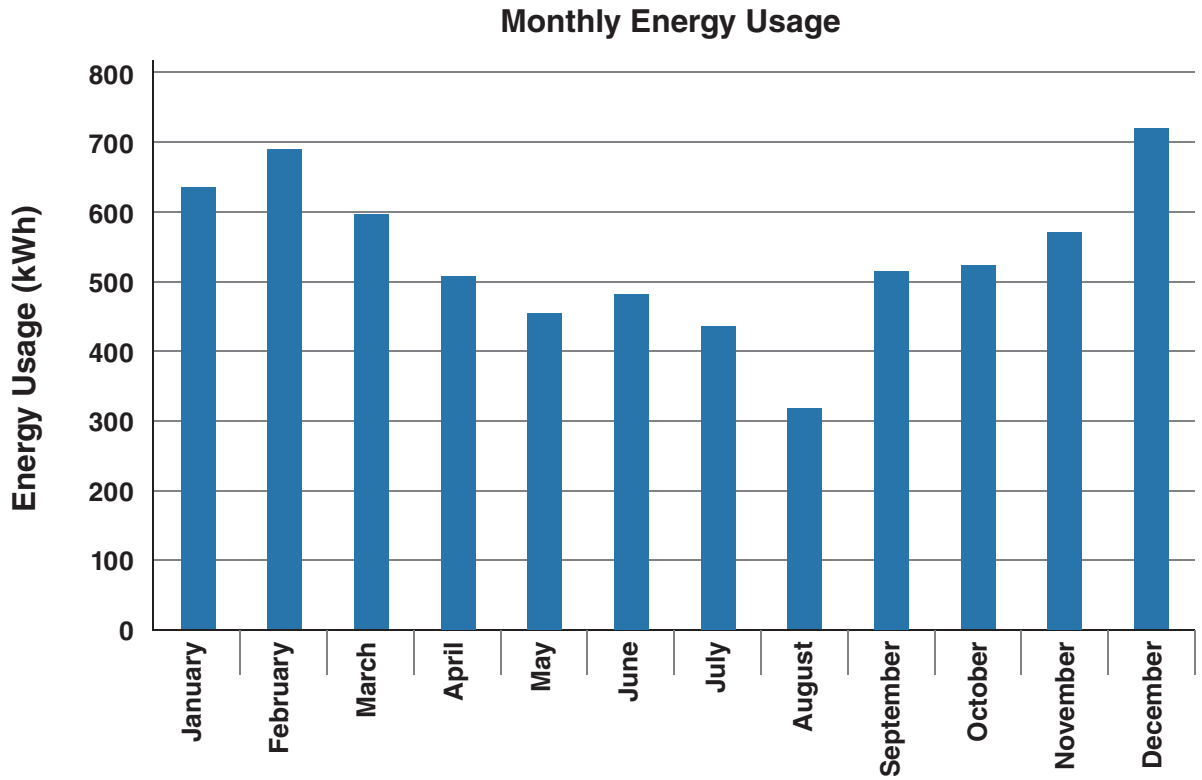
Meter #	5620624
Dec 01	7305
Dec 31	8020
31 days	715

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**



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.

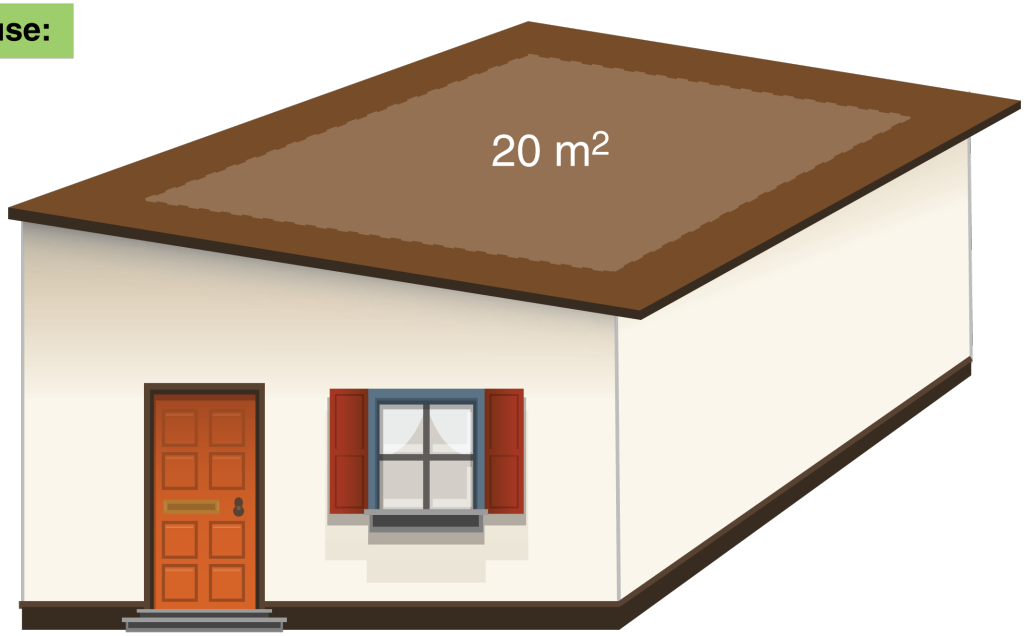
Depending on conditions and sunlight, one panel can generate up to 1.5 kWh per day.

Solar Energy Project

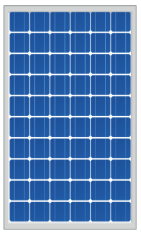
Answer this question on the indicated response sheet.

The roof of a house has an available area of 20 m² for solar panel installation.

House:

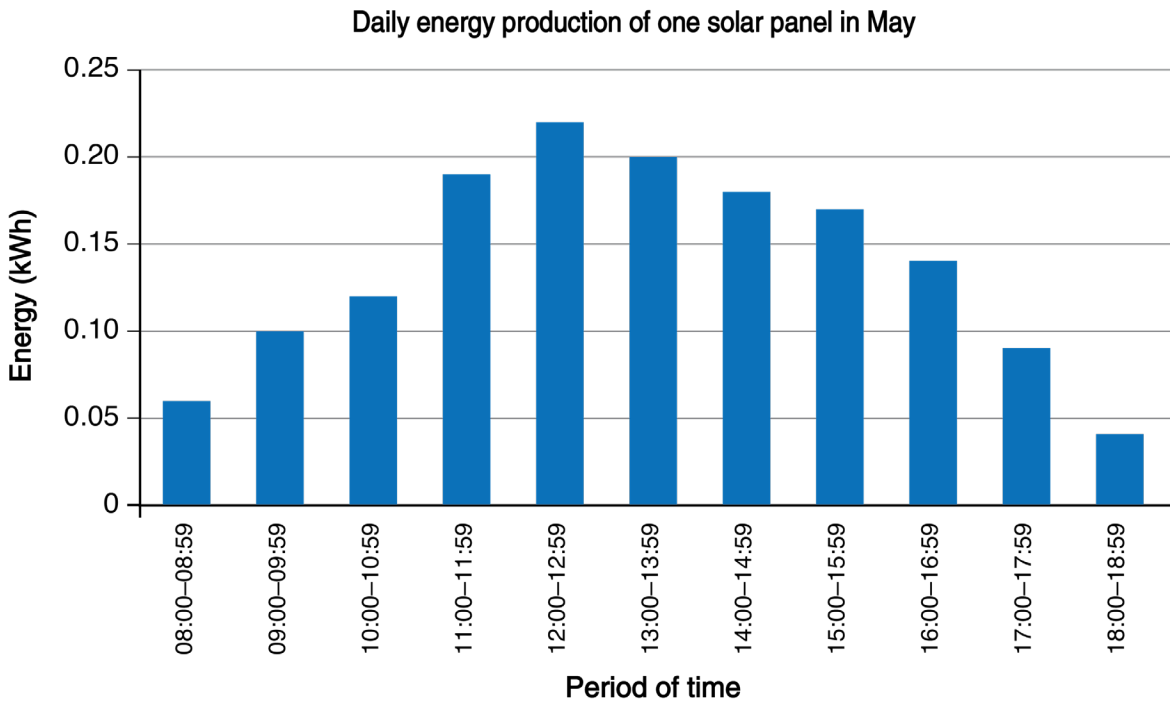


Solar panel:



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 $= \frac{450 \frac{\text{kWh}}{\text{month}}}{31 \text{ days}} = 14.5 \frac{\text{kWh}}{\text{day}}$

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

- Each panel has a surface area of 1.65 m²
- Energy genrated by one panel per day (range 1.4 - 1.7 kWh/day)
- #panels $= \frac{\text{roof area}}{\text{area per panels}} = \frac{20 \text{ m}^2}{1.6 \frac{\text{m}^2}{\text{panels}}} \simeq 12$ panels (range 10-12 panels)
- daily energy produced = (12 panels) × $(1.5 \frac{\text{kWh}}{\text{panel}}) = 18 \frac{\text{kWh}}{\text{day}}$
- energy produced in May = (31 days) × $(18 \frac{\text{kWh}}{\text{day}}) = 558$ kWh

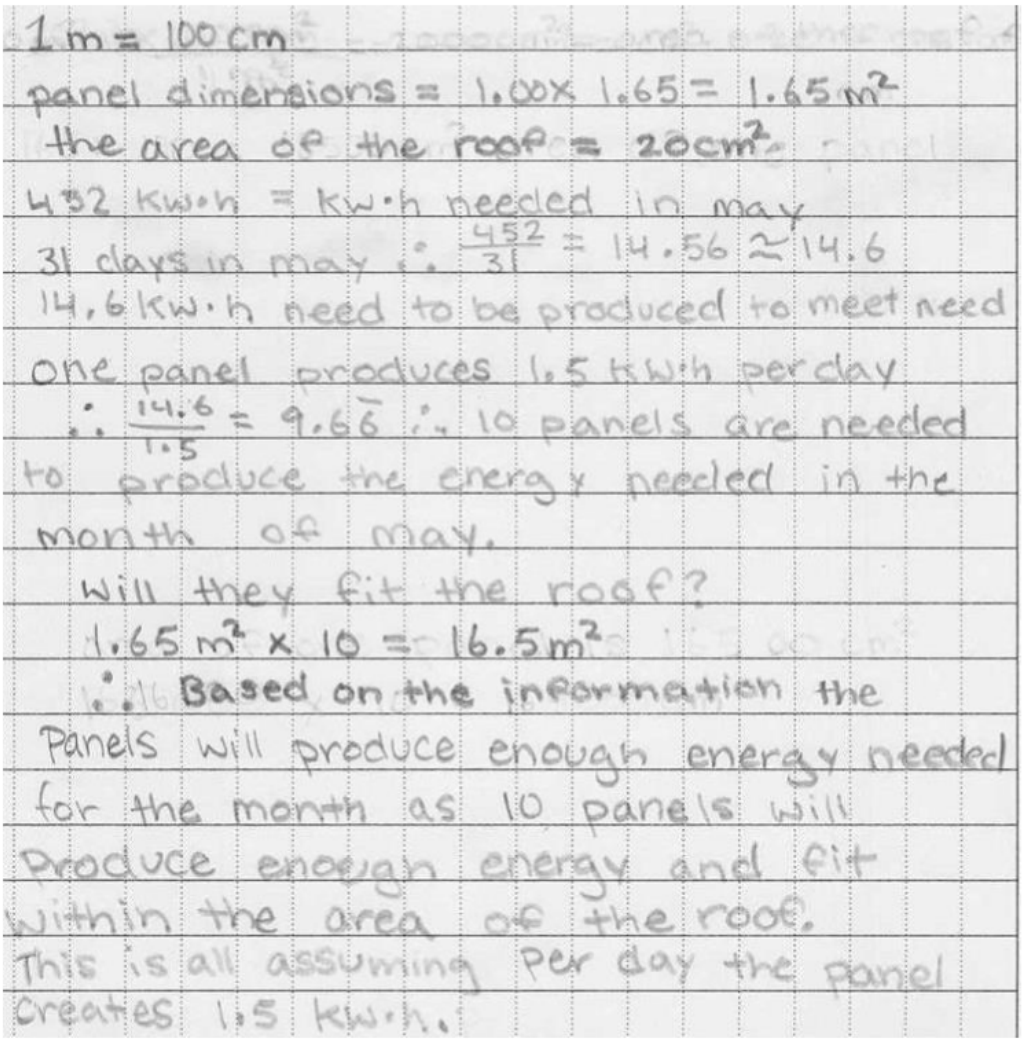
Compare the energy produced to the energy required

