

# Determining Project Needs – Utilizing Geometry In Agricultural Mechanization

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## Objectives:

Upon completion of the lesson the student will be able to:

1. Formulate perimeter and surface area for rectangles, triangles, and circles;
2. Formulate volume for cubes, prisms, cylinders, and cones;
3. Apply plane and volumetric geometry to agricultural mechanics situations; and
4. Calculate materials needed for various agricultural mechanics projects utilizing plane and volumetric geometry.

## Focus/Interest Approach:

Guessing is not good!

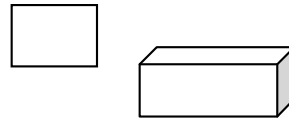
The mind is your best tool!

Legalized Student Torture!

## Lecture Notes: Determining Surface Area & Volume of Basic Geometric Shapes

### I. Rectangles & Cubes:

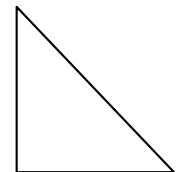
- a. Perimeter: Add all sides
- b. Area of a Rectangle =  $L \times W$
- c. Volume of a Cube =  $L \times W \times H$
- d. Practice:



- i. Determine the surface area of a rectangle that is 4' x 8'
- ii. How much soil is there in a hole that is 3' x 6' x 4'?

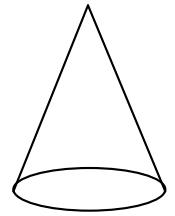
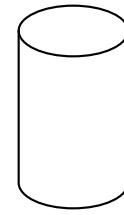
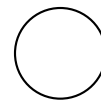
### II. Triangles, Prisms, & Pyramids:

- a. There are many types of triangles to be concerned with, but all can be broken down into the basic right triangle.
- b. Perimeter: Add all sides
- c. Missing a side? Pythagorean Theorem =  $a^2 + b^2 = c^2$
- d. Area of a Right Triangle =  $\text{Base} \times \text{Height} / 2$  ( $B \times H / 2$ )
- e. Volume of a Right Prism =  $[(B \times H) / 2] \times \text{Length of the prism}$
- f. Volume of a Pyramid =  $(\text{Area of base} \times H) / 3$
- g. Practice:



- i. Surface area of an equilateral triangle with sides of 24".
- ii. Volume of a right prism that has a base of 3", a height of 4", and a length of 12".
- iii. Volume of a 4-sided pyramid that has a base that measures 10' x 10' and a height of 12'.

III. Circles, Cylinders, & Cones:



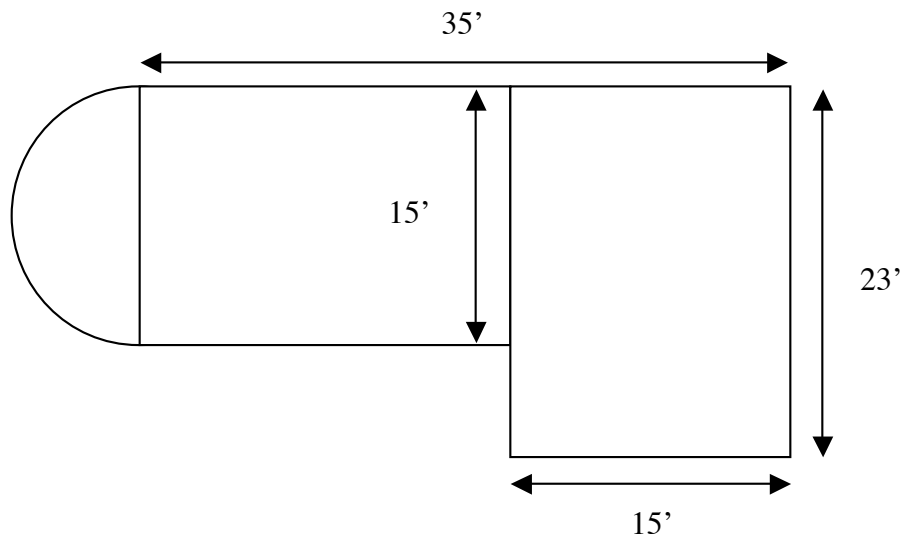
- a. Circumference =  $\pi \times \text{Diameter}$  -  $\pi d$
- b. Area of a Circle =  $\pi \times (\text{radius}^2)$  -  $\pi r^2$
- c. Volume of a Cylinder =  $\pi r^2 \times \text{Height of Cylinder}$
- d. Volume of a Cone =  $(\pi r^2 \times H)/3$
- e. Practice:
  - i. Circumference of a circle that has a diameter of 10'.
  - ii. Surface area of a circle with a diameter of 17'.
  - iii. Volume of a cylinder that has a diameter in 15" and has a height of 12'.
  - iv. Volume of a cone that has a base radius of 6' and a height of 18'.

