

# A Cottage Renovation



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## Learning Situation

### **MTH-4173: Geometric Representation in a General Context 1**

#### Adult Learners' Workbook

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General Information About the Learning Situation

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## **Broad Area of Learning**

- Environment and consumption

## **Subject-Specific Competencies**

### **Competency 1: Uses strategies to solve situational problems.**

- Indication (oral or written) that the situational problem has been understood
- Application of strategies and appropriate mathematical knowledge
- Formulation of a solution suited to the situational problem
- Appropriate validation of the steps in the solution

### **Competency 2: Uses mathematical reasoning.**

- Formulation of a conjecture suited to the situation
- Correct use of appropriate mathematical concepts and processes
- Proper implementation of mathematical reasoning suited to the situation
- Proper organization of the steps in an appropriate procedure
- Correct justification of the steps in an appropriate procedure

### **Competency 3: Communicates by using mathematical language.**

- Correct interpretation of a mathematical message
- Production of a message in keeping with the terminology, rules and conventions of mathematics, and suited to the context

## **Family of Learning Situations**

- Measurement and spatial representation

## **Cross-Curricular Competencies**

- Solves problems
- Exercises critical judgment
- Uses effective work methods
- Updates their potential
- Communicates in an appropriate manner

## **Essential Knowledge**

- Trigonometric and metric relations in the triangle
- Similar and isometric triangles

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## Background

Your best friend, Alexander, has inherited his grandfather's cottage located in the Charlevoix region. The cottage was built on a cliff overlooking the Saint Lawrence River. While showing you pictures of the beach, Alexander tells you that the location is amazing and that he has many childhood memories of being on the beach with his cousins.



Source: pixabay.com

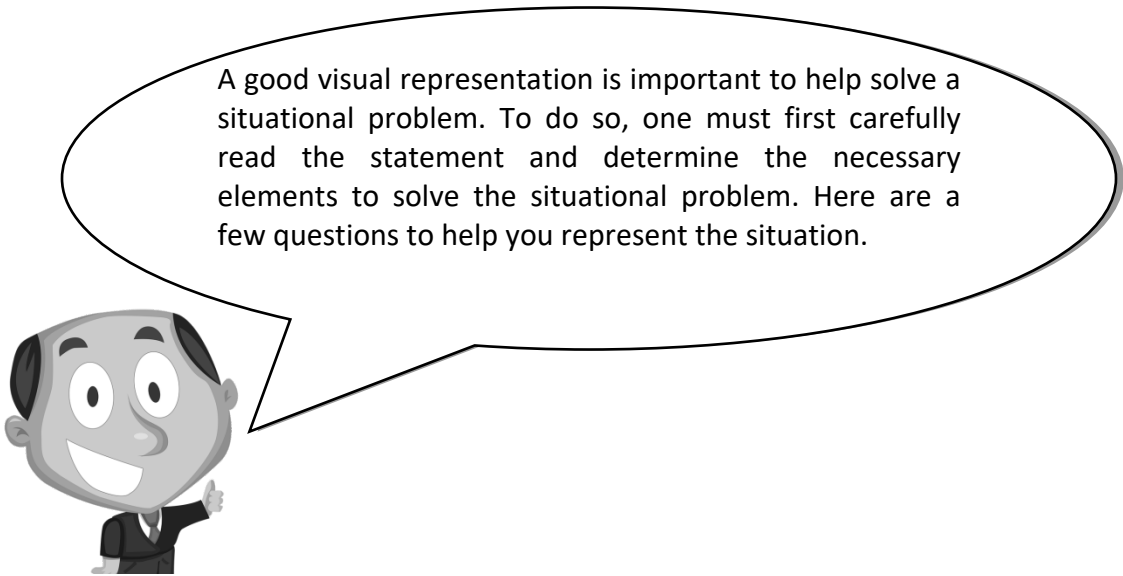
While visiting his new acquisition, Alexander realized that the cottage will need a number of renovations. He has also decided to make a few alterations to the cottage and its exterior. He has asked you to give him a hand to plan and carry out the work. To get you started, here are the measurements for the cottage and the lot that he took during his last visit.

### Cottage and lot measurements

- Lot width: around 100 ft.
- Lot length: around 150 ft.
- Wooded area: around 50 sq. ft.
- Width of cottage: 21.4 ft.
- Length of cottage: 25.7 ft.
- Height of first floor: 9 ft.
- Height of second floor (outside walls): 4 ft.
- Length of deck: 19.4 ft.
- Width of deck: 4.5 ft.
- Length of roof slope 1: 14 ft.
- Length of roof slope 2: 16.2 ft.
- Angle between both roof slopes:  $90^\circ$
- Height of cliff: 27.6 ft.
- Distance between cottage and cliff: 10 ft.

### Task 1 – Space for fireplace

Alexander has decided that he wants to install an outdoor fireplace to use on summer evenings. He explains that he and his wife have already found an affordable—and original—cylindrical fireplace. To avoid scorching the grass, he would like to put down concrete slabs where the fireplace will be set up. While listening to the conversation, Alexander’s wife mentions that she saw some superb slabs in the shed near the cottage and that she would like to use them to create a sunburst pattern around the 76.2 cm diameter circular slab that the fireplace will be placed upon. In her enthusiasm, she tells you that the 20 tiles are triangular—one of the angles is  $77.5^\circ$  and the sides that form this angle are congruent and measure four inches. Alexander then becomes hesitant, and says this project would be impossible as there are not enough tiles. Sensing the tension rise between Alexander and his wife, you try to avert an argument by showing them who is right using mathematical reasoning and a situation diagram.