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

Solar Energy Project

Exemplar #1 – Score: 4

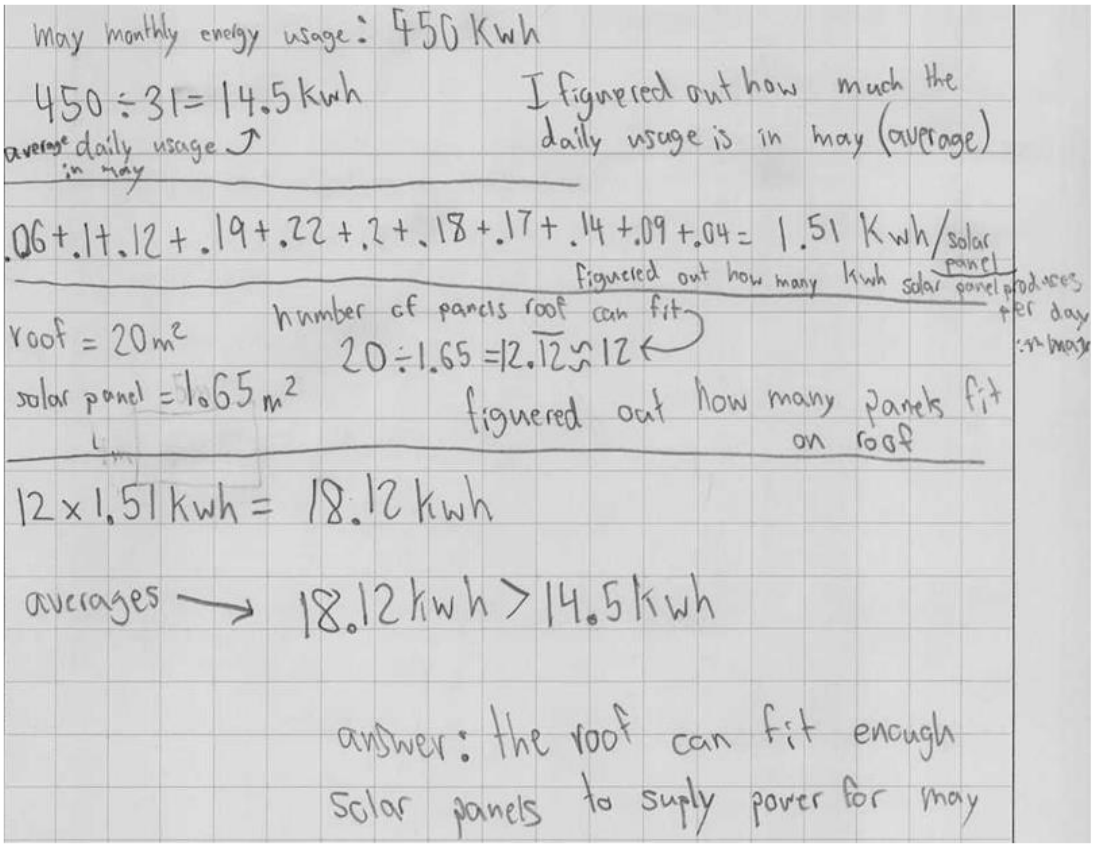
- ☑ Student response shows an alternate strategy that demonstrates an extensive understanding of the situation.
- ☑ Approach is effective and comprehensive.
- ☑ Reasoning is clearly communicated.
- ☑ Note: A unit error (area of the roof = 20 cm^2) is correctly represented later in the response.



Solar Energy Project

Exemplar #2 – Score: 4

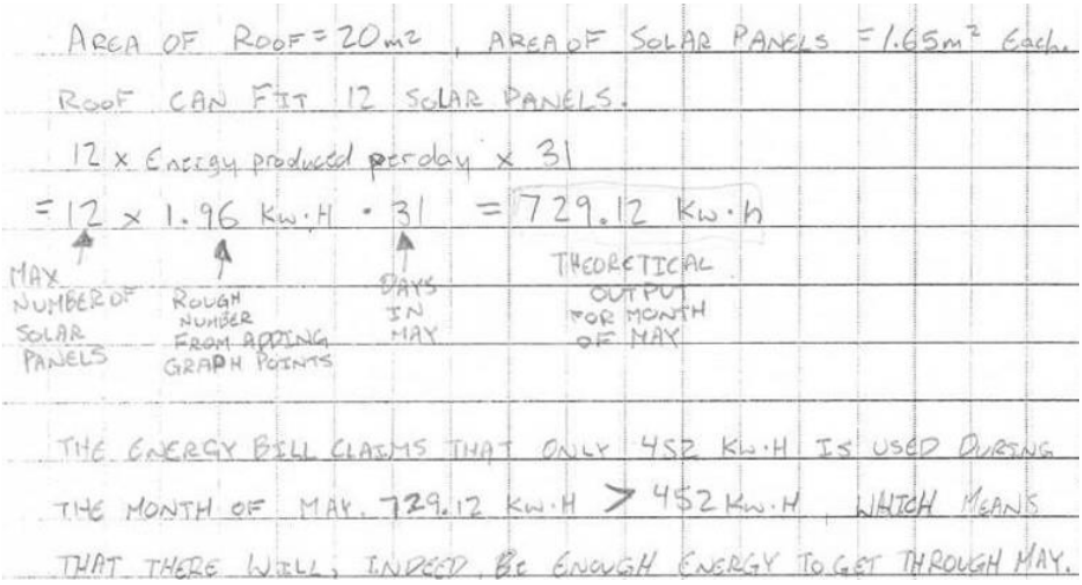
- ☑ This response demonstrates an extensive understanding of the situation.
- ☑ The steps are clear and laid out in a logical order.
- ☑ Answer is clearly communicated and supported by calculations.



Solar Energy Project

Exemplar #3 – Score: 3

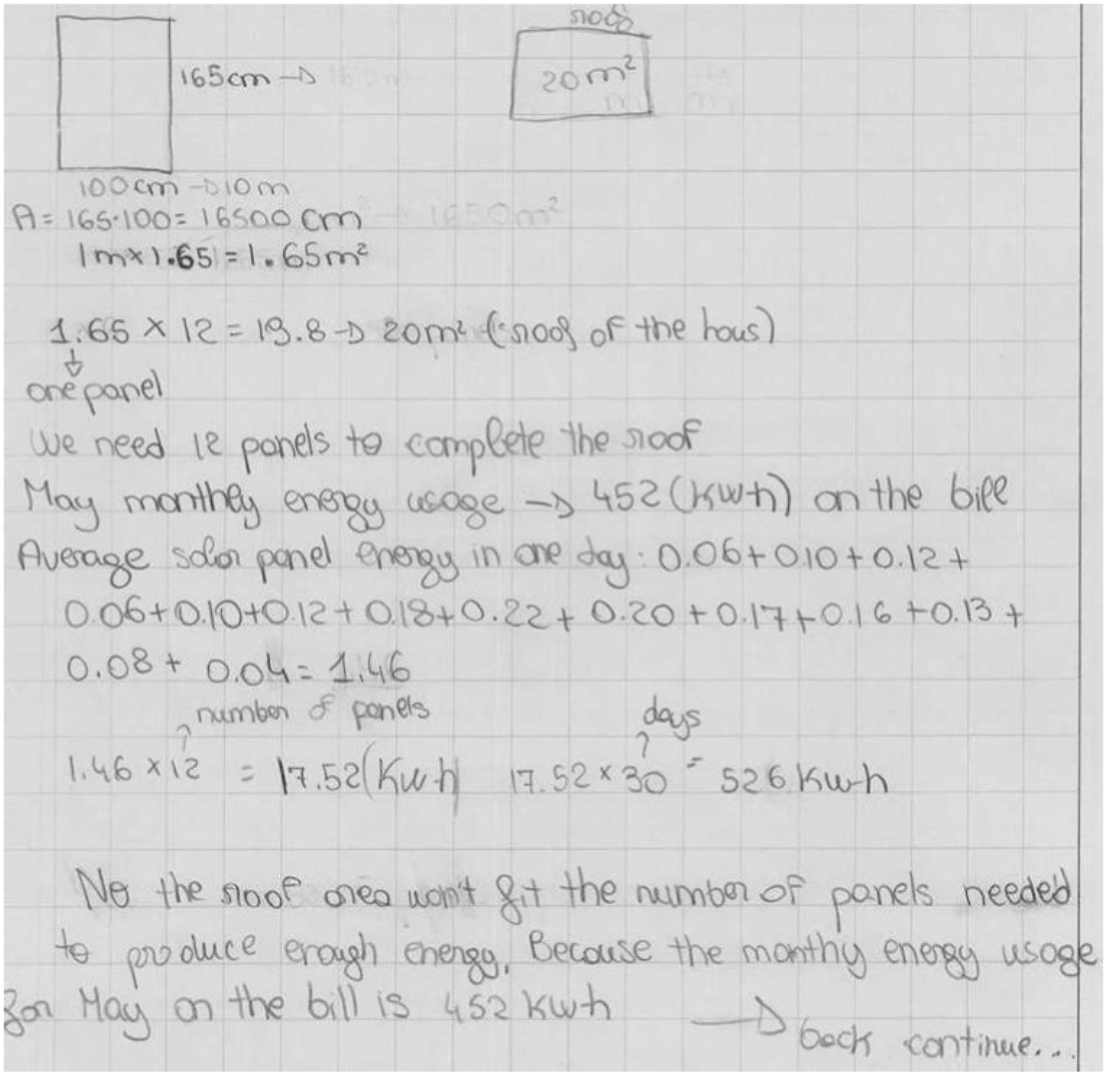
- ☑ Obtained solution was compared to 452 kWh but no work was shown for some components (e.g., area of roof, total number of solar panels).
- ☑ Good strategy but should not be estimating daily production (by “roughly” adding graph points) to estimate daily production of energy.

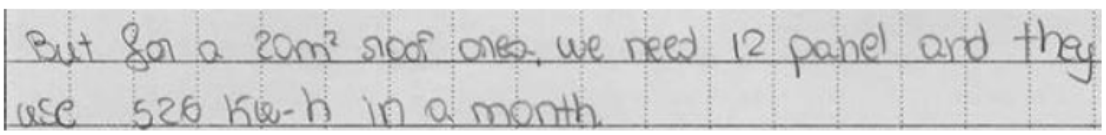


Solar Energy Project

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 × 12 = 18.8).
- ☑ 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.

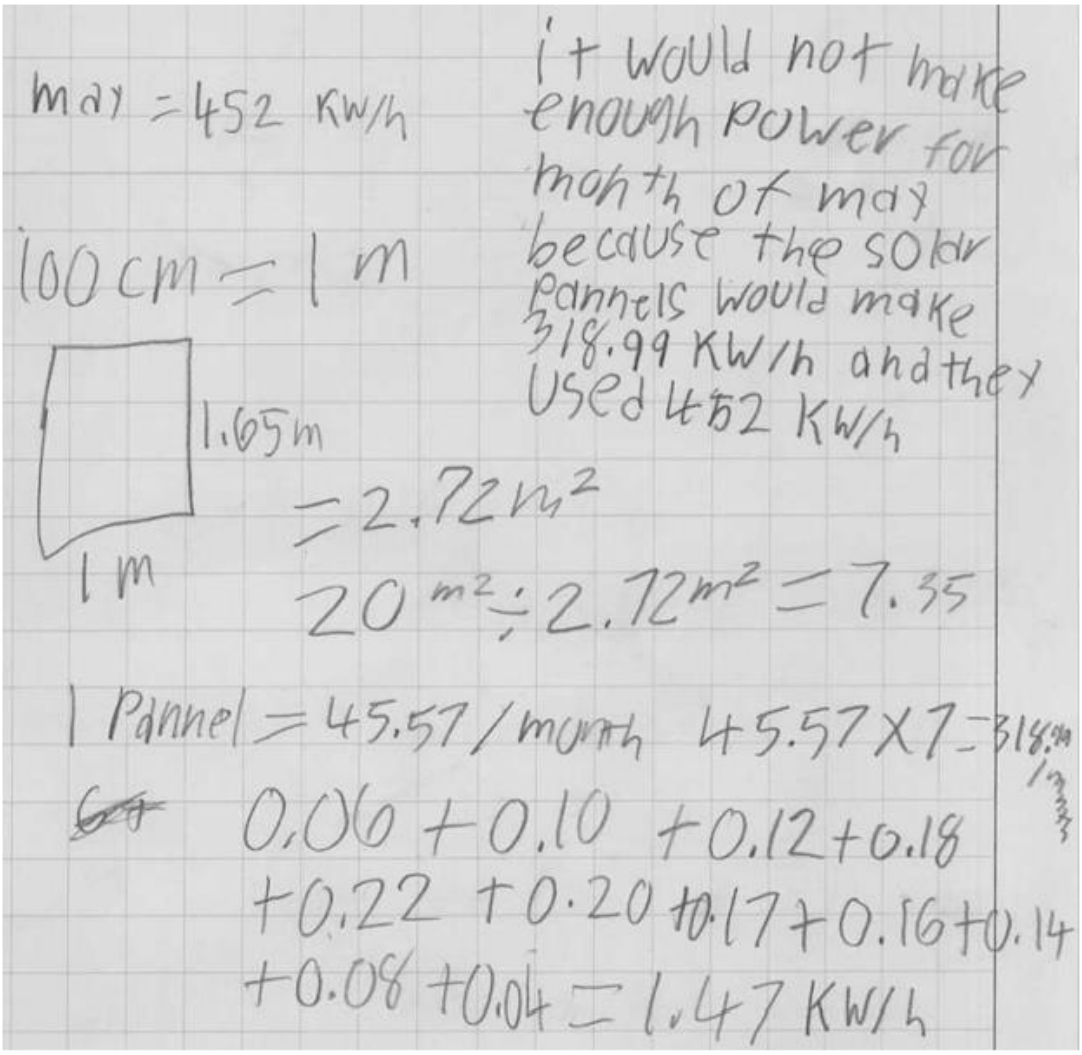




Solar Energy Project

Exemplar #5 – Score: 2

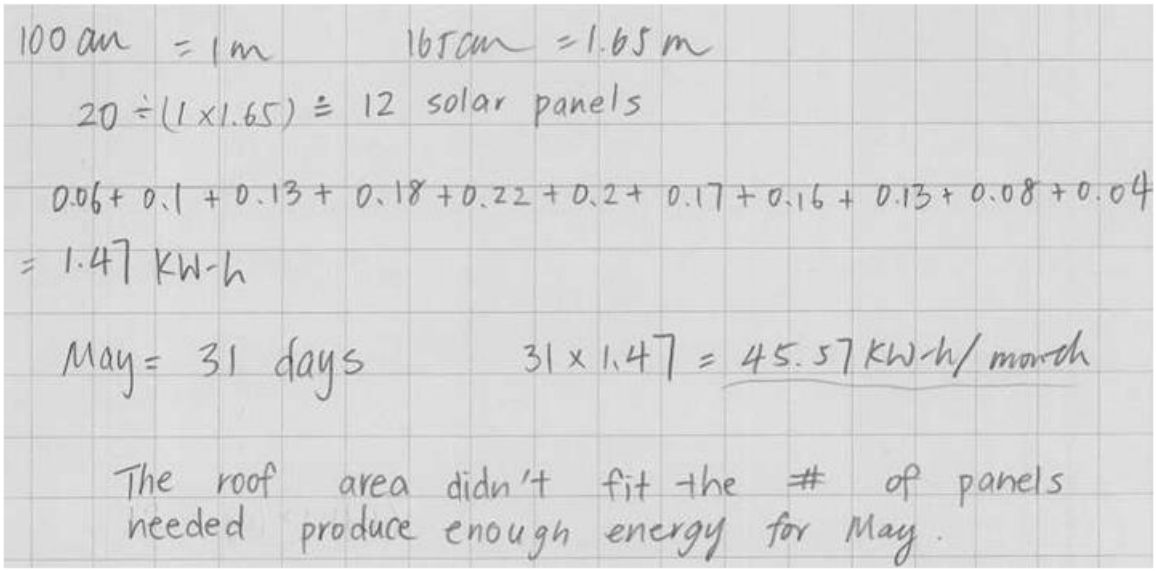
- Exemplar shows student calculated energy production per day for one panel but incorrectly calculated area. The incorrect area was then used in their energy production per month calculation. The rest of the calculations are correct (i.e., an accurate comparison was made from incorrect calculations). 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.