IV. Where do we find these shapes in agricultural mechanization?

- a. Rectangles:
  - i. Plywood
- b. Cubes:
  - i. Fuel Cell Storage Tank
- c. Triangle:
  - i. Land Measurement, Laying-Out Fence Corners
- d. Prism:
  - i. Commodity Bucket
- e. Pyramid:
  - i. Grain Hopper
- f. Circles:
  - i. Center-Pivot Irrigation Calculations
- g. Cylinder:
  - i. Pipe Welding & Project Construction
- h. Cone:
  - i. Top of a Grain Silo or a Silo Floor

Guided Practice:

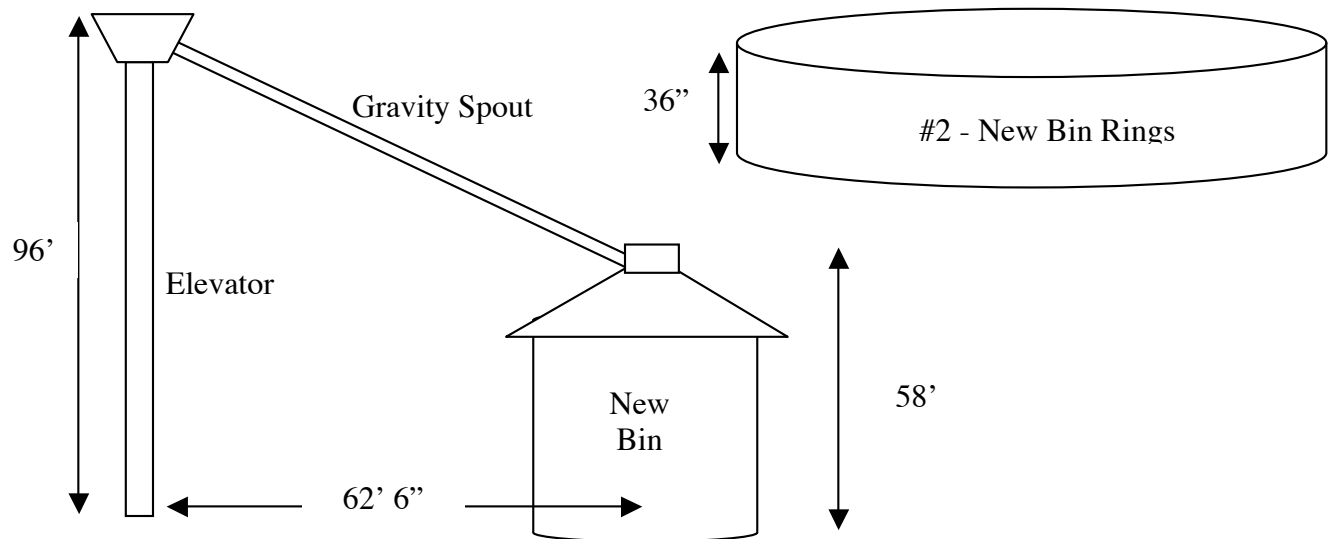
Determine the volume of "ready-mix" concrete to order from the following plans. The slab is 6" thick and will have an 18" x 24" footing around its perimeter. Be sure to add 10% for waste and error.



You are the owner of a grain elevator in rural Kansas that has a maximum capacity of 30,000 bushels. Industry experts have predicted a 21% production increase for your market area over the next two years. You decide to construct a new silo that has a diameter of 30'. Answer the following questions.

Questions:

1. What will be your capacity increase in bushels over the next two years at 21%?
2. If each ring of the newly constructed bin is 36" tall, how many rings in the new bin will be full of grain after the 21% growth?
3. After construction is complete for your new storage bin you must install a gravity spout for filling the bin. If the center of bin is located 62' 6" from the elevator leg, what length would the gravity spout need to be?



#3 – Gravity Spout Length

View Website with Flash Animation:

[www.epin.ncsu.edu/apiti/ol\\_2000/module1/geometry/geomfram.htm](http://www.epin.ncsu.edu/apiti/ol_2000/module1/geometry/geomfram.htm)

### Independent Practice:

1. Worksheet with bulk storage grain bin.
2. Worksheet with combine storage.

### Review:

- Numerous problems in the discipline of agricultural mechanics can be solved with a basic knowledge of plane and volumetric geometry.
- Review objectives.

### Materials Needed:

1. Computer & Projector
2. Dry Erase Board
3. Calculator
4. Pocket Reference