

Hay Crop Challenges

SUBJECT AREA: Math

GRADE: 6

MAIN CONCEPTS: Shape and Space: Measurement



SUMMARY

Students will be challenged with a problem-based scenario to design a hay storage facility. They will complete calculations to determine the design criteria, and apply concepts of perimeter, area, and volume as they complete a grid drawing of their plan.



MATERIALS

- Calculator



LEARNING RESOURCES

- Alberta Education Program of Studies



ASSESSMENT

Students will provide evidence of learning by:

- Drawing a map grid of their plan.
- Completing questions on "Hay Crop Decisions" (perimeter, area, and volume) and explaining their strategy.



Students must be confident with calculations of perimeter, area, and volume to complete the challenge questions included in the assignment.

General Learner Outcomes:

Students will:

Develop and apply a formula for determining the:

- Perimeter of polygons
- Area of rectangles
- Volume of right rectangular prisms.

Specific Learner Outcomes:

Students will:

Develop and apply a formula for determining the:

- Perimeter of polygons
- Area of rectangles
- Volume of right rectangular prisms.



STUDENT ASSIGNMENT

Hay Crop Challenges

On a trip to your grandparents' farm, you notice as you arrive, that they have had great success with their hay crop of irrigated alfalfa/grass mixed hay. Their fields were laden with jumbo square bales, measuring 1.2m wide x 1.2m height x 2.4m length (4'x4'x8') and weighing approximately 907 kg (2,000 lbs.).



Upon your arrival, Grandpa Sam and Grandma Sue were collectively planning to build a pole shed for hay storage, as they prepared a space to store the hay for the approaching winter. They were ecstatic because their hay crop had produced 240 bales, and their $\frac{1}{4}$ section (160 acres) field was _____ hectares in size. (1 acre = 0.4 hectare).



Formulas used:
Perimeter: $P = \text{distance around}$
 $P = + \text{all sides}$
Area: $A = \text{Length} \times \text{Width}$
Volume: $V = \text{Length} \times \text{Width} \times \text{Height}$

**The answers you helped Grandpa Sam and Grandma Sue calculate are listed below:
(show your work in the boxes provided).**

What was the size of their $\frac{1}{4}$ section hay field in hectares? (1 acre = 0.4 hectare)

What was their hay production in bales per hectare (how many bales/ hectare did they have)?

Grandpa Sam can carry 10 bales per load on his stacker (base 2 bales x height 5 = 10 bales):

- What size of floor space (base) dimensions are needed for the storage shed (area) to store all of Grandpa and Grandma's bales? Different choices could be made, but what decision would you make?
- Size of stacker load is a factor (the measurement of each bale is 1.2m wide x 1.2m height x 2.4m length and the base of each stacker load (2 bales) is $(1.2\text{m} + 1.2\text{m}) \times 2.4\text{m}$)
- $240 \text{ bales} / 10 \text{ bales per load} = 24 \text{ loads.}$
- Factors of 24 to choose from:
 - 1 x 24
 - 2 x 12
 - 3 x 8
 - 4 x 6

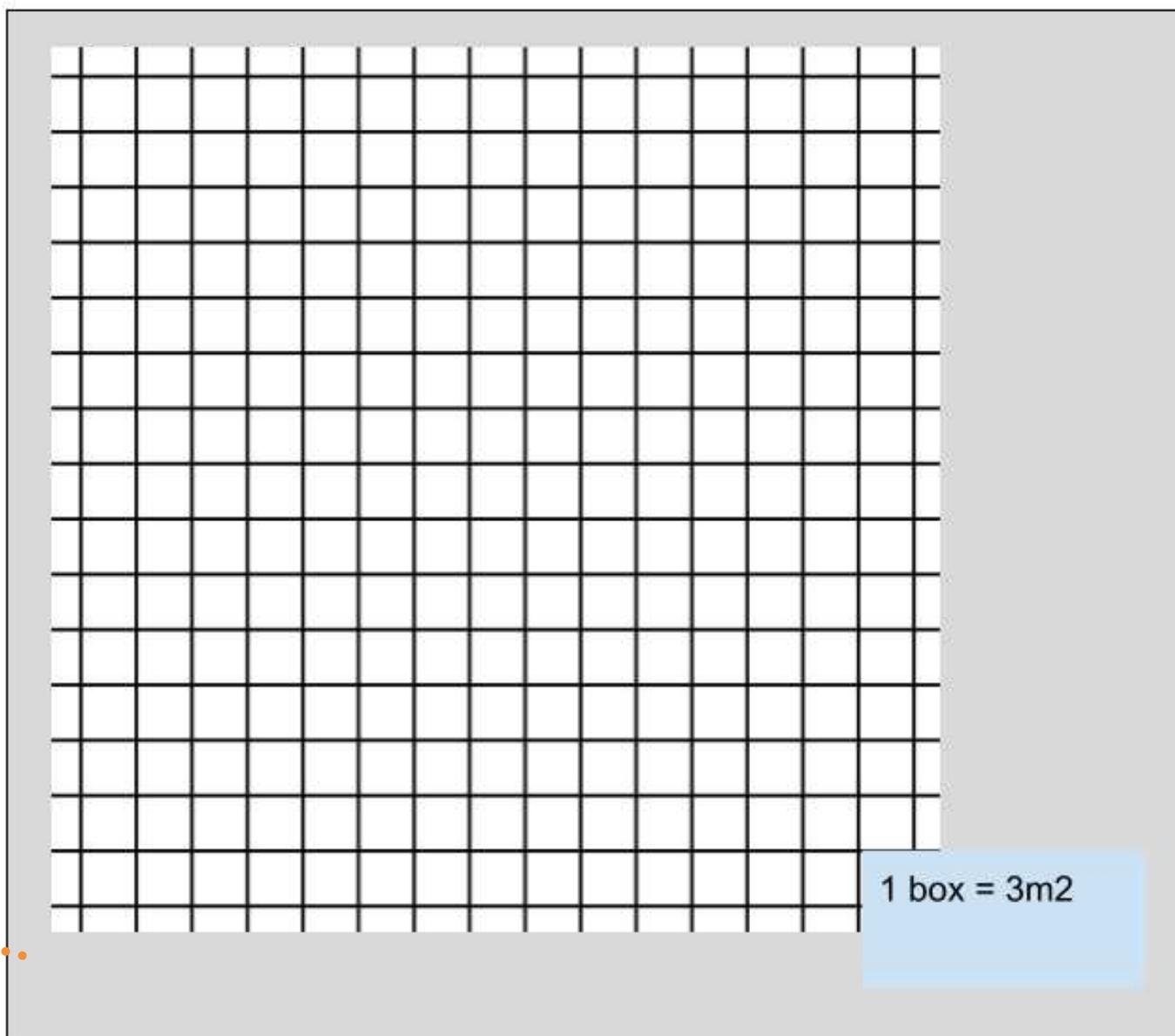
Round your answer to area ($A = \text{length} \times \text{width}$) to the next whole number (i.e. 4.5m would round to 5) to help ventilation if the shed is enclosed at a later date.