Solar Energy Project

Exemplar #6 – Score: 2

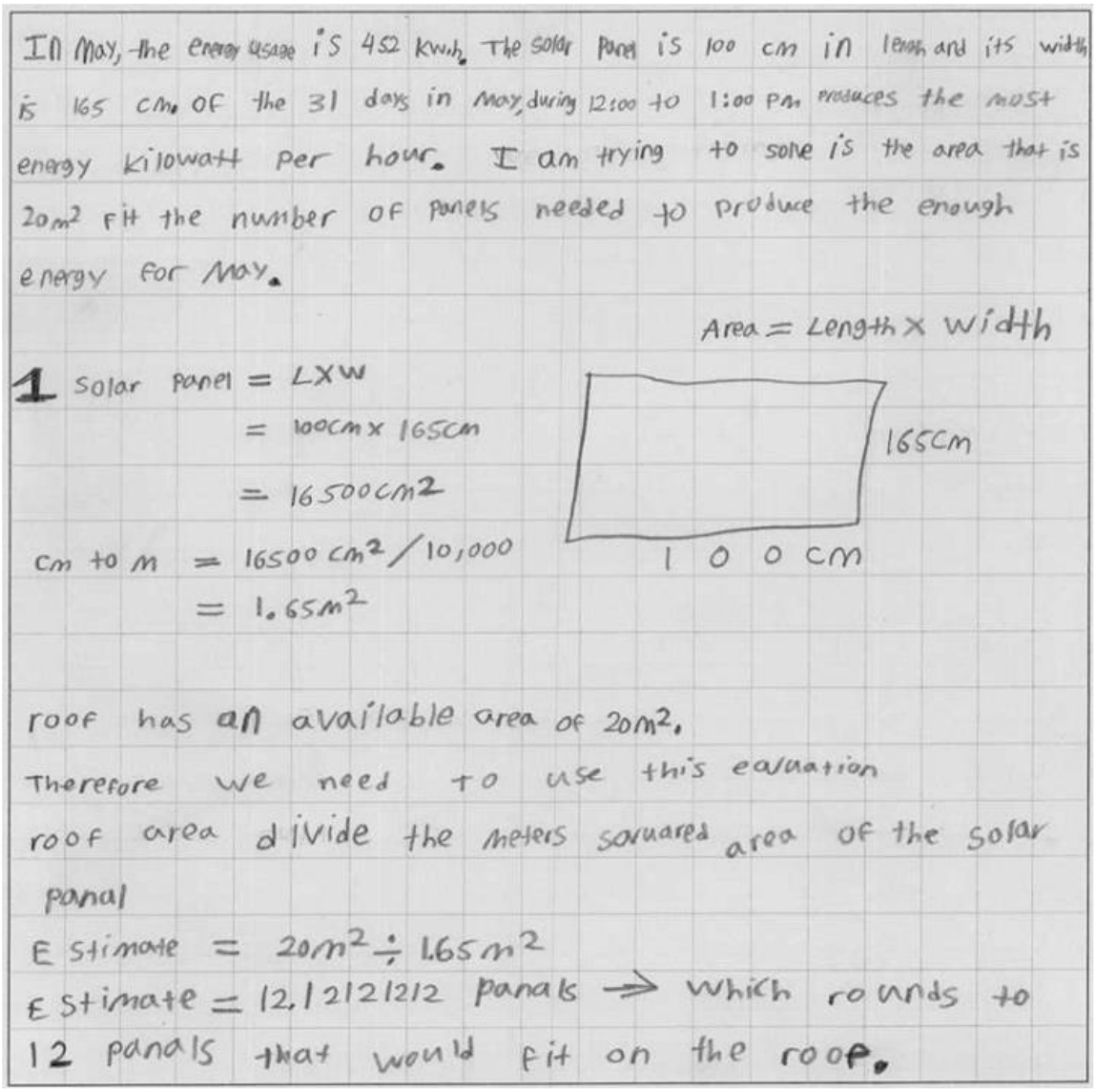
- ☑ Correctly calculate how much one panel produces in a month but did not consider energy produced by total number of panels, nor did it consider energy consumption needs in May.
- ☑ The approach is unclear, as is the reasoning. The student's comparison is not clearly stated.
- ☑ To improve score, determine 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.



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 = LXW
= 100cm x 165cm
= 16500cm2

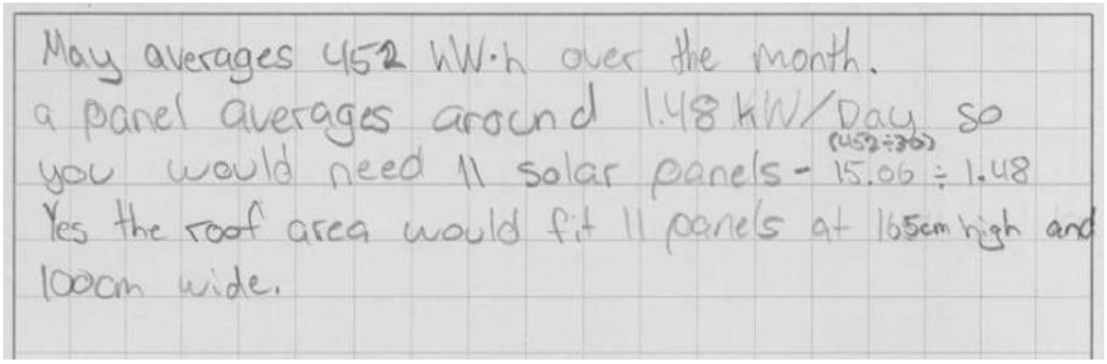
cm to m = 16500 cm² / 10,000
= 1.65m²

roof has an available area of 20m².
Therefore we need to use this equation roof area divide the meters squared area of the solar panal
Estimate = 20m² ÷ 1.65m²
Estimate = 12.121212121 panals → which rounds to 12 panals that would fit on the roof.

Solar Energy Project

Exemplar #8 – Score: 1

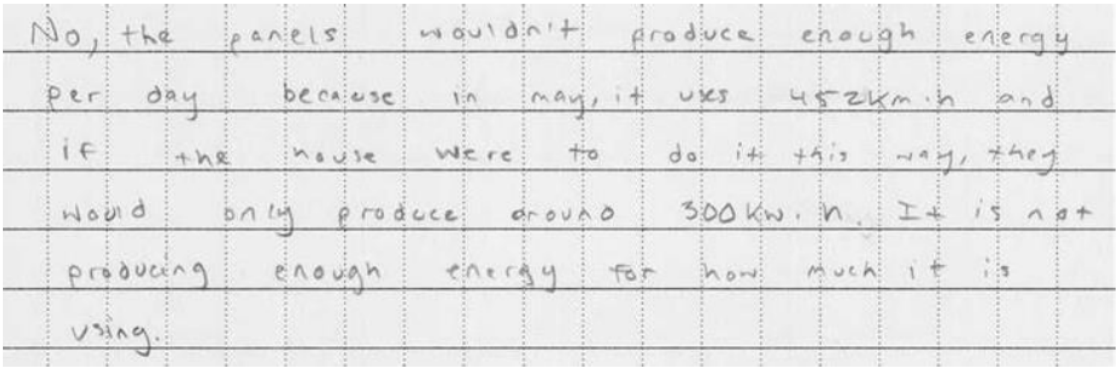
- ☑ Correctly determined energy need, although the number of solar panels needed was miscalculated (May has 31 days in the month).
- ☑ Insufficient work when determining: (1) the number of panels that would fit on the roof; and (2) the daily energy consumption, resulting in score of 1 despite a reasonable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



Solar Energy Project

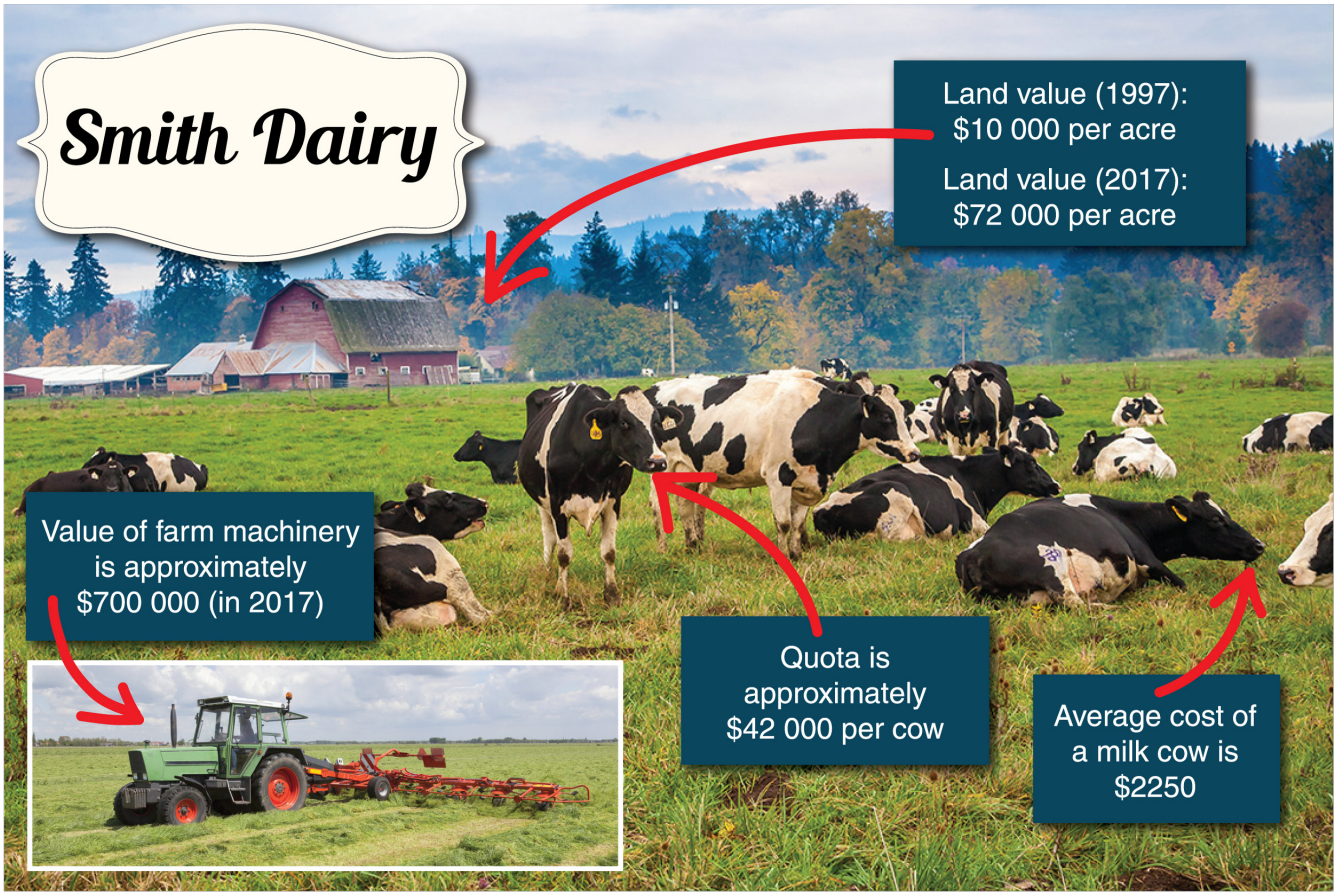
Exemplar #9 – Score: 0

☑ Solution provided with no supporting work.