A good visual representation is important to help solve a situational problem. To do so, one must first carefully read the statement and determine the necessary elements to solve the situational problem. Here are a few questions to help you represent the situation.

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## Question 1

Describe in your own words what we are looking for in this situational problem.

## Question 2

Determine the elements that will help you solve the situational problem.

## Question 3

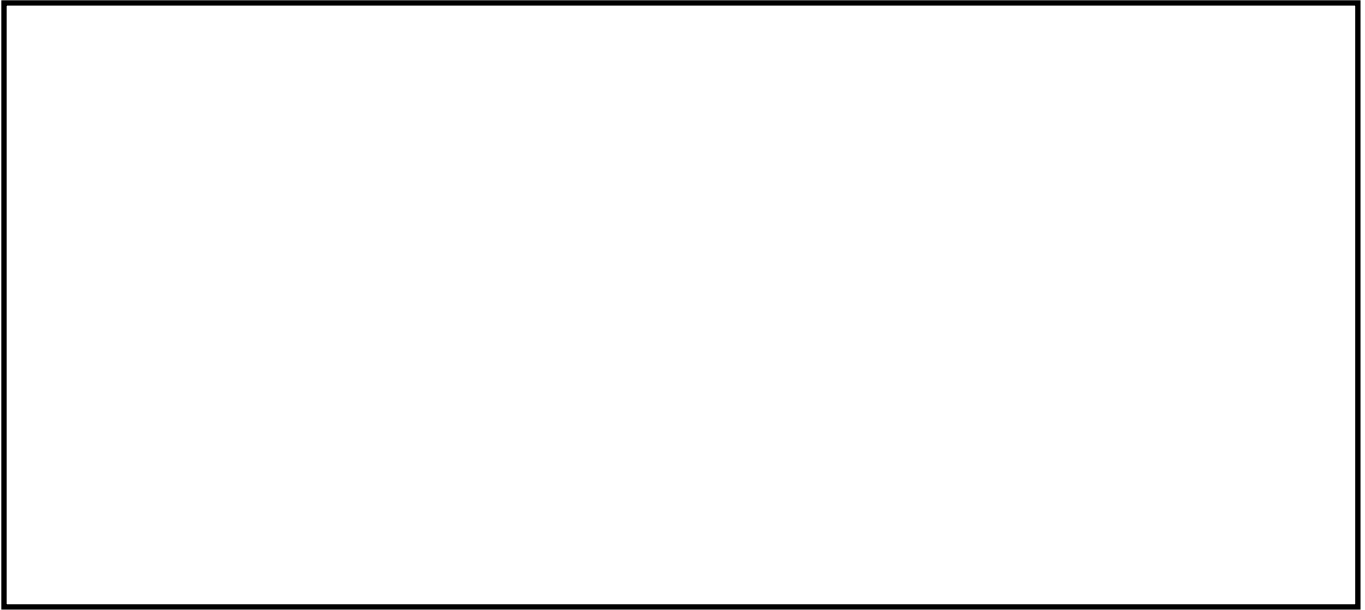
Draw a diagram of the situational problem.

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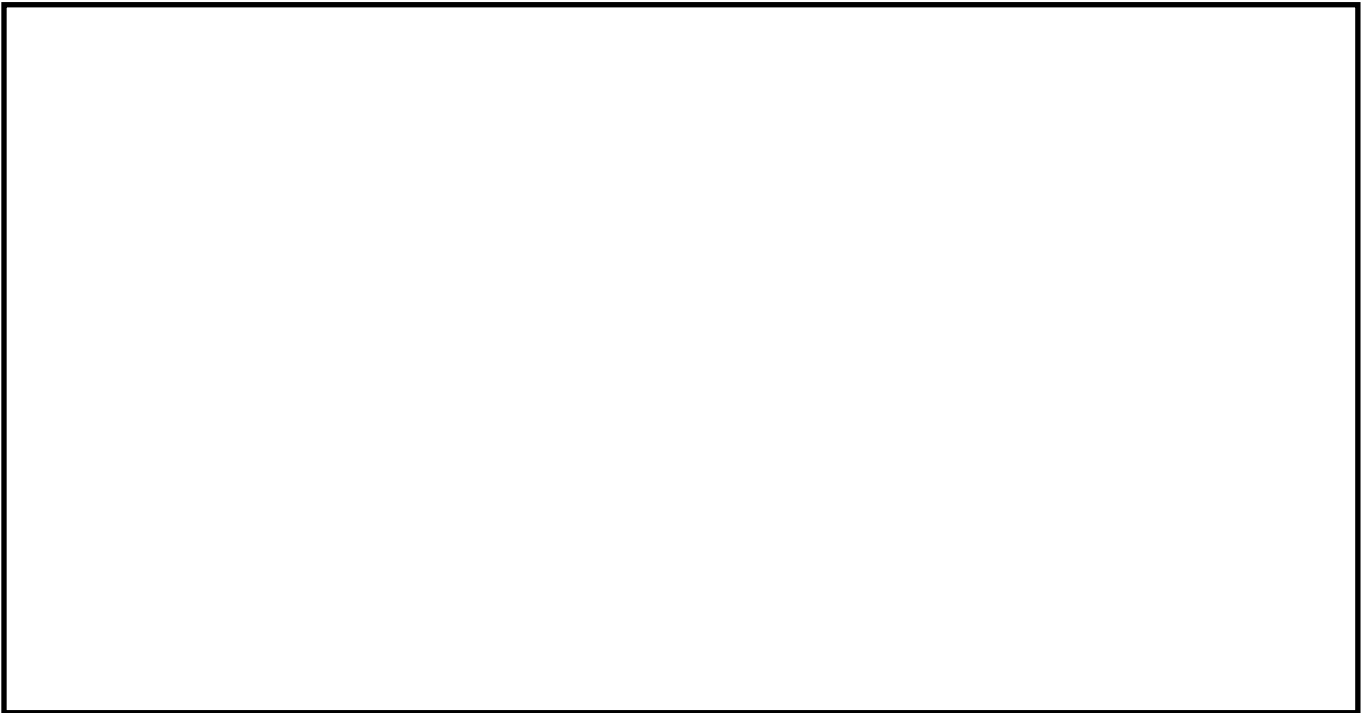
### Question 4

