# BECOME AN AGRICULTURAL ENGINEER

## **Background:**

An engineer is someone who uses math and science to solve a problem. An agricultural engineer applies these concepts to the farm. They might design farm machines (such as a new tractor or tool) or facilities (such as chicken house or milking parlor) to maximize the efficiency of the farm.



## Bonus:

Learn about Temple Grandin and how she used her experience as a person with autism to engineer better solutions for cattle.

### Task:

You will apply what you have learned about measurement and perimeter to design a farm for your assigned livestock. Each animal will have a different set of needs and requirements in order to be kept most comfortable. There may be more than one correct way to create the requirements.

You will work in a group to design your blueprint first on a piece of construction paper by measuring and then drawing the lines for your fences, enclosures, and other features.

Next you will use construction paper to create your own 3-D farm model. Each group will complete one model.

Farms will be inspected by the Farm Safety Inspector to be sure that you have followed the appropriate specifications.

### Materials:

11x17 white paper Rulers Scissors Construction paper Pencils Glue









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# GROUP ONE: DAIRY COWS

### Farm Requirements:

Dairy cows spend a lot of time in the field grazing. In fact, they spend about 6 hours a day eating both the grass in the pasture and the feed provided by the farmer. In order to keep both the dairy herd and the nearby streams and waterways healthy, you need to construct a fence to keep the cows out of the waterways.

The fence must have a perimeter of 130 centimeters.

Because you have fenced the cows out of the stream you need to provide them with a watering trough where they can have access to plenty of fresh water throughout the day. Dairy cows drink 25-50 gallons of water each day!

The watering trough must have a perimeter of 20 centimeters.

Dairy cows are milked at least twice a day, every day. The building where they are milked is called the milking parlor. Most milking parlors are automated, some are even robotic! You will need to construct a milking parlor so that the cows can be milked.

### The perimeter of the milking parlor must be 60 centimeters.





# **GROUP TWO: EQUINE (HORSES)**

### Farm Requirements:

Horses love to eat short, juicy grass. They also eat hay (which is dried grass), especially in the winter or in their stable. Some horse owners might also supplement their horse's diet with barley, oats, or other types of feed. In a field, horses might spend most of their day grazing. To keep them from wandering off you need to build a fence around pasture.

The perimeter of the fence must be 100 centimeters

Horses typically have a stable where their grooming equipment might be kept. Horses should be groomed frequently with a comb, brush and hoof pick (which removes dirt, stones, and other objects from the feet). The horse owner might also keep the horse's saddle and blankets in the stable.

The perimeter of the stable must be 60 centimeters.

In addition to being used for storage, most stables have stalls for each horse. A horse might sleep in his stall (although horses generally sleep standing up!) or go there to be protected from bad weather. There are 3 horses on your farm and each needs their own stall in the stable.

Each stall must have a perimeter of 24 centimeters.







# **GROUP THREE: CHICKENS**

#### Farm Requirements:

The majority of chickens raised in Virginia and the nation are raised in climate-controlled barns, called houses, designed to maximize the chicken's health and welfare by providing a balanced diet, clean water, comfortable bedding, and fresh air. On many farms a computer monitors the temperature and air in the chicken house and automatically adjusts to keep the birds comfortable. This information can also be delivered straight to the farmer's phone. Your farm will have two chicken houses on it.

The perimeter of each chicken house must be 80 centimeters.

Chicken houses have automated feeders and water dispensers located throughout them. This provides the chickens with access to nutritionally balanced food and fresh water. Place a feeder as well as a water dispenser in each chicken house.

The perimeter of each feeder must be 12 centimeters and the perimeter of each water dispenser must be 8 centimeters.









# GROUP FOUR: BEEF CATTLE

#### Farm Requirements:

Beef cattle spend much of their day grazing in pastures. Many beef farmers utilize rotational grazing where cattle are cycled to different pastures, sometimes called paddocks, over time. This practice helps ensure the quality of both the grass and the soil.

Divide your farm into 3 equivalent paddocks. The total outside perimeter of your farm must equal 110 centimeters.

You will need to provide a source of clean drinking water for your cattle. In addition to being sure that the water level remains stable, you will also need to ensure that it does not freeze in the winter.

Place a water trough in one of your paddocks. The trough must have a perimeter of 20 centimeters.

Your beef cattle will need a barn or shelter. This will give the cows shelter from the weather as well as a place for routine health procedures.

The perimeter of the shelter should be 46 centimeters.









# TEACHER'S NOTES

#### Virginia Standards of Learning:

Mathematics: 3.9, 4.7, 5.8

#### **Extensions/Adaptations:**

- Take students on a virtual field trip to the farm by visiting AITC's Farm Life 360 on YouTube. These 360 degree videos allow viewers to explore various farms including a chicken house, beef cattle pasture, and milking parlor.
- Read The Girl Who Thought in Pictures by Julia Finley. The true story Temple Grandin shares how she used her unique mind to connect with animals and bring innovation to the agricultural world.
- You may bring in toy farm animals or toy fencing for students to include in their models.
- Directions can be modified to include other math concepts such as radius/circumference. For example, the cows' water trough could be directed to made with a radius of 5 centimeters.
- You may choose to convert the measurements to standard (rather than the metric that was used).
- This project can be done individually, in pairs or groups. There is generally more than one way to design each enclosure which makes it interesting when the different groups demonstrate various ways of designing their farms.
- Younger students may omit perimeter measurements and instead focus on simply creating a farm to meet their animals' needs. You may also substitute shape requirements for measurements (for example: Farms must include 2 rectangles, 3 squares, and 1 circle).
- Challenge students to use toothpicks and pipe cleaners to build a nest for a hen. Use hard candies as the "eggs" and see whose nest can hold the most eggs. Note that this type of nest is most common in a small poultry operation. Chickens in larger scale breeding operations will have man-made "nests" where they lay their eggs. These have a slanted bottom with flap that allow the egg to be deposited straight to the incubator.