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. <u>Determines the total value of the farm assets, including land and buildings, cows, quota and machinery.</u>

Sale of the land and building:	160 acres × $72 000 = **$11 520 000**
Sale of cows:	135 × $2 250 = **$303 750**
Value of Machinery:	**$600 000**
Cash Value of Quotas:	135 × $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. <u>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.</u>

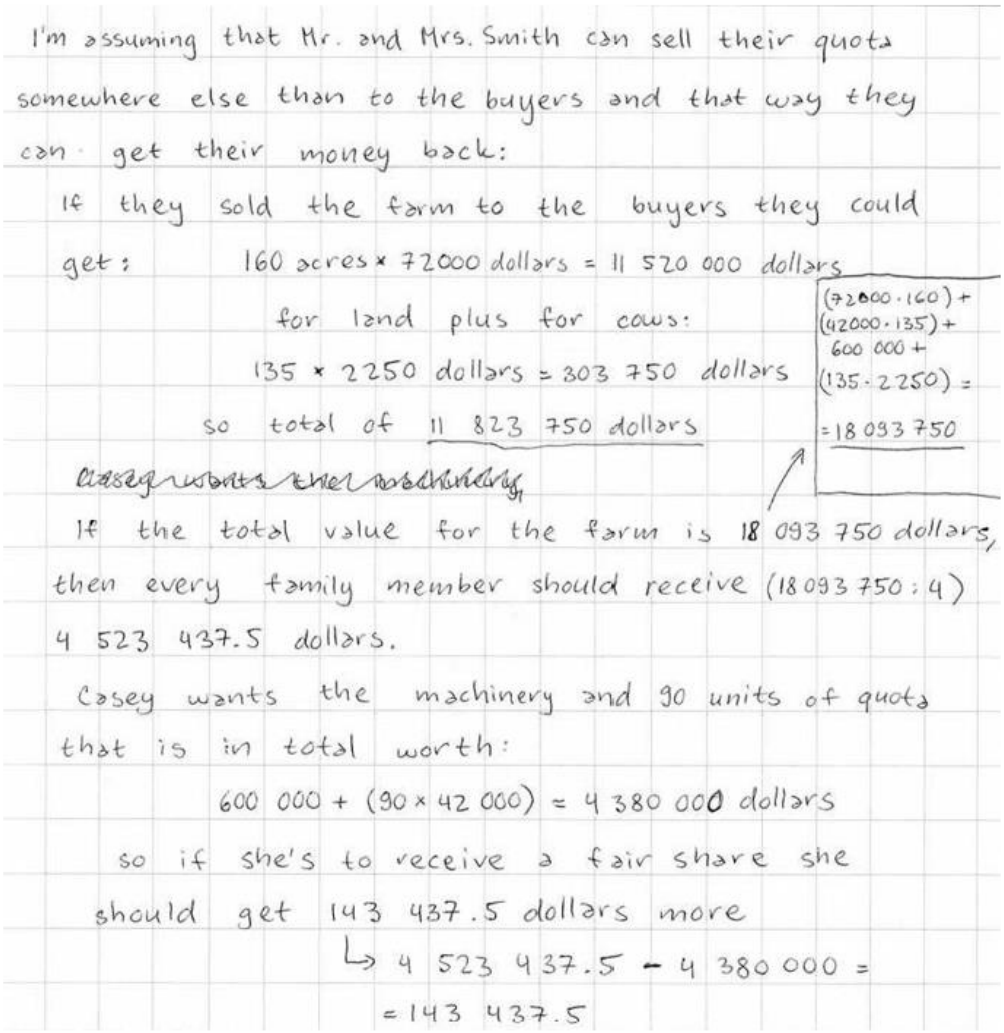
Casey:	Machinery	**$600 000**
	90 units of quota:	90 × $42 000 = **$3 780 000**
	Receives the difference between her full share and these assets	$6 031 250 - $4 380 000 = **$1 651 250**
Brad:	No requests/interest in farming: cash	**$6 031 250**
Mr. & Mrs. Smith:	Retired: cash	**$6 031 250**

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 acres × 72000 dollars = 11 520 000 dollars

for land plus for cows:

135 × 2250 dollars = 303 750 dollars

so total of 11 823 750 dollars

(72000 · 160) + (42000 · 135) + 600 000 + (135 · 2250) = = 18 093 750

~~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 × 42 000) = 4 380 000 dollars

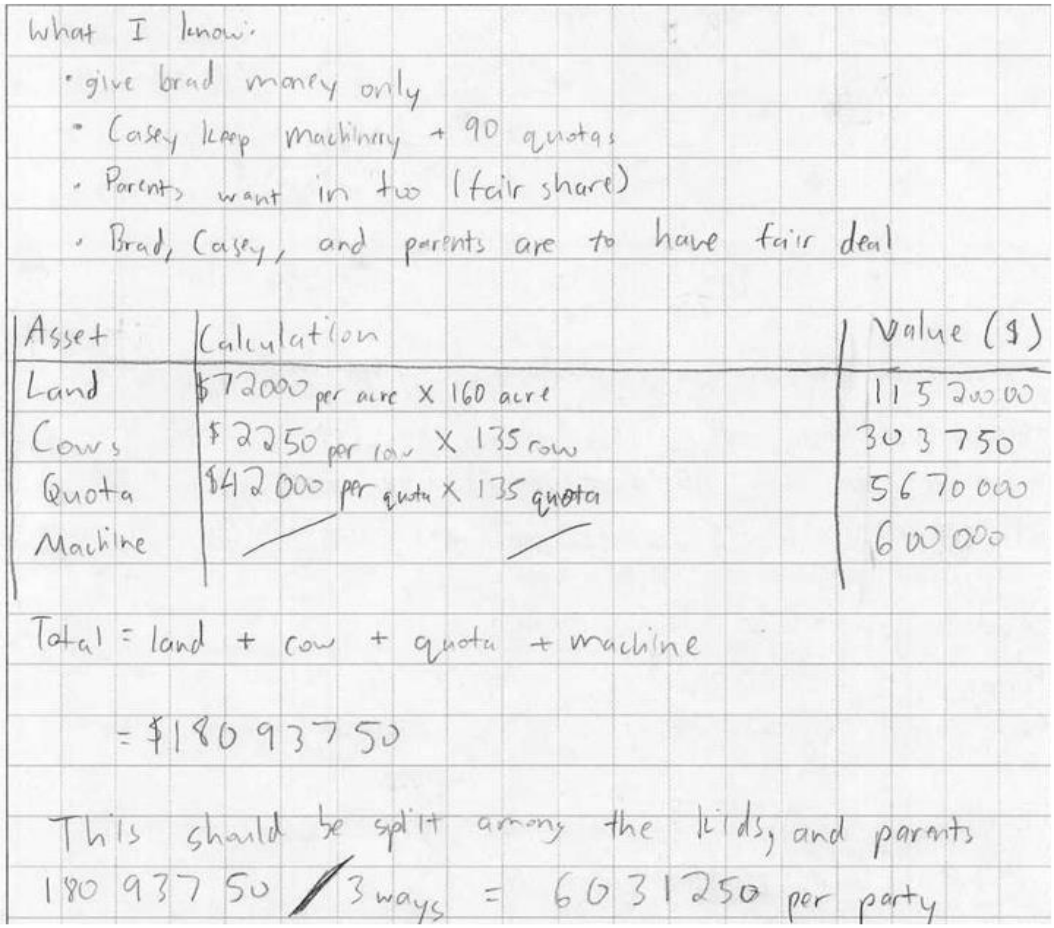
so if she's to receive a fair share she should get 143 437.5 dollars more

↳ 4 523 437.5 − 4 380 000 = = 143 437.5

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 two (fair share)
- Brad, Casey, and parents are to have fair deal

Asset	Calculation	Value ($)
Land	$72000 per acre X 160 acre	11520000
Cows	$2250 per cow X 135 cow	303750
Quota	$42000 per quota X 135 quota	5670000
Machine		600000

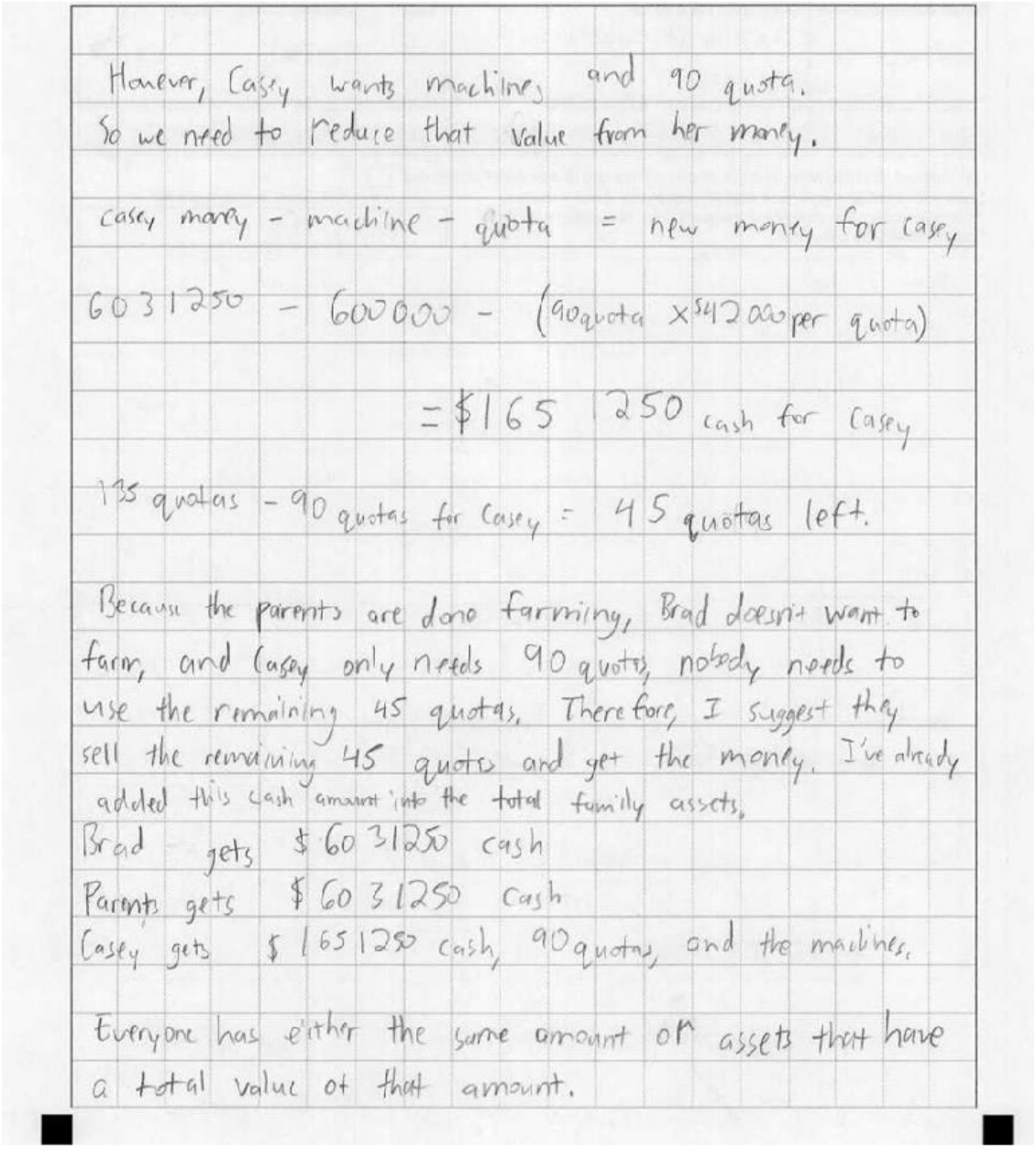
Total = land + cow + quota + machine

= $18093750

This should be split among the kids, and parents

18093750 / 3 ways = 6031250 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

603 1250 - 600 000 - (90 quota x $42 000 per quota)

= $165 250 cash for Casey

135 quotas - 90 quotas for Casey = 45 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 $ 603 1250 cash

Parents gets $ 603 1250 cash

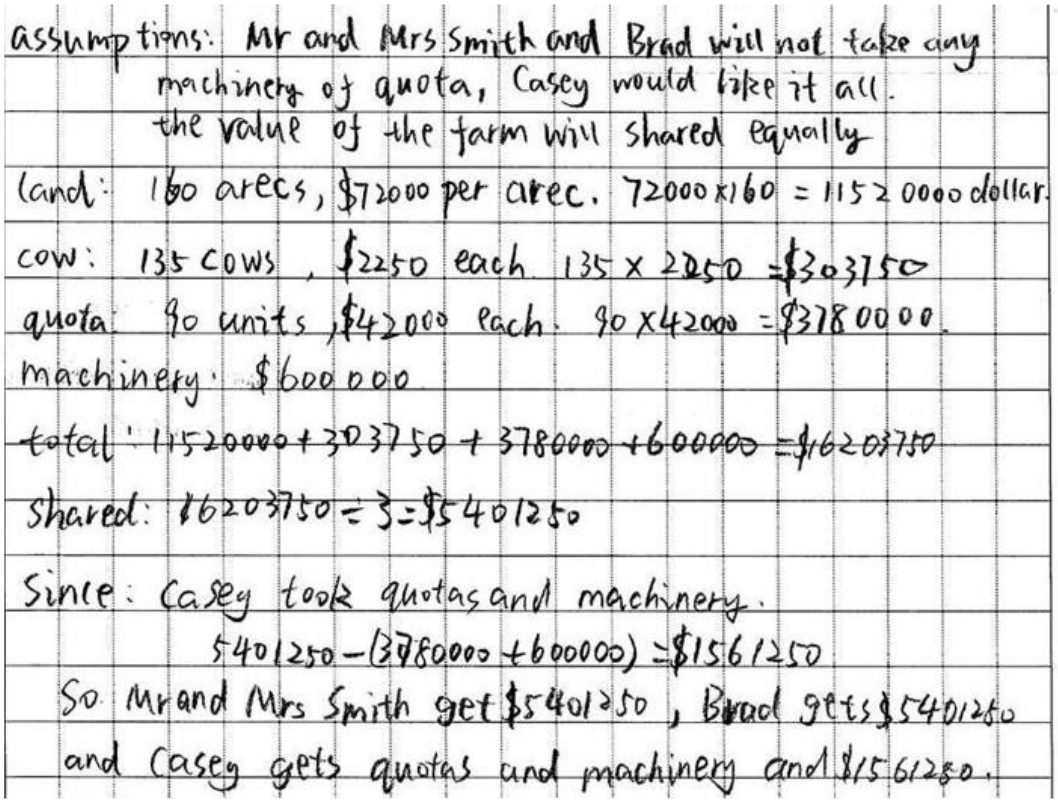
Casey gets $ 165 250 cash, 90 quotas, and the machines.