Determine the steps that will be necessary to solve the situational problem.



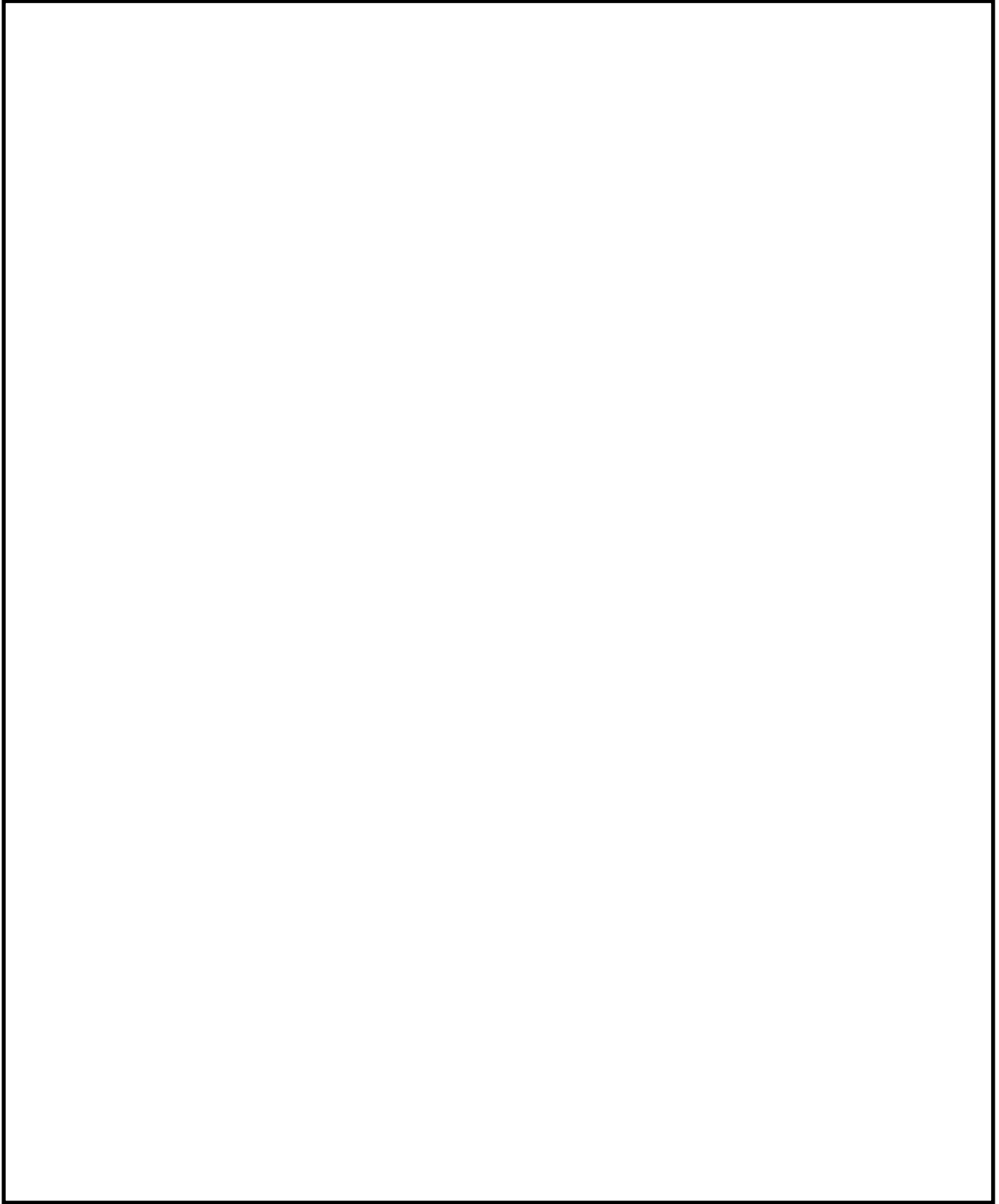
### Question 5

Clearly present the steps you would use to solve the situational problem.



