

# To Build a Farm

*By Joshua Hall, Central Middle School*

## **Objectives**

Reinforce concepts of area of geometric figures as well as develop problem solving skills

## **Suggested grade levels**

9-12, adaptable for 7-8

## **Alaska Content Standards**

Math A1-6, B1-8  
(see text for specifics)

## **Terms to Define**

diameter

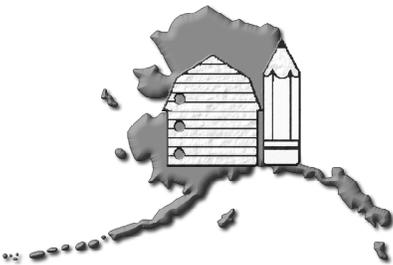
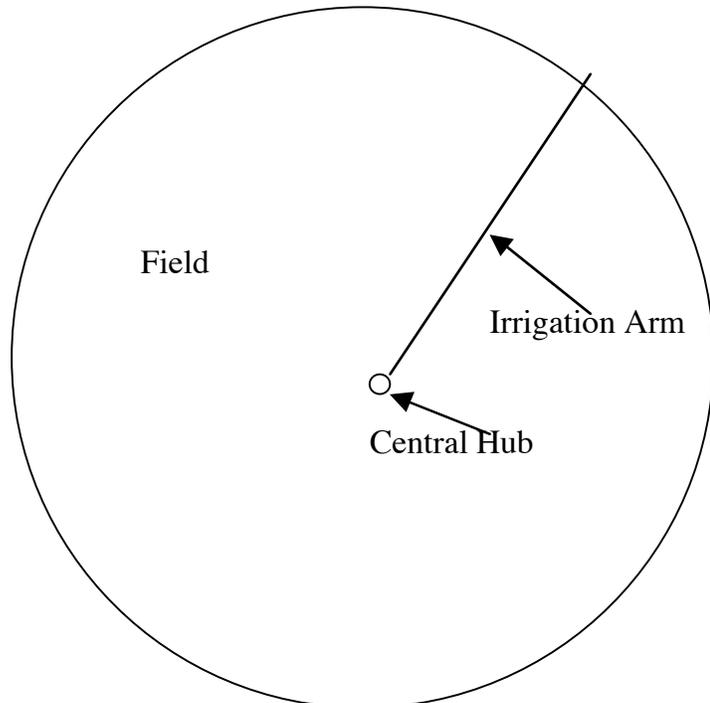
circumference

right-of-way

radius

hundredweight

You are an agricultural consultant who has been hired by Mr. Elmer Grosalottahay. Mr. Grosalottahay just purchased a fallow farm that is 1 mile square, and he plans to put it back into production. Your job is to design the most efficient and cost effective system of field irrigation possible. Mr. Grosalottahay farms in central Alaska where the soil is fertile but does not hold moisture very well, and rain is spotty. It has been shown that the most effective way to irrigate in this region is with a huge radial sprinkler system. Water is pumped to sprinklers mounted on a long rolling arm that pivots around a central pump. As the arm rotates through 360 degrees, it creates a perfectly circular field.



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**Here are the conditions under which you will operate:**

There is one 24-foot-wide road on the property that connects the western edge of the land to the house in the northeast corner. (see diagram)

There must be a minimum, 15 feet wide, clear right-of-way that runs from the northwest corner of the property to the southeast corner of the property. (see diagram)

The circular field that you create must have 2, 24-foot wide roads running edge to edge and crossing at the center.

24-foot-wide roads must also connect the house to the edge of the circle at 3 places, each connecting with the end of one of the diameter roads.

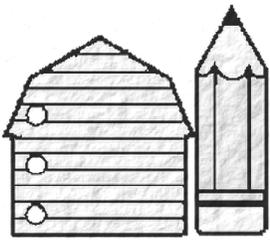
A 24-foot-wide road costs \$5 per foot to build.

The central hub for the irrigation system costs \$40,000, and must be centered in a clear circle 50-feet in diameter. It can cover 160 acres. Piping and pumps will add another \$1,000 per acre served.

The maximum length of the irrigation arm is 1,320 feet.

The average annual net income for a farm in Alaska is \$17, 260.

Plan the most efficient use of the space. You may plan one or more fields; whatever you think is best.