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 arecs, $72000 per arec. 72000×160 = 11520000 dollar.

cow: 135 cows, $2250 each 135 × 2250 = $303750

quota: 90 units, $42000 each. 90×42000 = $3780000.

machinery: $600000

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

shared: 16203750 ÷ 3 = $5401250

Since: Casey took quotas and machinery.

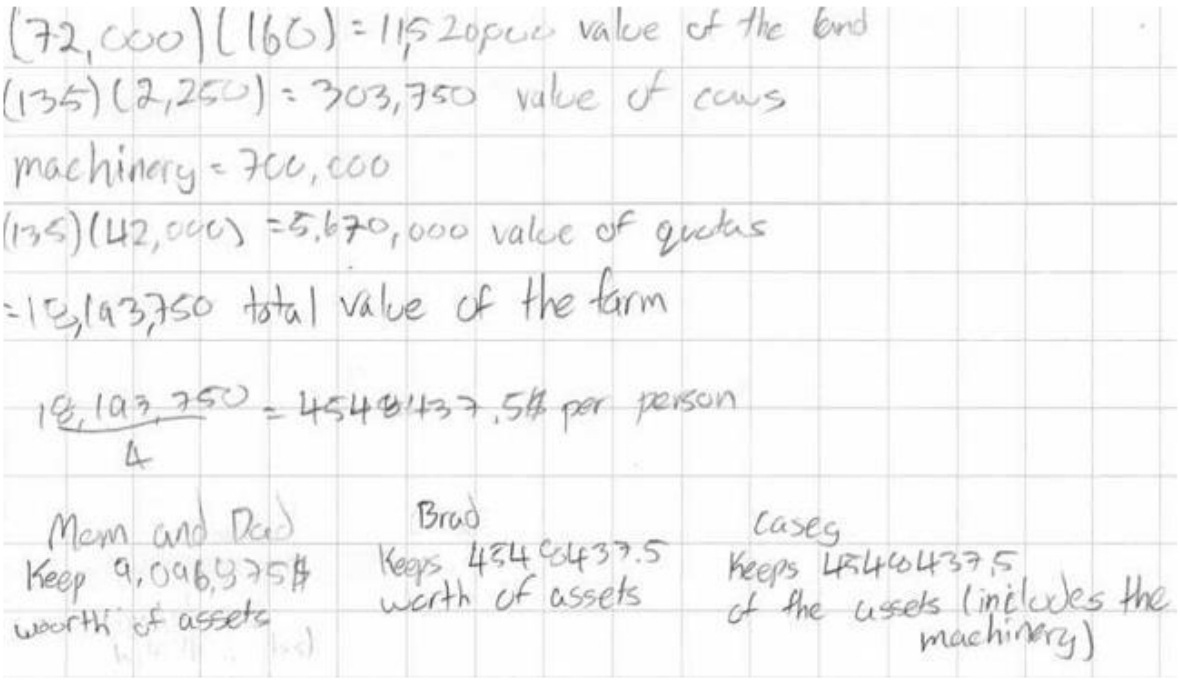
5401250 − (3780000 + 600000) = $1561250

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

Dairy Farm

Exemplar #4 – Score: 3

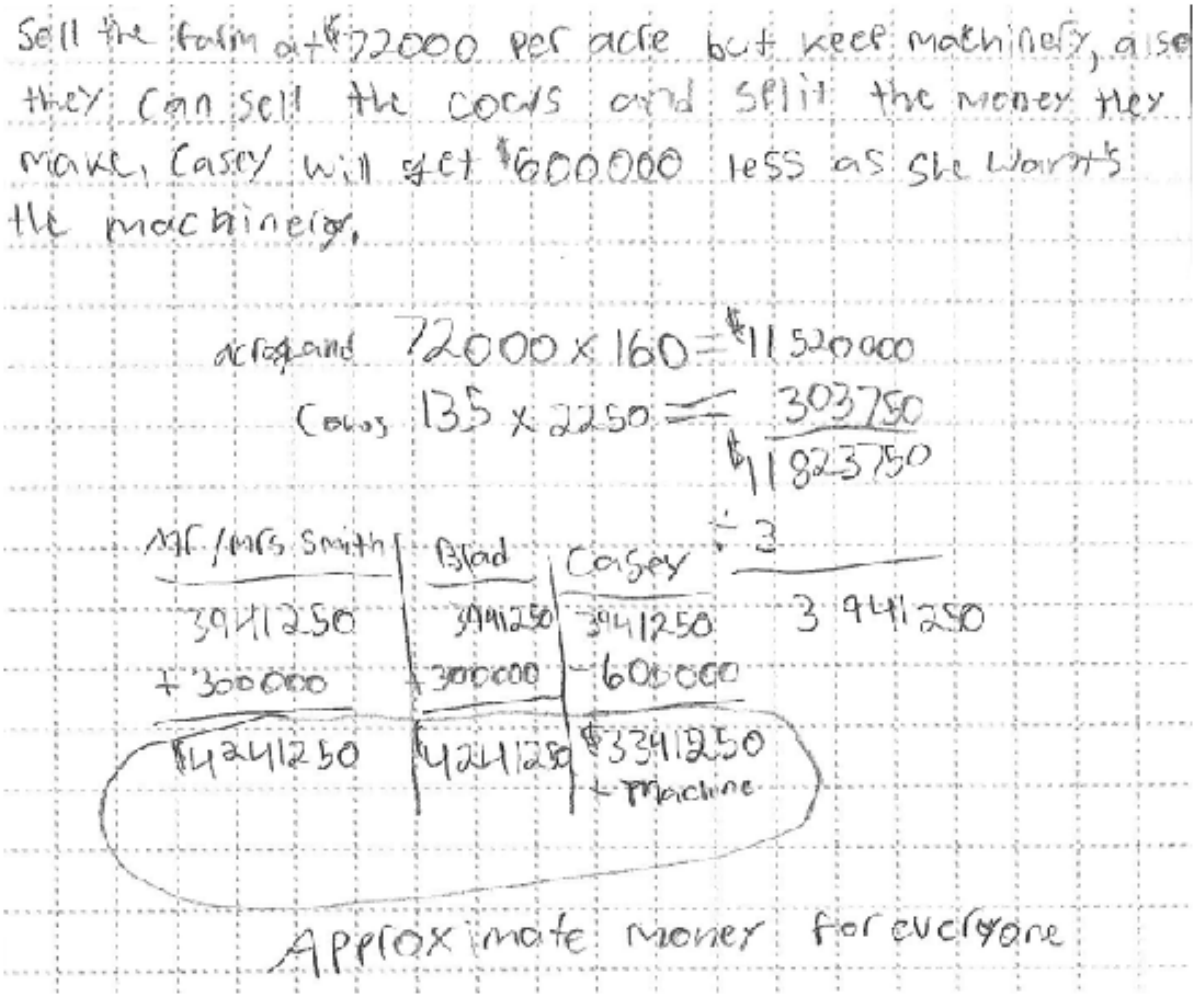
- ☑ Correctly calculated the appropriate overall value for each person but did not fully answer question by explaining how Casey will get her value (e.g., in form of machinery, quota).
- ☑ To improve score, include a breakdown of Casey's share of assets.



Dairy Farm

Exemplar #5 – Score: 2

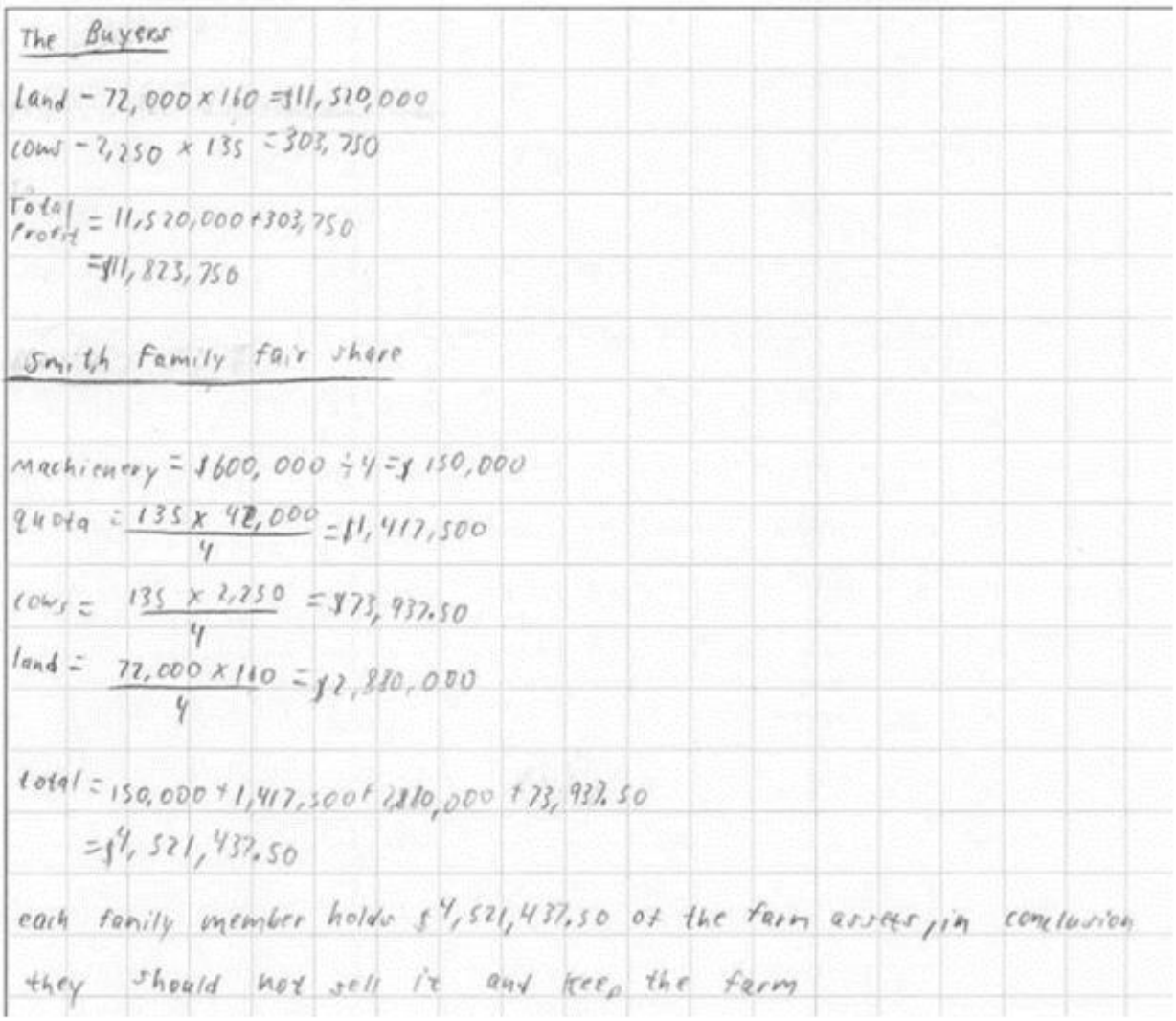
- ☑ Exemplar accurately includes calculated values of cows and land, however, the quotas were excluded entirely from the calculations.
- ☑ Student attempted to deal with value of machinery by subtracting from Casey's share and sharing it with the other two groups.
- ☑ To improve score, student needs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



Dairy Farm

Exemplar #6 – Score: 2

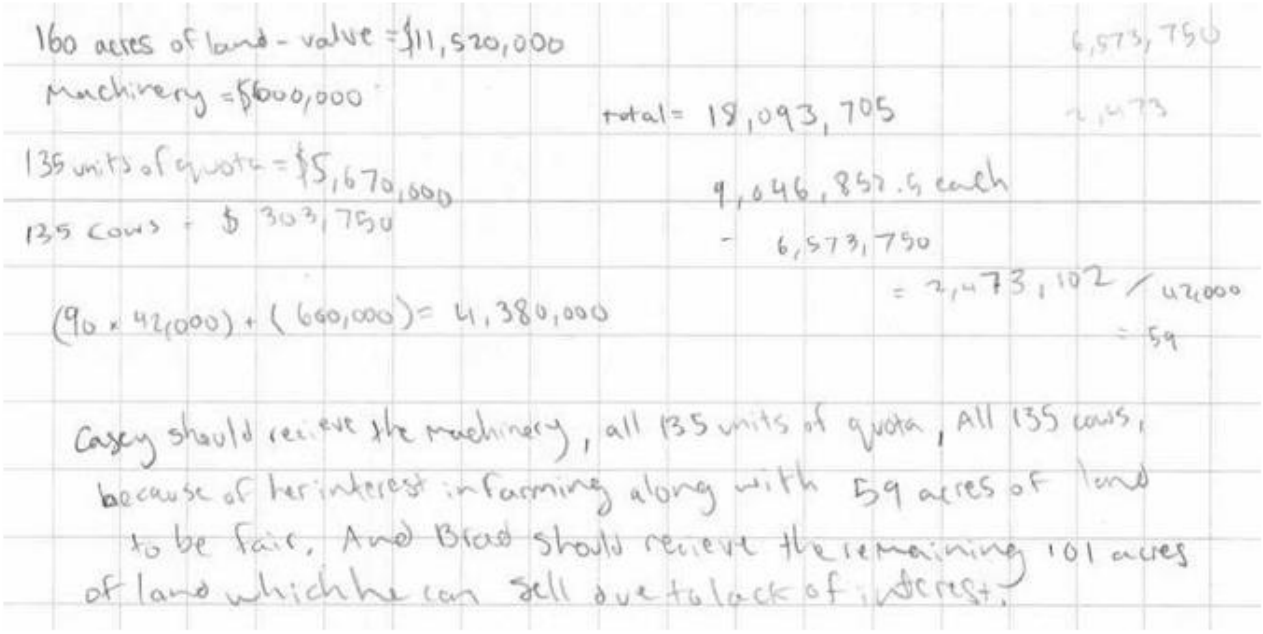
- ☑ Equal division was conducted. (In a Share question involving division of resources, equal division is not an appropriate strategy.)
- ☑ Calculation error when determining value of cows.
- ☑ To improve score, response needs to consider the value of the wishes of each family member.