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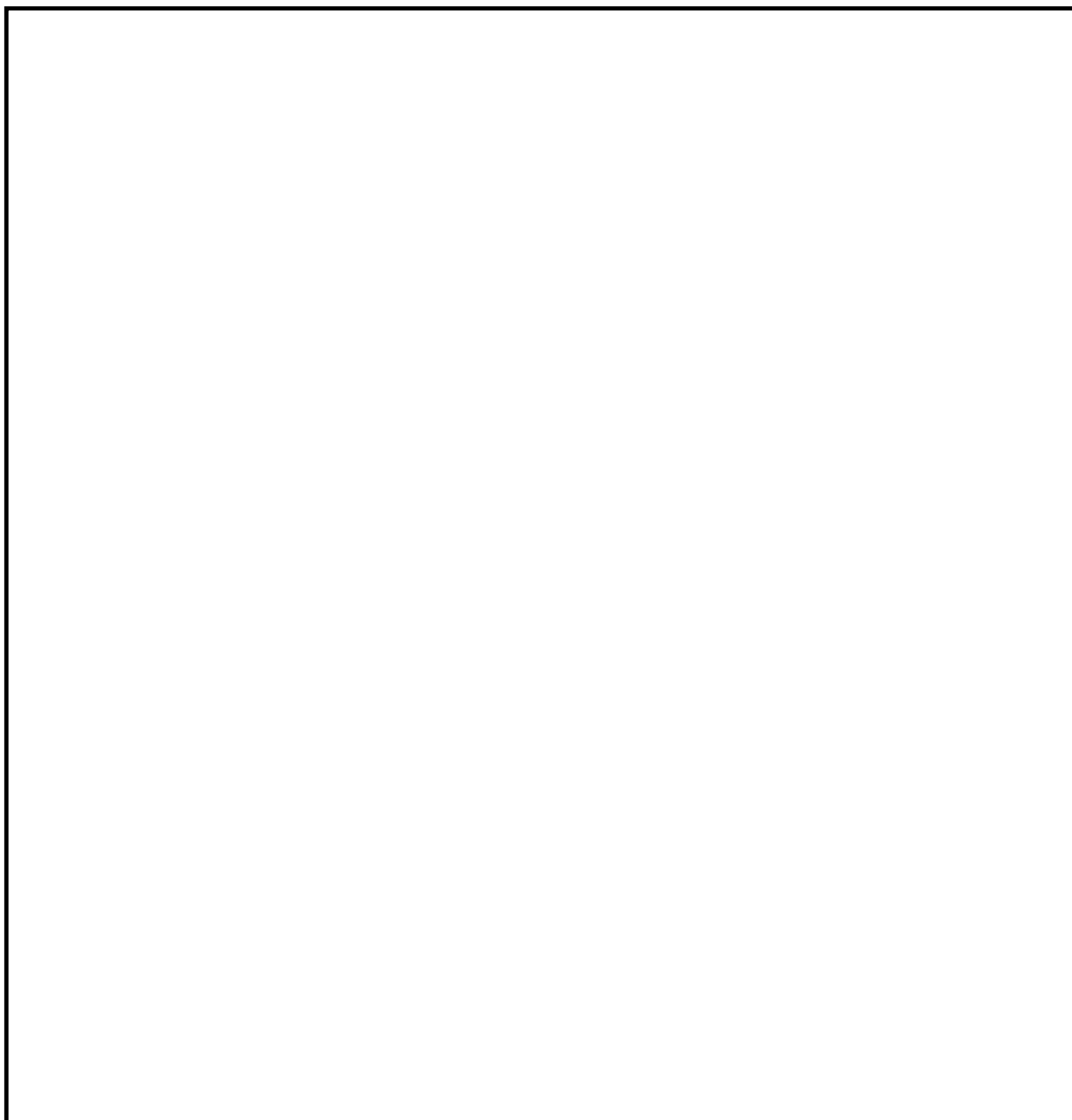
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**Answer:** \_\_\_\_\_

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\_\_\_\_\_



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### Self-evaluation

Using the scores opposite, determine the aspects you need to improve to solve a situational problem. After determining a score for each question, add them up and refer to the instructions below the questionnaire.

Scores	
1	I did not succeed.
2	I succeeded with help from my instructor.
3	I succeeded by reviewing my workbook.
4	I succeeded by working alone.

	Scores
<b>Representation</b>	
I was able to determine what was being looked for in the situational problem.	
I was able to make a visual representation of the situational problem.	
<b>Planning</b>	
I was able to determine the important information required to solve the situational problem.	
I was able to determine the steps necessary to solve the situational problem.	
<b>Activation</b>	
The steps are clear.	
The steps are consistent with what was being looked for in the situational problem.	
<b>Reflection</b>	
I was able to make a decision based on the results obtained.	
<b>Total (add scores)</b>	

Describe in a few words what you felt when solving a situational problem.

Describe in a few words what you felt when making a visual representation of a situational problem.

### Instructions

7-15	If you obtained a result in this range, it is important to meet your instructor in order to determine suitable strategies to help you solve the situational problem.
16-28	If you obtained a result in this range, you have little or no difficulty in solving the situational problem. You may proceed to task 2.

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You now know the questions you need to ask to properly represent the situations. Here are two non-guided tasks that will help you. Remember that you can ask your instructor for help, especially to represent the situational problem.