In order to help with your planning process for the last 3 questions, use a grid to draw your plan on the next page. Your drawing must include:

- Grid legend is included (length of each grid block = 3m)
- Perimeter fence (posts 3m apart)
- Gate (6m wide)
- Hay shed

STUDENT ASSIGNMENT

Hay Crop Challenges



What size of pen (perimeter) would be needed to fence around their new hay storage shed. Make sure the fence is at least 10m away from the building, providing lots of room to turn large equipment around?

How many fence posts (posts are 3 meters apart) will be needed?

How many rolls of barbed wire will be needed for a 4 wire fence? Grandpa Sam bought barbed wire in 400m rolls.

What was the size of their $\frac{1}{4}$ section hay field in hectares? (1 acre = 0.4 hectare)

$$160 \text{ acres} \times 0.4 = 64 \text{ hectares}$$

What was their hay production in bales per Hectare? (How many bales/ hectare did they have)?

$$4 \text{ bales} / .04 \text{ hectare} = n / 1 \text{ hectare}$$

$$4 \times 1 = 0.4 \times n$$

$$4 / 0.4 = 10 \text{ bales per hectare}$$

What size of floor space (base) dimensions are needed for the storage shed (area) to store all of Grandpa and Grandma's bales? Different choices could be made, but what decision would you make?

$$240 \text{ bales} / 10 \text{ per load} = 24 \text{ loads}$$

Factors of 24:

1 x 24 not a realistic choice

2 x 12 not a realistic choice

3 x 8 is my choice

4 x 6 could be a second choice

Base of each load $(1.2\text{m} + 1.2\text{m}) \times 2.4\text{m}$ so

$$(1.2\text{m} + 1.2\text{m}) \times 3 = 7.2\text{m wide or } 2.4\text{m} \times 3 = 7.2\text{m}$$

$$2.4\text{m} \times 8 = 19.2\text{m long or } (1.2\text{m} + 1.2\text{m}) \times 8 = 19.2\text{m}$$

$$\text{Area: } 7.2\text{m} \times 19.2\text{m} = 138.24 \text{ m}^2$$

I would make the shed $8\text{m} \times 20\text{m} = 160 \text{ m}^2$ as I used the next whole number

What size of pen (perimeter) would be needed to fence around their new hay storage shed. Make sure the fence is at least 10m away from the building, providing lots of room to turn large equipment around?

$$((8 + 10 + 10) \times 2) + ((20 + 10 + 10) \times 2) = 136\text{m}$$

$$(28 \times 2) + (40 \times 2) = 136\text{m}$$

$$P = 136\text{m}$$

How many fence posts (posts are 3 meters apart) will be needed?

$$\text{Posts in this example} = 13 \text{ side} + 13 \text{ side} + 9 \text{ top} + 6 \text{ bottom} + 4 \text{ corners} + 2 \text{ gate} = 47 \text{ posts}$$

How many rolls of barbed wire will be needed for a 4 wire fence? Grandpa Sam bought barbed wire in 400m rolls.

$$P = 136\text{m} - 6\text{m gate} = 130\text{m}$$

$$130\text{m} \times 4 \text{ wire} = 520\text{m} + 10\text{m extra} = 530\text{m wire}$$

Grandpa will need to buy 2 rolls.