Dairy Farm

Exemplar #7 – Score: 1

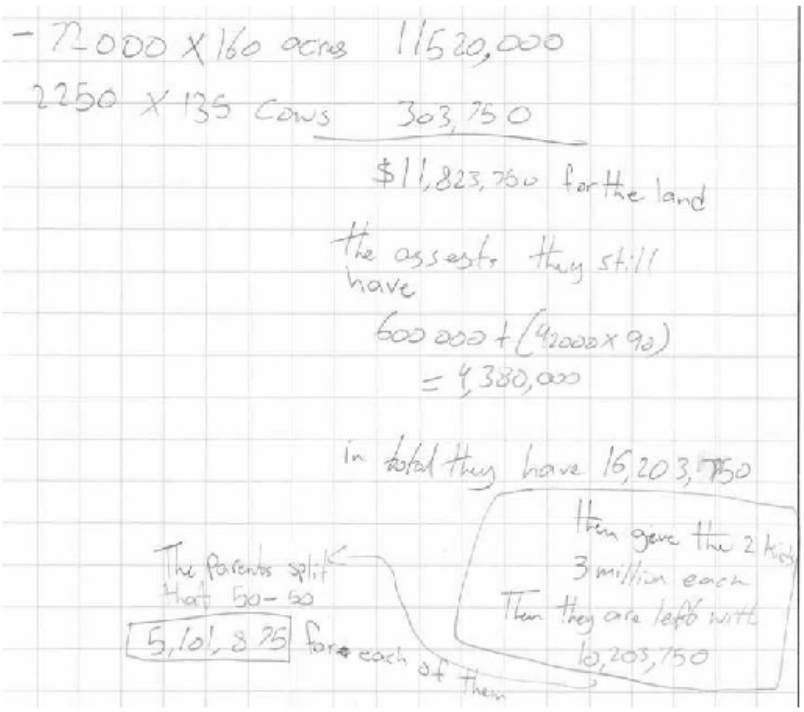
- ☑ Total value of assets calculated but did not apply a sharing process for these assets.
- ☑ Did not consider that buyers were purchasing a portion of assets, nor the share parents will get.
- ☑ To improve score, include calculations to divide assets.



Dairy Farm

Exemplar #8 – Score: 1

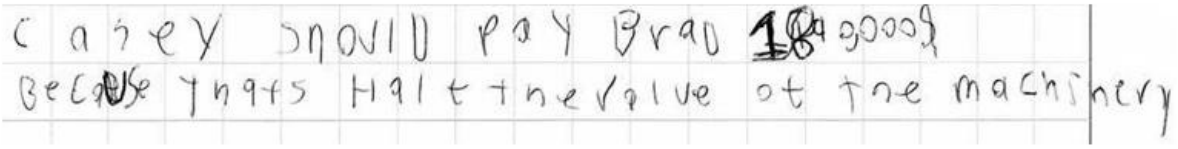
- ☑ Division does not follow criteria provided in the question and not supported by calculations. No explanation for the 3 million for Brad and Casey. The other 45 quota are unaccounted for.
- ☑ To improve score, calculate total value by considering all aspects (machinery and remaining quota) and ensuring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



Dairy Farm

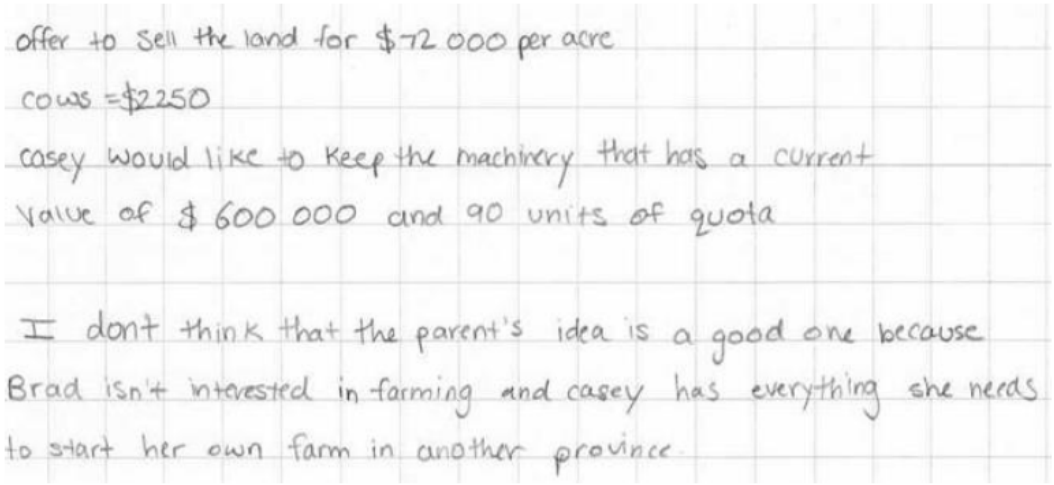
Exemplar #9 – Score: 0

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



Exemplar #10 – Score: 0

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



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.

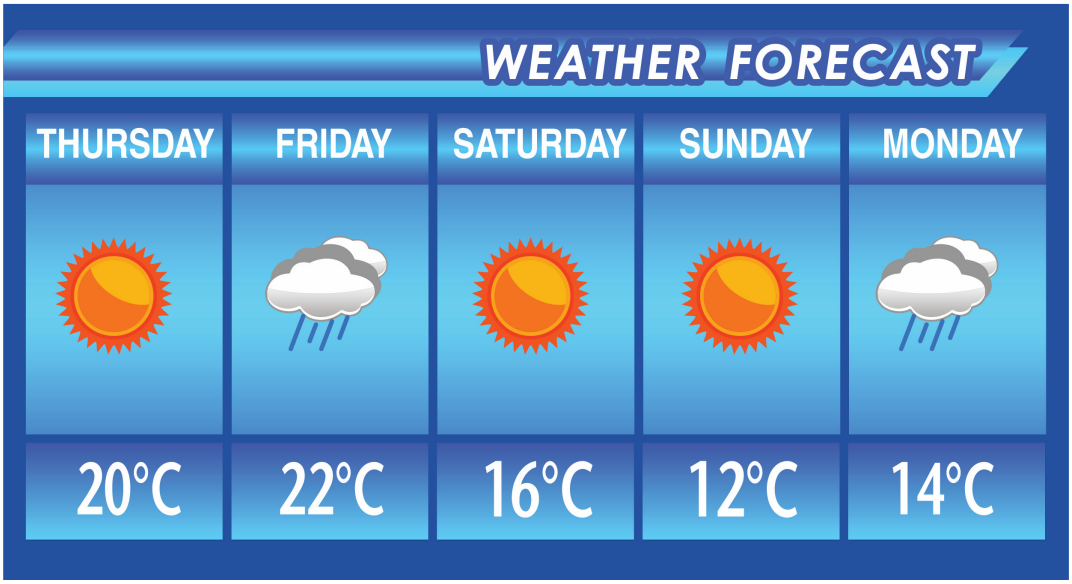
Other ice cream stores in the area experience an average 40% decrease in sales on rainy days to sunny days at the same temperature.

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

Ice Cream Shop



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

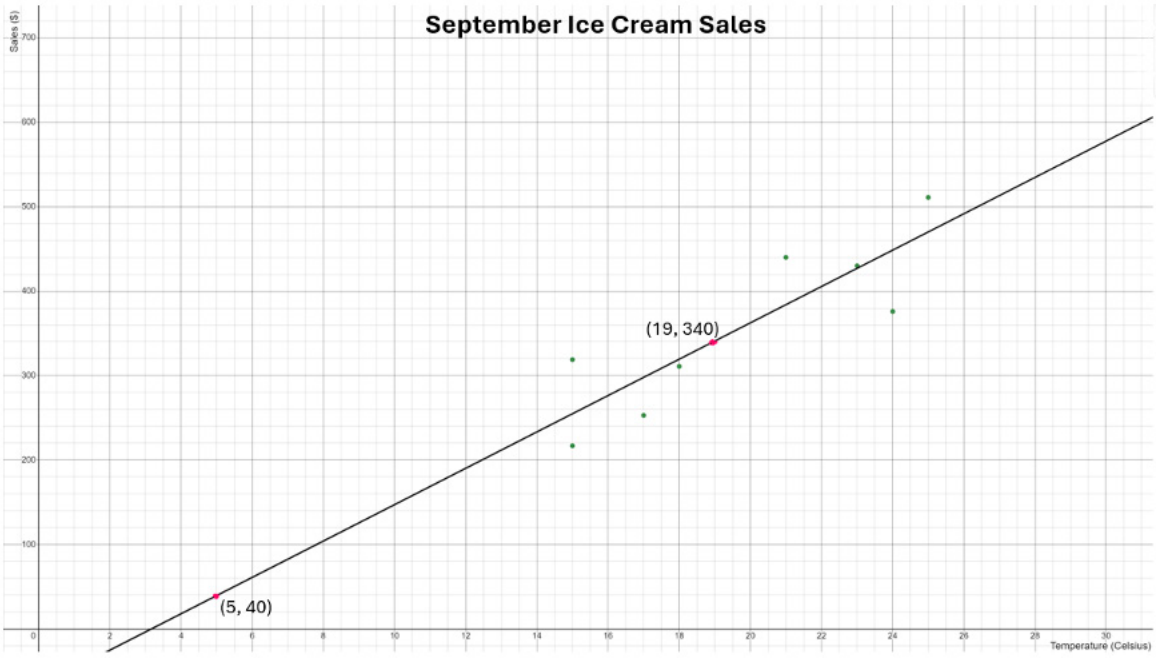
Ice Cream Shop

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

- Line of fit equation:

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

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

$$340 = 407.17 + b$$

$$-67.17 = b$$

$$y = 21.43x - 67.17$$

Determines predicted ice cream sales for five days

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

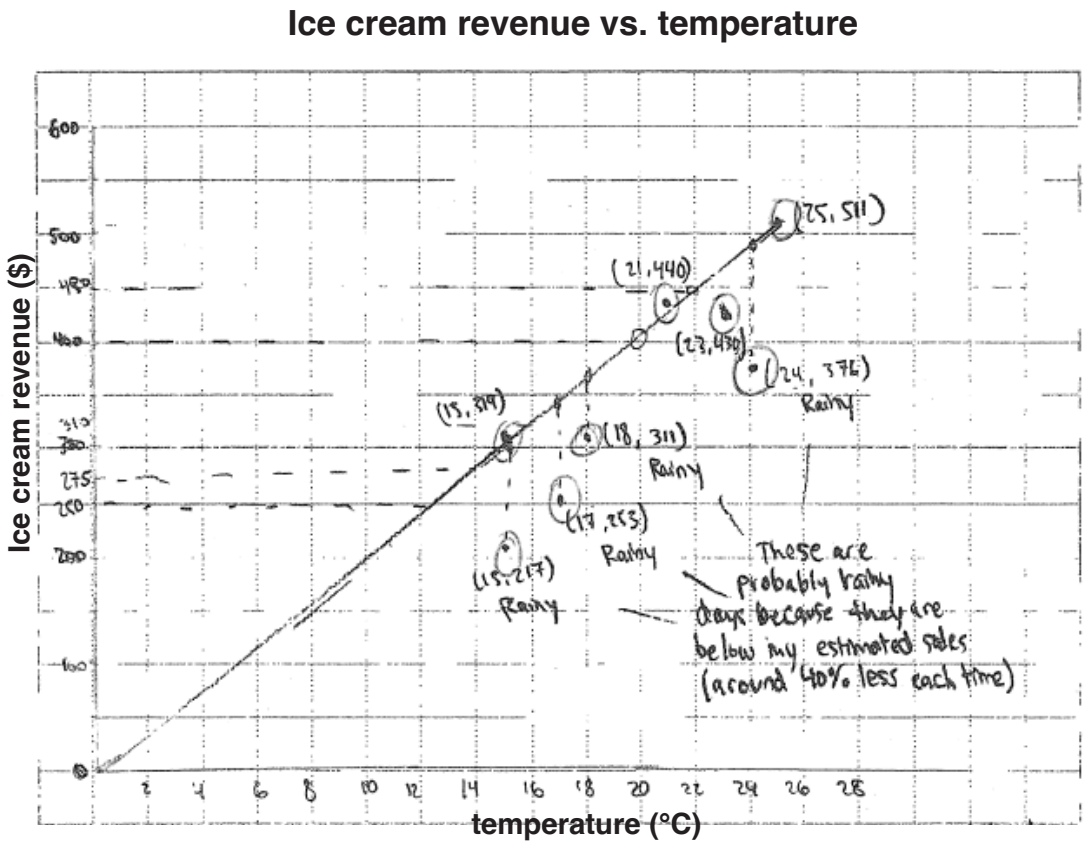
Day	Calculations	Predicted Sales ($)
Thursday	$y = 21.43(20) - 67.17 = 361.43$	361
Friday	$y = 21.43(22) - 67.17 = 404.29$ $Rainy = 404.29(0.6) = 242.57$	243
Saturday	$y = 21.43(16) - 67.17 = 275.71$	276
Sunday	$y = 21.43(12) - 67.17 = 189.99$	190
Monday	$y = 21.43(14) - 67.17 = 232.85$ $Rainy = 232.85(0.6)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

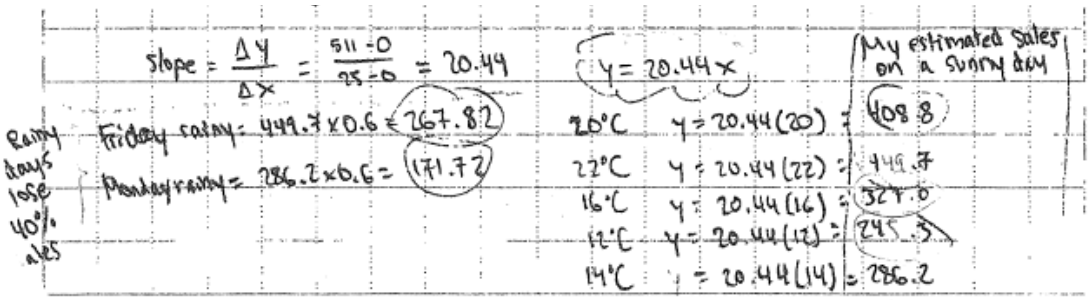
Using my line of fit to average sales based on temperature, the sales for the last weekend of the season at the ice cream shop should total around $1210.