# EXTENSION: ENGINEERING FOR EGGS

Provide students with any or all of the following materials:

- Paper bags
- Paper plates
- Pipe cleaners
- Construction paper
- Scissors
- tape

Challenge students to use the materials listed above to build a nest for a hen. Use hard candies as the "eggs" and see whose nest can hold the most eggs. Note that this type of nest is most common in a small poultry operation.

Chickens in larger scale breeding operations will have man-made "nests" where they lay their eggs. These have a slanted bottom with flap that allow the egg to be deposited straight to a conveyor belt that leads to the incubator. You may choose to have older students design this type of nest. Tell them that they must remember to consider how the egg will drop without breaking.









# BECOME AN AGRICULTURAL ENGINEER

Primary Version

## Background:

An engineer is someone who uses math and science to solve a problem. An agricultural engineer applies these concepts to the farm. They might design farm machines (such as a new tractor or tool) or facilities (such as chicken house or milking parlor).

## Task:

Farmers must provide for their animals' basic needs of food, water, space, and shelter. Each animal will have a different set of needs and requirements in order to be kept most comfortable. There may be more than one correct way to create the requirements.

You will use construction paper to create your own 3-D farm model. Each group will complete one model.

Farms will be inspected by the Farm Safety Inspector to be sure that you have followed the appropriate specifications.

## Materials:

11x17 white paper Construction paper Crayons Pencils Scissors Glue











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# GROUP ONE: DAIRY COWS

### Farm Requirements:

Dairy cows spend a lot of time in the field grazing. In fact, they spend about 6 hours a day eating both the grass in the pasture and the feed provided by the farmer.

Include 3 circle bales of hay on your farm. Have a small, medium, and large bale.

Dairy cows drink 25-50 gallons of water each day!

Make sure your cows have plenty of fresh water by including a rectangle water trough.

Dairy cows are milked at least twice a day, every day. The building where they are milked is called the milking parlor. Most milking parlors are automated, some are even robotic! You will need to construct a milking parlor so that the cows can be milked.

Your milking parlor should have 4 corners and 4 equal sides.





# GROUP TWO: EQUINE (HORSES)

### **Farm Requirements:**

Horses love to eat short, juicy grass. They also eat hay (which is dried grass), especially in the winter or in their stable. Some horse owners might also supplement their horse's diet with barley, oats, or other types of feed. In a field, horses might spend most of their day grazing. To keep them from wandering off you need to build a fence around pasture.

The fence should have 2 short sides and 2 long sides.

Horses typically have a stable where their grooming equipment might be kept. Horses should be groomed frequently with a comb, brush and hoof pick (which removes dirt, stones, and other objects from the feet). The horse owner might also keep the horse's saddle and blankets in the stable.

The stable should have 4 equal sides.

In addition to being used for storage, most stables have stalls for each horse. A horse might sleep in his stall (although horses generally sleep standing up!) or go there to be protected from bad weather. There are 3 horses on your farm and each needs their own stall in the stable.

Place 3 rectangle stalls in your stable. Include a small, medium, and large stall.







# **GROUP THREE: CHICKENS**

#### Farm Requirements:

The majority of chickens raised in Virginia and the nation are raised in climate-controlled barns, called houses, designed to maximize the chicken's health and welfare by providing a balanced diet, clean water, comfortable bedding, and fresh air.

### Build 3 rectangle chicken houses of equal size.

Chicken houses have automated feeders and water dispensers located throughout them. This provides the chickens with access to nutritionally balanced food and fresh water.

Place 3 circle feeders as well as 3 circle water dispensers in each chicken house. The feeders should be larger than the water dispensers.









# EXTENSION: ENGINEERING FOR EGGS

Provide students with any or all of the following materials:

- Paper bags
- Paper plates
- Pipe cleaners
- Construction paper
- Scissors
- tape

Challenge students to use the materials listed above to build a nest for a hen. Use hard candies as the "eggs" and see whose nest can hold the most eggs. Note that this type of nest is most common in a small poultry operation.

Chickens in larger scale breeding operations will have man-made "nests" where they lay their eggs. These have a slanted bottom with flap that allow the egg to be deposited straight to a conveyor belt that leads to the incubator. You may choose to have older students design this type of nest. Tell them that they must remember to consider how the egg will drop without breaking.









# TEACHER'S NOTES

### Extensions/Adaptations:

- Take students on a virtual field trip to the farm by visiting AITC's Farm Life 360 on YouTube. These 360 degree videos allow viewers to explore various farms including a chicken house, beef cattle pasture, and milking parlor.
- Read The Girl Who Thought in Pictures by Julia Finley. The true story Temple Grandin shares how she used her unique mind to connect with animals and bring innovation to the agricultural world.
- You may bring in toy farm animals or toy fencing for students to include in their models.
- Use Lego bricks for alternative measurement. For example: the fence must be 10 blocks long and two blocks high.
- Many livestock farmers also grow crops such as hay, soybeans, or corn to feed their animals. Add
  additional requirements to students' farms by having them include the row crops. For a bonus
  challenge, use small hard candies to represent the crops and ask students to design a machine that can
  harvest (pick up) the "crops." Provide items such as rubber bands, plastic cups, paper clips and straws
  for this activity.