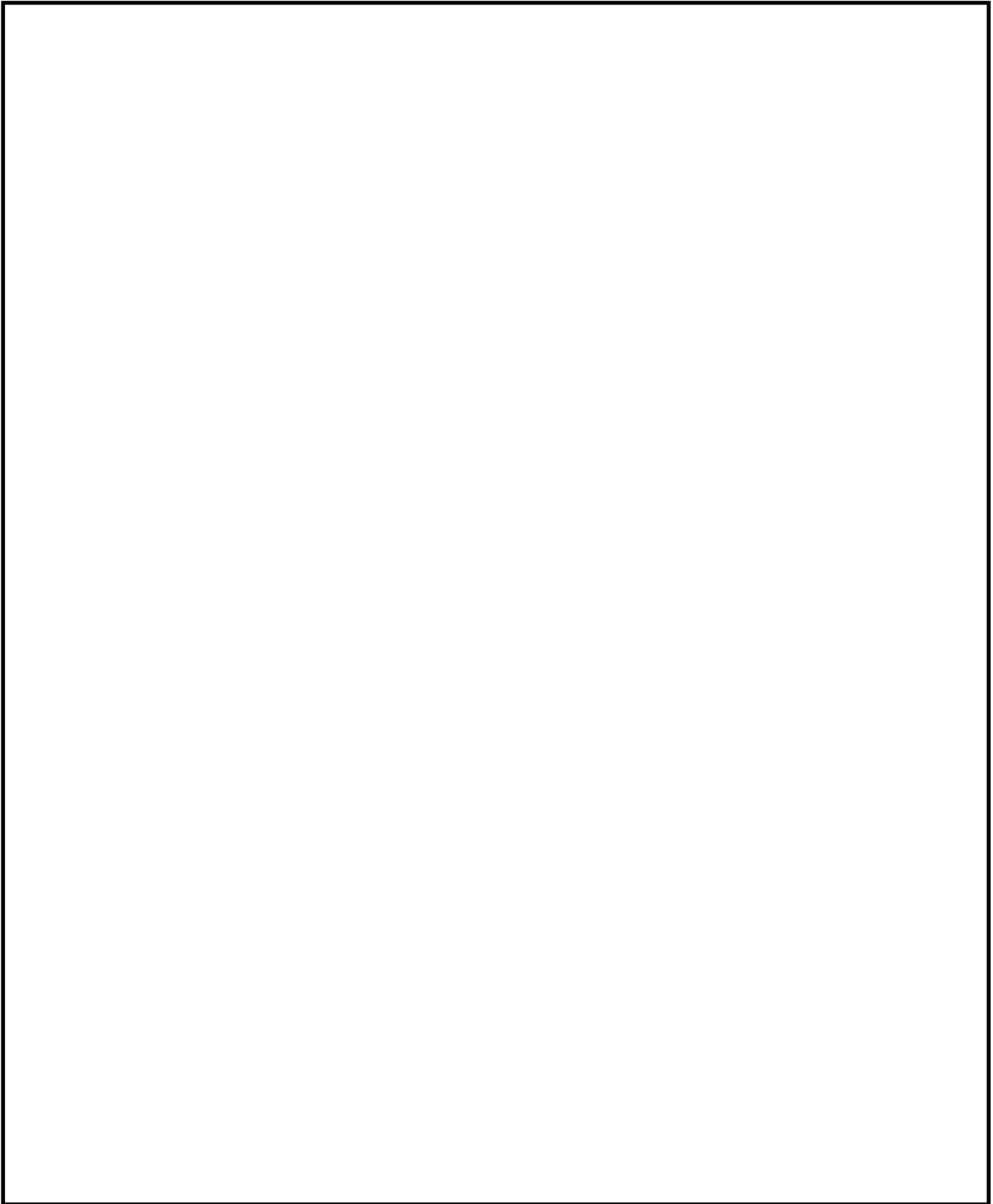
### Task 2—Extending the deck

While reminiscing about his happiest memories of the cottage, Alexander tells you that some of the very best times were those spent on the beach at the foot of the cliff. He used to get into mischief with his cousins, as no one could see them from the cottage. Now that he is older and plans to have a family of his own, he would like to extend the deck to the cottage's second floor so as to be able to keep an eye on the children as they play by the water's edge. Though he knows he would only be able to see half of the beach, Alexander would like to be able to see at least two metres of beach from the end of the deck. He would also like the deck to be the same length as the existing one. The foreman explained that extending the deck to the second floor would be a very expensive project as he would have to install posts to support it. He nevertheless decided to give him a good deal. Alexander would have to pay \$60/sq. ft.

Knowing that he only has a budget of \$3,000 for this project, help Alexander determine whether he would be able to extend the deck and how much would it cost.