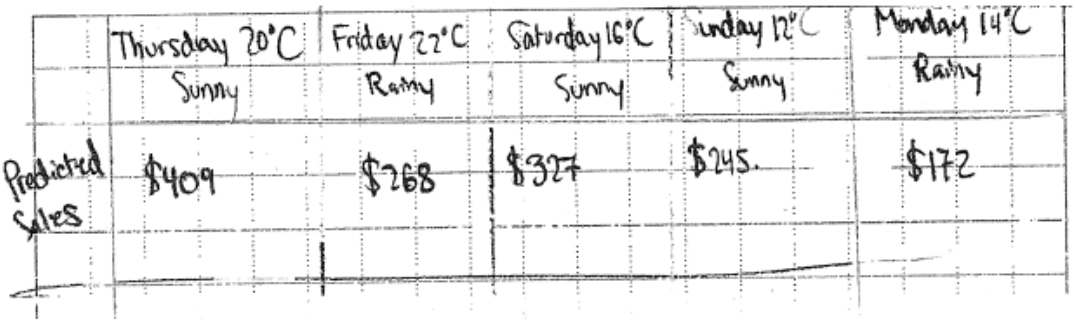
Ice Cream Shop

Exemplar #1 – Score: 4

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



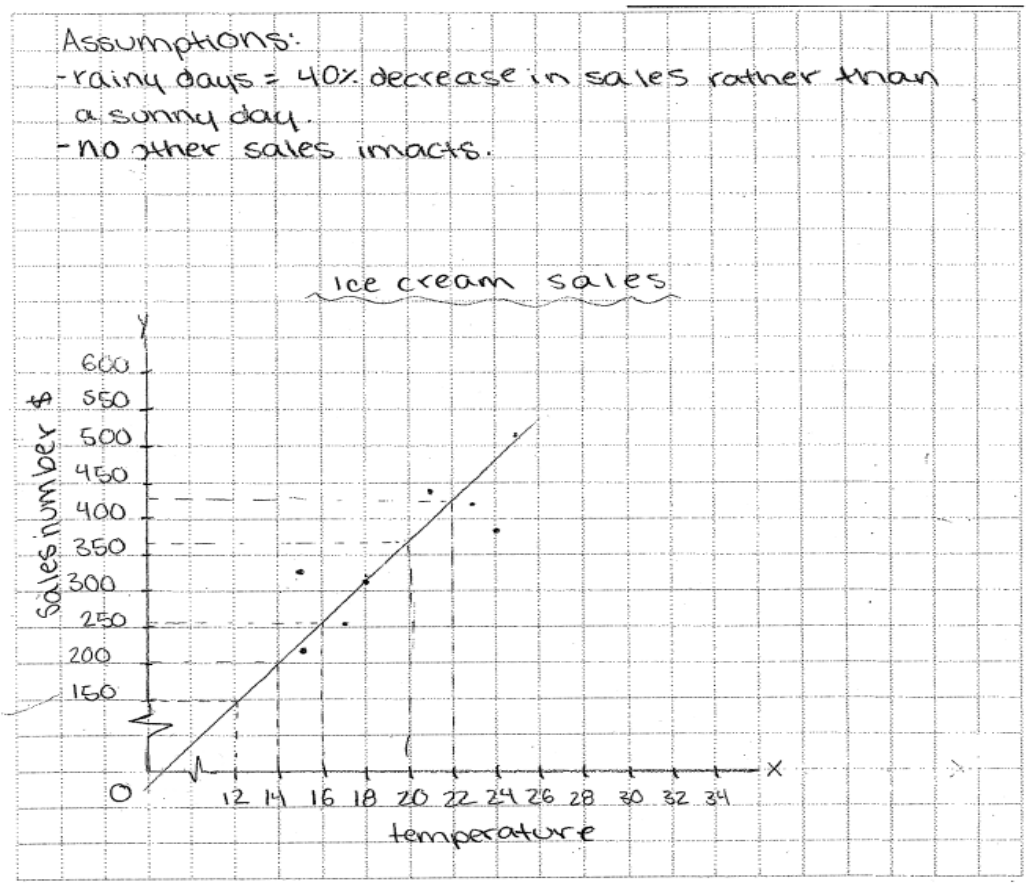


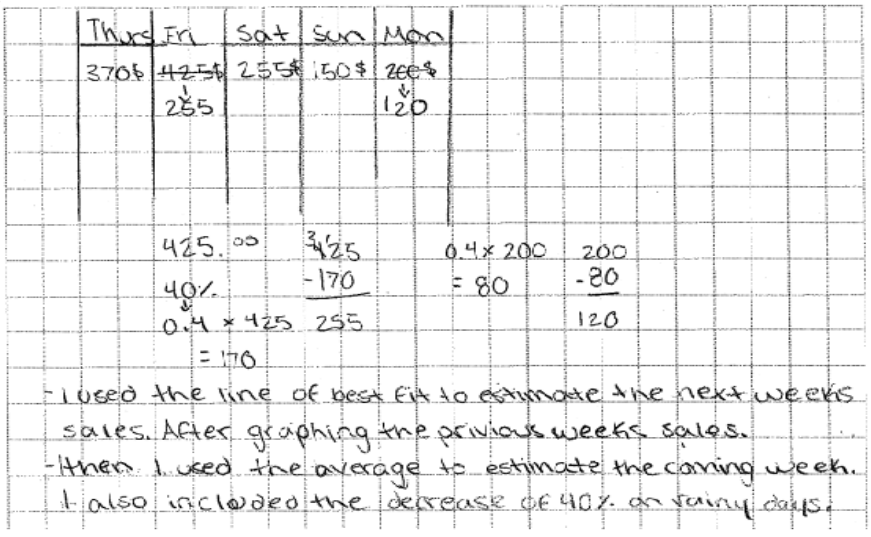


Ice Cream Shop

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.

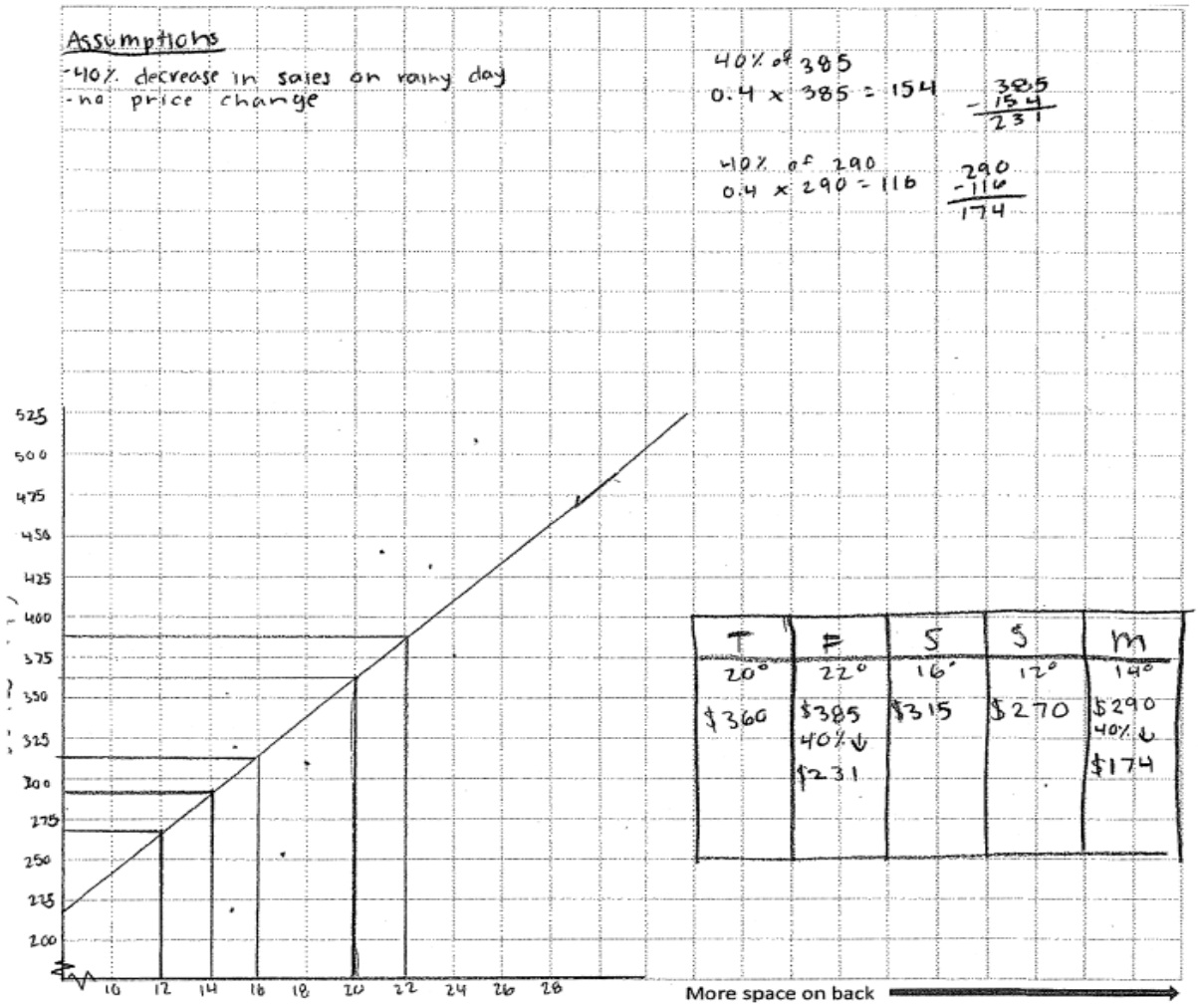




Ice Cream Shop

Exemplar #3 – Score: 3

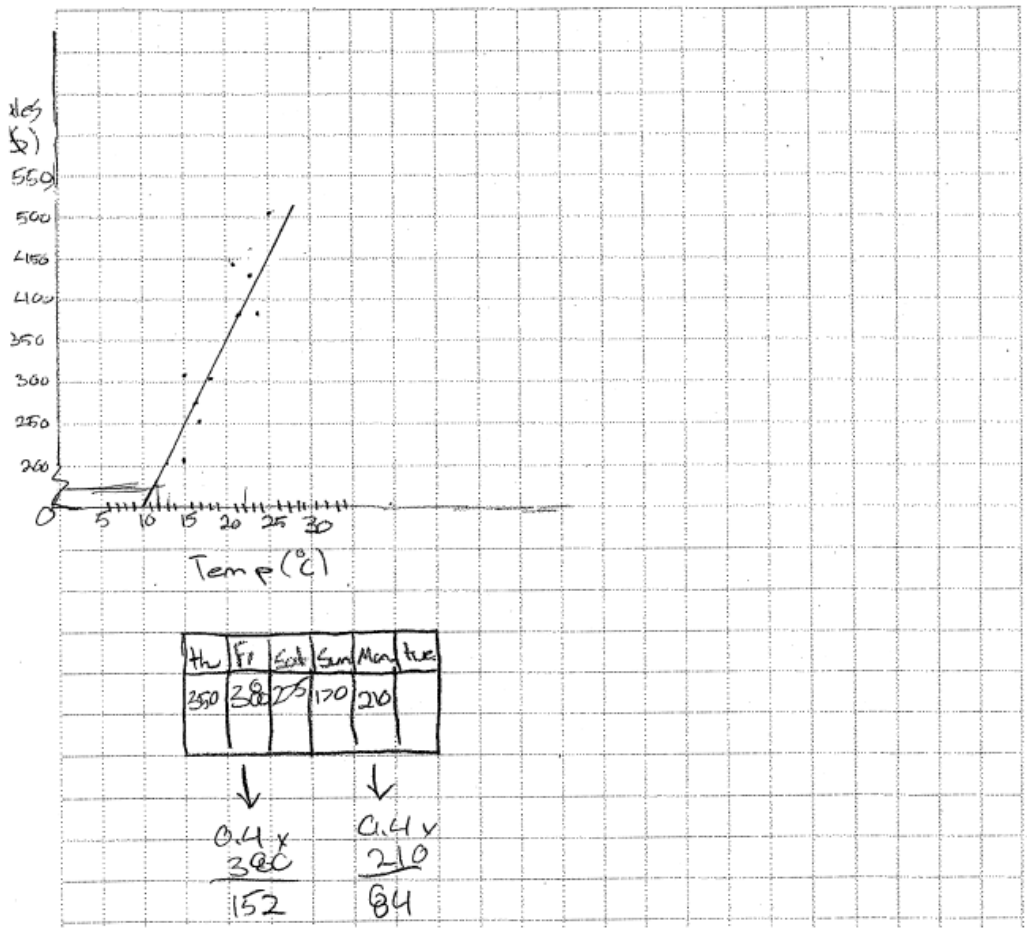
- ☑ Stated assumptions, which demonstrates good communication.
- ☑ Graph is accurately plotted, with adjustments made to sales numbers due to weather.
- ☑ Next steps: labeled axis on graph; line of best fit should reflect all points plotted.