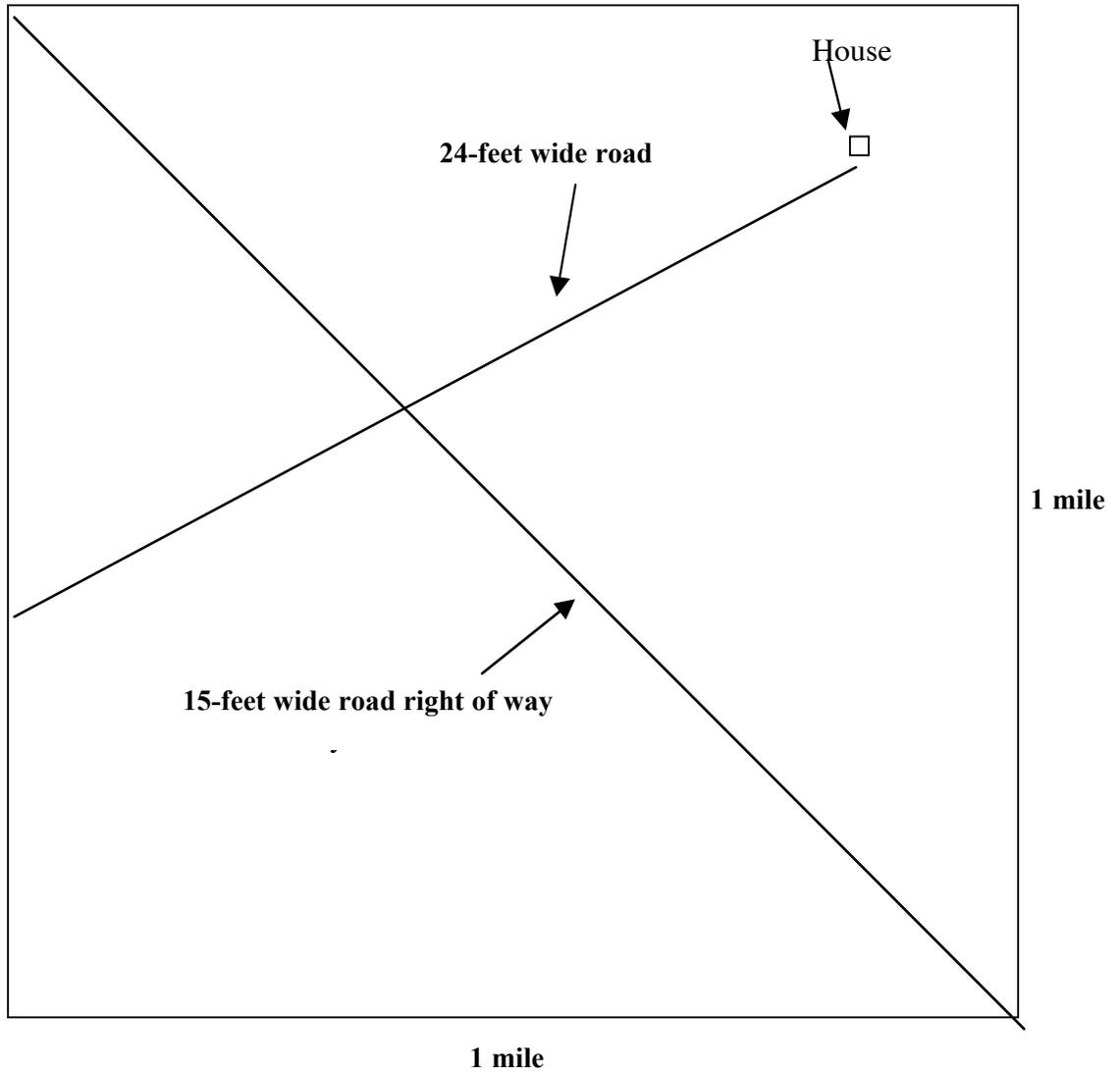


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*Joshua Hall teachers at Central Middle School, Anchorage School District. This lesson prepared with the assistance of Peter Bierman, UAF Cooperative Extension Service, Palmer; Suzan Benz, USDA Alaska Agricultural Statistic Service; and Jeff Curry, USDA Farm Services Agency.*

Here is a diagram of the property on which you will work

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Plan the field that will give Mr. Grosalottahay the most area to farm for the least cost.

Your report must include the following:

- A large diagram to scale of the property with your proposed irrigation scheme

A detailed list of the calculations you made including the length of any road to be built, the cost of irrigation equipment and the total area on which crops can be grown. (area of the circle minus roads, right of way etc.)

- A balance sheet with the itemized proposed cost of your plan

You must give an oral presentation to the class (and Mr. Grosalottahay) detailing each of the above items. The creativity of your design and the quality of your presentation will influence on the old farmer.

Remember, he has to live and work on the farm so he cares a great deal how it looks, and how easy it will be to work.

Have fun and be creative!

Oh, and did I mention that Old Man 'lottahay used to be a geometry teacher and is very appreciative of good math skills? Hint, Hint!!

**This Idea is all Wet, Part 2**

Now that you have created the best field, for Mr. Grosalottahay, you must make a recommendation what he should plant. The two staple crops in Alaska are potatoes and hay. Elmer can plant any combination of these two crops that he chooses. Given the following constraints. Make a recommendation as to how Mr. Grosalottahay should plant his field.

Hay requires a total of 10 inches of water per acre throughout the growing season.

Potatoes require a total of 15 inches of water per acre throughout the growing season.

There are about 27,000 gallons of water in an acre-inch.

Irrigation system costs about \$2 per acre inch to operate.

Hay yields about 3 tons per acre in a good year and 1 ton per acre in a bad year.

Hay sells for about \$225 per ton.

Potatoes yield about 20,000 pounds per acres in a good year and 10,000 pounds per acres in a bad year.

Potatoes sell for an average of \$20 per hundredweight (cwt); a hundredweight is 100 pounds.

**Specific Alaska standards addressed include**

M2.4.1 Evaluate measurements for accuracy, precision, and error with respect to the measuring tools, methods, and the computational process.

M5.4.6 Construct geometric models, transformations, and scale drawings using a variety of methods including paper folding, compass, straight edge, protractor, and technology.