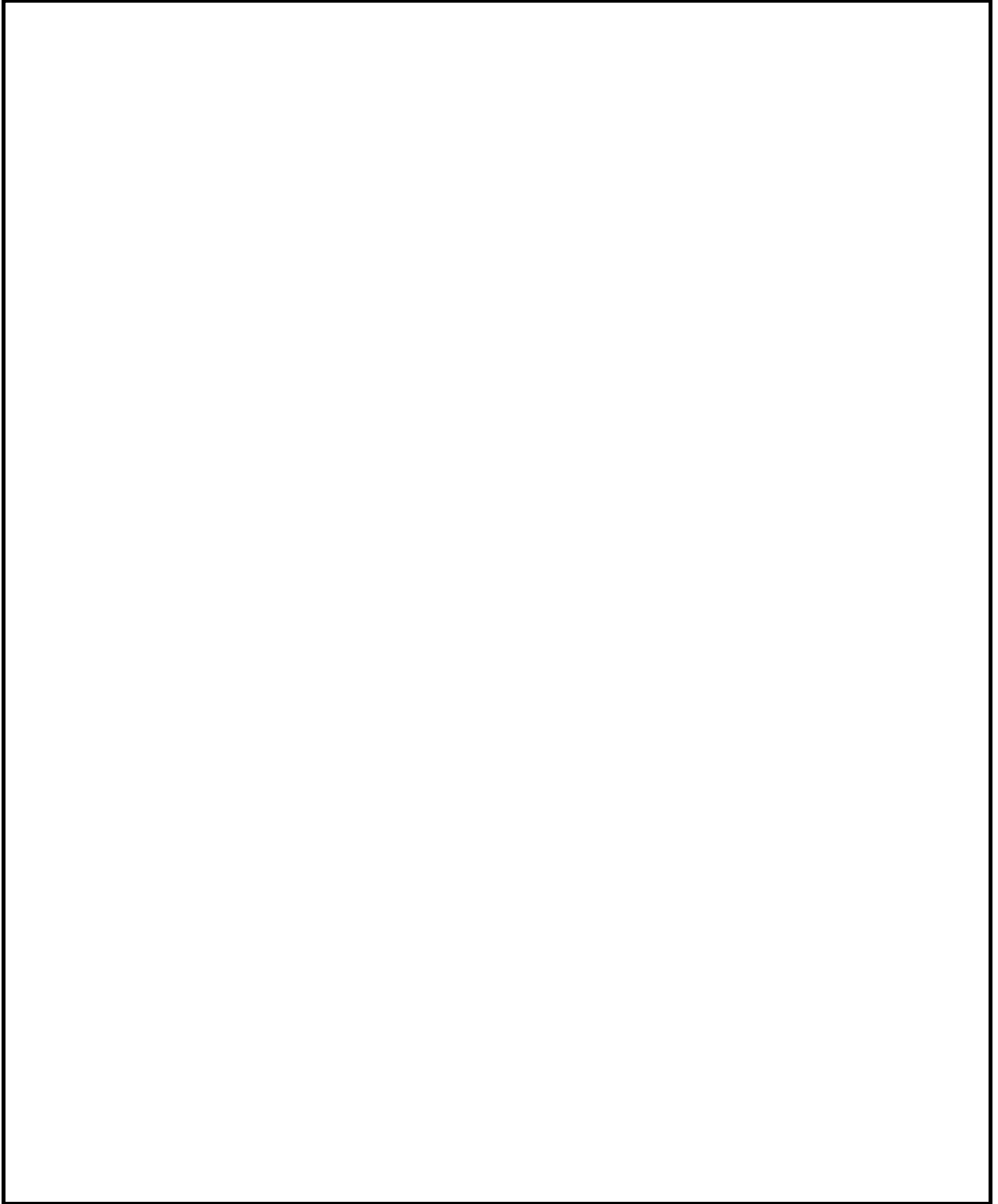
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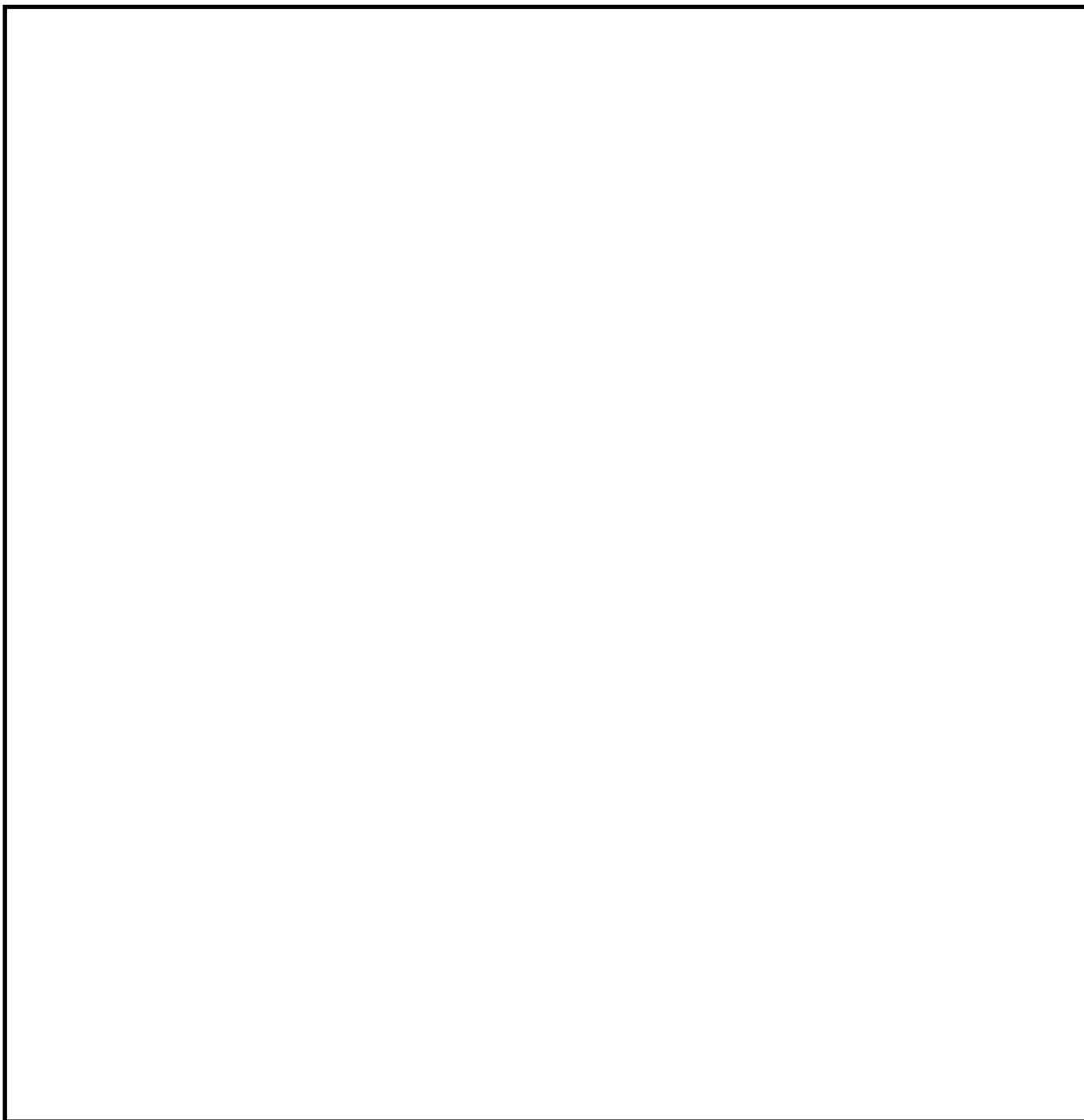
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**Answer:** \_\_\_\_\_