Ice Cream Shop

Exemplar #4 – Score: 2

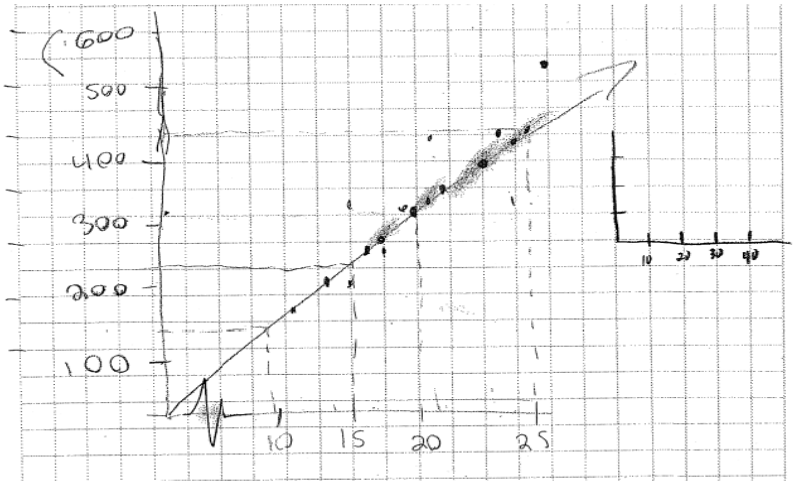
- ☑ Line of best fit attempted.
- ☑ Some calculations on adjusted sales due to weather but did not incorporate this work into revenues.
- ☑ No evidence of how data was attained from graph (interpolation).
- ☑ Next steps: determine weather-adjusted sales and show how future sales were derived from the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

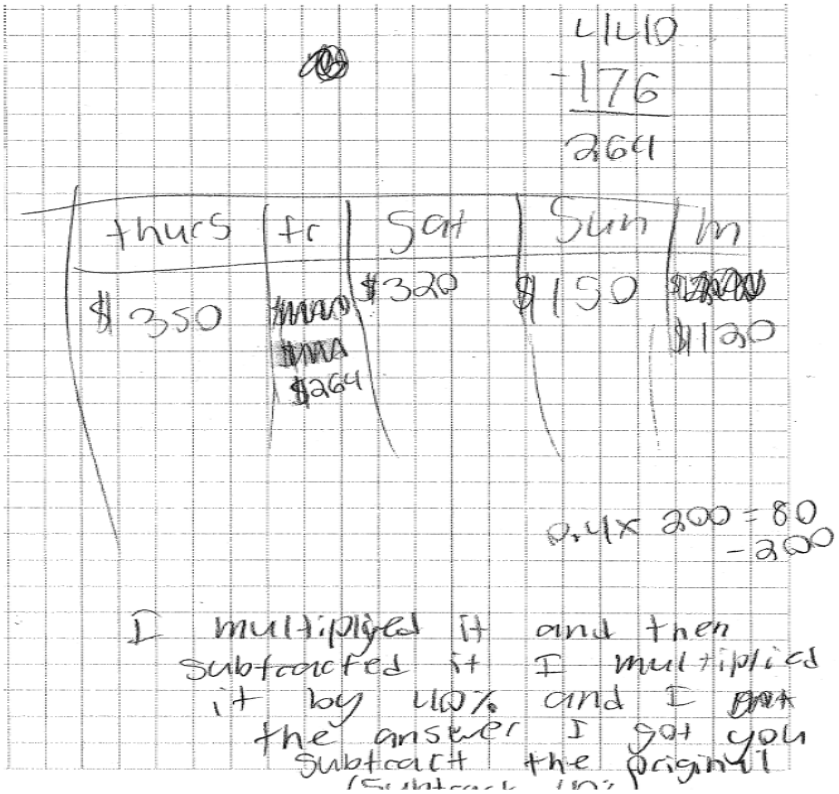


Ice Cream Shop

Exemplar #5 – Score: 2

- ☑ Response on right track, with a line of best fit included.
- ☑ Imprecise graph made it difficult to accurate 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.

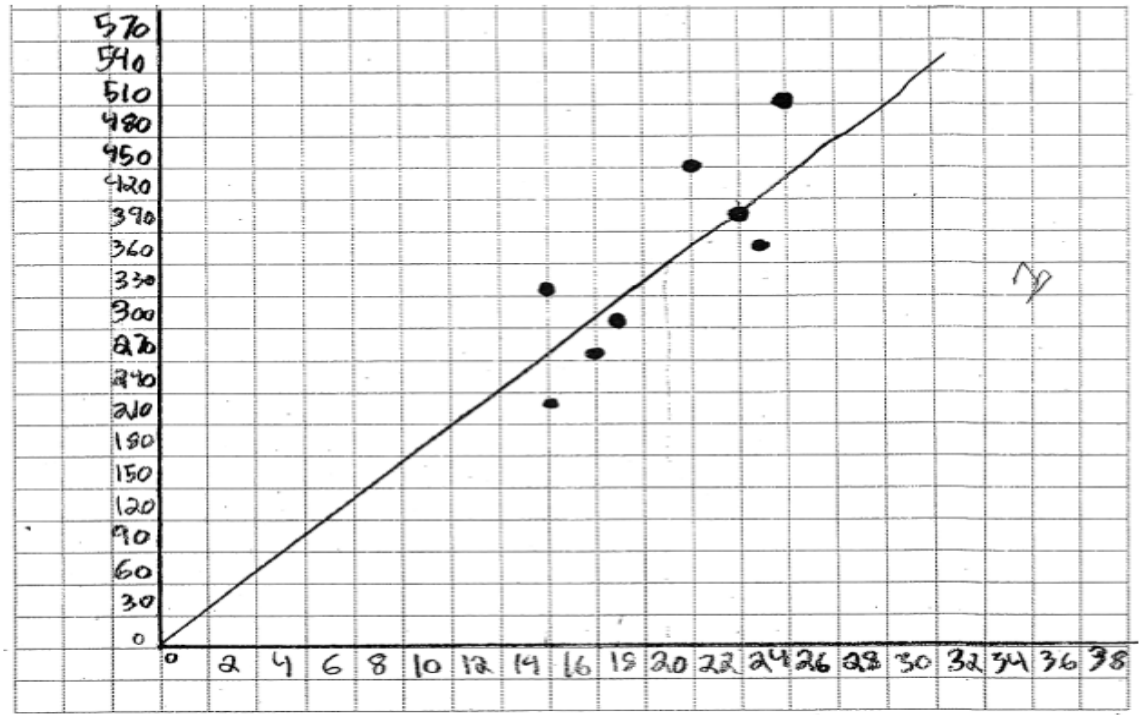




Ice Cream Shop

Exemplar #6 – Score: 1

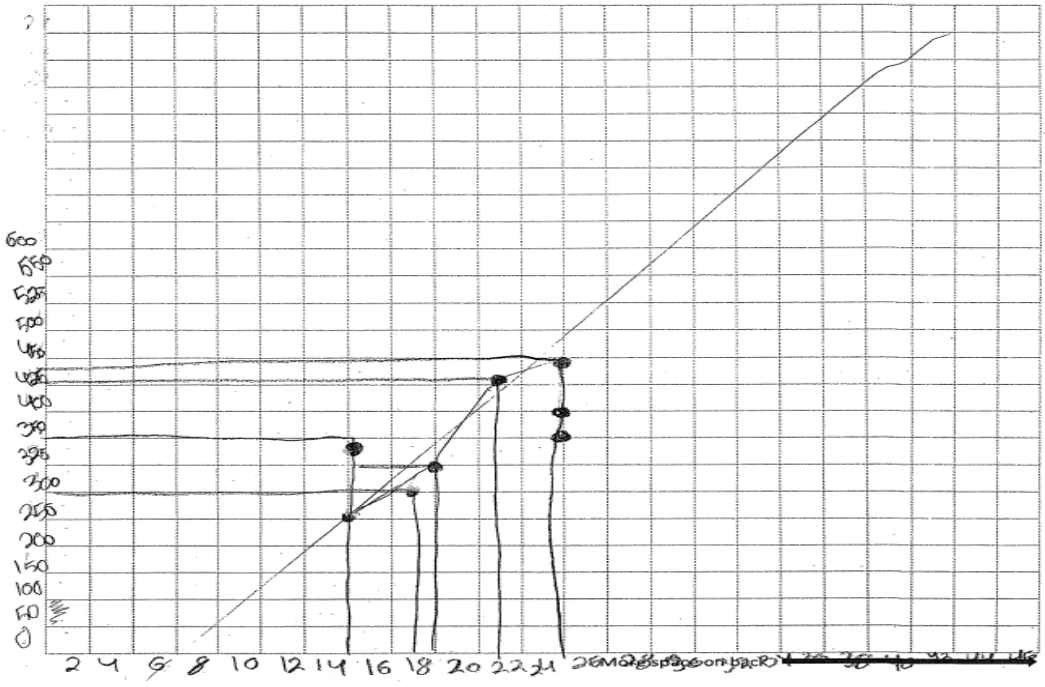
- ☑ Attempted to plot given points with line of best fit.
- ☑ Did not calculate any weather-adjusted sales data.
- ☑ Did not use graph to find values for future sales (i.e., interpolation).
- ☑ Next steps: Label increments of graph on the line. Show interpolated values on the graph.



Ice Cream Shop

Exemplar #7 – Score: 1

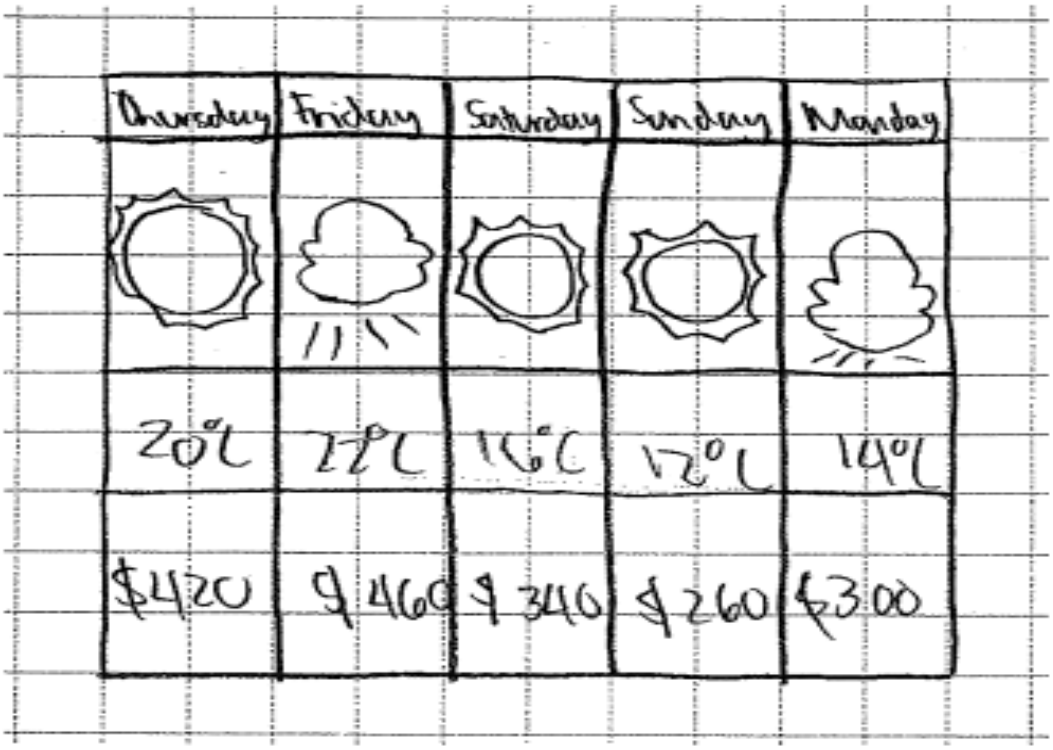
- ☑ Points are plotted incorrectly, although a line of best fit is attempted.
- ☑ Axes incorrectly labelled; values are not consistently labeled at gridlines.
- ☑ Next steps: Create an accurate graph (including labels). Label the data points to show interpolated values.



Ice Cream Shop

Exemplar #8 – Score: 0

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



Ice Cream Shop

Exemplar #9 – Score: 0

☑ All work shown is unrelated to solution.