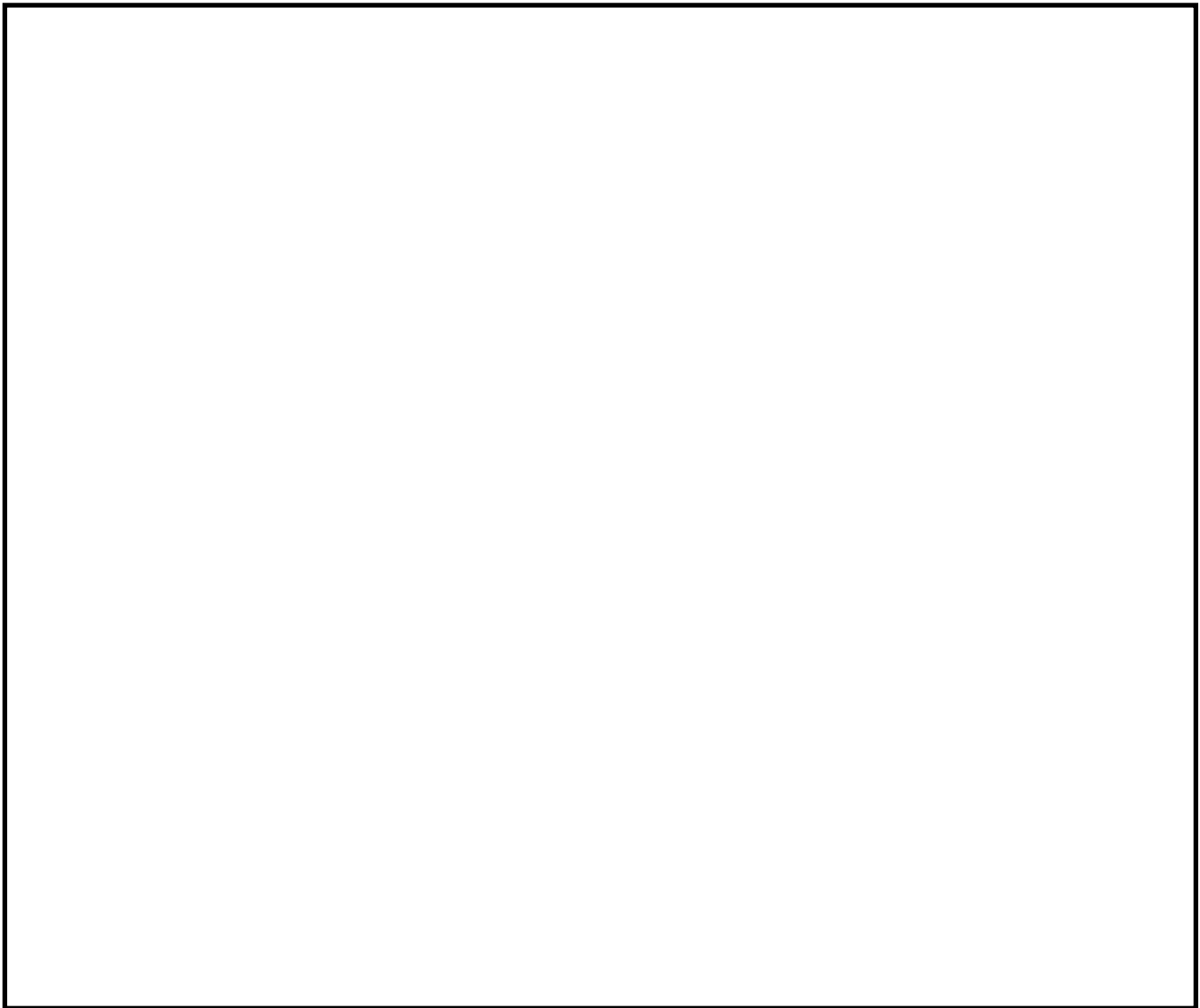
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### Task 3 – Renovating the roof

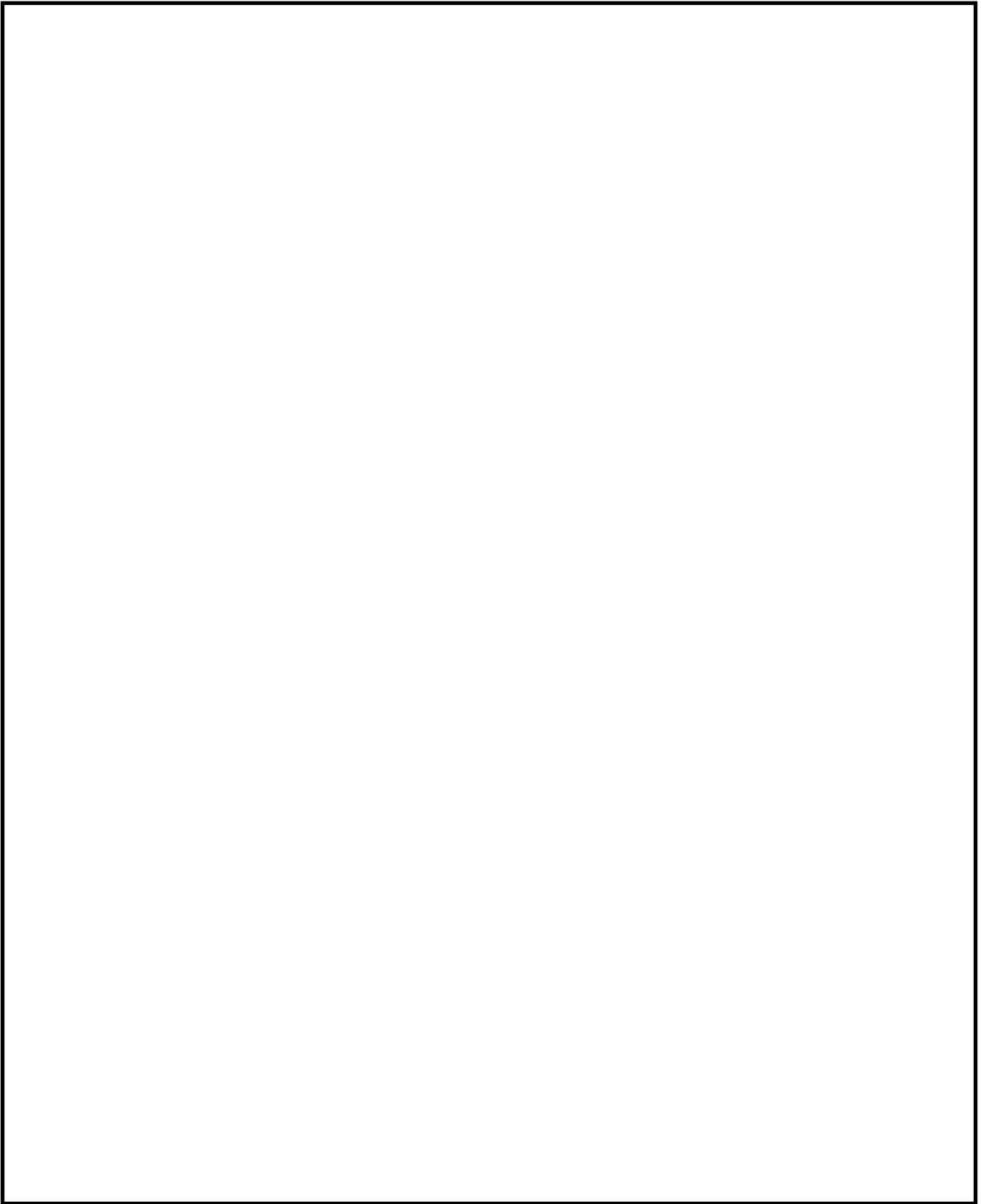
After considering the situation and discussing it with his wife, Alexander has come to the conclusion that renovating the roof, checking the artesian wells and insulating the windows are tasks that exceed his construction skills. However, he would like to take part in planning the roof renovations as he wants to make some changes. Alexander is 6 feet tall, and has noticed that the bedrooms on the second floor are very low because of the roof slope. Since he is making renovations, he would like to modify the roof so he can stand up when he is 2 feet away from the outside walls. Using mathematical reasoning, help Alexander determine the required modifications.



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**Answer:** \_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_

### **Conclusion**

Summarize in your own words the renovations that Alexander can and cannot do and indicate their specifications.



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### Self-reflection

Describe in a few words the various strategies that you used to solve situational problems.

Describe in a few words how the diagrams helped you to solve the situational problems.

Explain in a few words how trigonometry has allowed you to identify and answer situational problems