Agricultural Algebra: Welcome to the Farm

High School Algebra- Conversion

Math

Objectives

Students will apply algebraic concepts to solve real-world agricultural algebraic problems.

Vocabulary

Acre —a measure of the area of land, one acre = 43,560 ft^2
Agriculturalist—a person involved in the agricultural industry
Bovine—an animal of the cattle group, which also includes buffaloes and bisons.
Bushel—a weight equivalent for agricultural products used in the buying and selling of the products, one acre of wheat produces an average 35 bushels
Calf—a young bovine animal, usually under one year of age
Cattle—the general term used to describe animals of the bovine species (cows, bulls, calves, steers, etc.)
Cow—a female bovine (cattle) that has given birth to a calf
Feed rations—the daily feed portion prepared from various feeds according to various animals' requirements. It is based on feeding standards and information about the composition and nutritive value of feeds
Head—the term used to count one beef animal, like the term "people" to count humans

Background

You probably have asked yourself this question before, "When will I ever use algebra in my life?" Well, believe it or not, algebra is a very important tool to many people around the world, and is part of the daily routines of many **agriculturalists**, including farmers and ranchers. From calculating **feed rations** to knowing how much **fertilizer** they will need to put on their fields, farmers and ranchers use algebra to complete their daily tasks. The following worksheets are just a few examples of how algebra is used each day.

In Oklahoma, wheat is grown for the purpose of grain for human consumption and also for animal feed. The wheat farmer makes many decisions that go into producing a quality product that is both cost efficient and good for the land. One acre of wheat produces an average of 35 bushels. One **bushel** of wheat equals 60 pounds of wheat and yields 42 loaves of bread.

Although today we think of **cattle** as mainly used for meat and milk, early cattle served a triple-purpose. They provided meat, milk and labor to their owners. Eventually their draft purposes were largely replaced by horses and much later by machinery so they were selected more for single or in some cases dual purposes. Both beef and dairy cattle are in the **Bovine** family. A **cow** usually gives birth to one **calf** a year. Ranchers check their cattle often, counting them to make sure all **head** of cattle are there.

Activity 1: Farmland Worksheets, (Math) 1 50 minute class period

Materials

Math Exercises

Pen or Pencil
Calculator
Agricultural Algebra Welcome to the Farm Worksheets:

- The Wheat Farmer
- The Cattle Rancher

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Standards

Oklahoma Academic Standards

Activity 1: Welcome to the Farm Worksheets (Math)

A1.A.1.3 Analyze and solve real-world and mathematical problems involving systems of linear equations with a maximum of two variables by graphing (may include graphing calculator or other appropriate technology), substitution, and elimination. Interpret the solutions in the original context.

Agricultural Algebra: Welcome to the Farm

Activity 1 Worksheet 1: The Wheat Farmer

Name: _____ **Date:** _____

Class/Hour/Teacher: _____

The Wheat Farmer

In Oklahoma, wheat is grown for the purpose of grain for human consumption and also for animal feed. The wheat farmer makes many decisions that go into producing a quality product that is both cost efficient and good for the land.

The Franklin family farms wheat in Oklahoma. They are proud of their wheat farming heritage, and for the past 50 years have harvested an average of 30 bushels per acre on their 550-acre family farm. Fifty years ago, the Franklin family produced about 25 bushels per acre, but with increased technology and germination rates, their family farm produces closer to 35 bushels per acre each year.

Using the additional information provided to the right, calculate the following answers. Remember to include units for your answers.

A BUSHEL OF FACTS

Did you know that 60 lbs. of wheat = 1 Bushel?

A bushel of wheat yields 42 commercial loaves of white bread (one-and-a-half pound loaves)

1. **On average, how many bushels of wheat are currently being produced each year on the Franklin family farm?**

Answer: _____

2. **How many potential loaves of bread does the wheat from the Franklin family farm currently produce each year?**

Answer: _____

3. **Using the 50 year average, how many bushels of wheat have been produced on the Franklin Family Farm?**

Answer: _____

4. **Using their farm average, how many pounds of wheat has been produced on the Franklin Family Farm in the past 50 years?**

Answer: _____

5. **How many potential loaves of bread has the wheat from the Franklin family farm produced in the past 50 years, using the 50 year average?**

Answer: _____

6. **Using the information provided, create a math problem about the Franklin family wheat farm. Include the answer.**

Your Question:

Answer: _____

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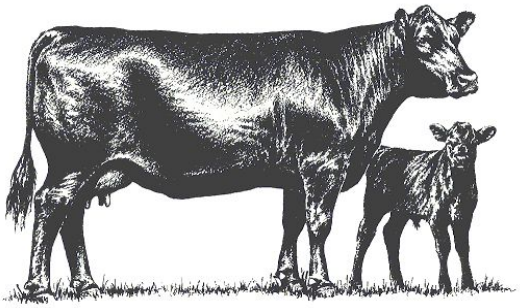
Activity 1 Worksheet 2: The Cattle Rancher

Name: _____ Date: _____

Class/Hour/Teacher: _____

The Cattle Rancher



Although today we think of cattle as mainly used for meat and milk (dairy cattle), early cattle served a triple-purpose. They provided meat, milk and labor to their owners. Eventually their draft purposes were largely replaced by horses and much later by machinery so they were selected more for single or in some cases dual purposes.

Oklahoma ranks fifth in the United States in total cattle, with more than 5 million head in the state in 2018. Beef Cattle are the number one agricultural commodity in the state, with nearly 2.6 billion dollars in 2017.

There are many day-to-day tasks that the cattle rancher uses math for, including calculating feed rations, vaccination rates, average daily gain, and average weights for truckloads of cattle. Discover some of the ways that cattle ranchers use algebra each day.

1. The Sloan family farm has a total of 574 pairs in their herd, a pair consists of a mother cow and a calf. Before winter comes, they decide they want to move their cattle to a different area of their ranch where it will be easier to feed and monitor the pairs through the winter.

   In order to move the herd, they need to load them onto cattle hauling trailers that have two decks (think double decker bus) and are 53 feet long by 8'6" wide.

   A. What is the total square foot measurement of the bottom deck of the trailer?

Answer: _____

B. What is the total square foot measurement of the trailer (account for both decks)

Answer: _____

2. To transport the cows, ranchers use an average weight and square footage comparison to calculate the amount of space needed per head. For cattle that are 1400 lbs, it is recommended that they have 18 square feet of space to move around within the hauling trailer. Taking this into consideration calculate the following:

A. How many cows are able to fit on one deck/level of the transport trailer? (Note: be sure to round down for this answer… you can't put a fraction of a cow into a trailer.)

Answer: _____

B. How many trailer loads will the Sloan family need to make in order to move all of the cows to the other pasture?

Answer: _____

C. If it costs $58 per trip to the other pasture, what will be the total cost to move just the cows for the winter?

Answer: _____

3. Now that we know how we will be moving the cows, we need to calculate the transportation for the calves. When transporting cattle that are less than 400 lbs, it is recommended that they have 5.25 square feet of space to move around. Taking this into consideration calculate the following:

   A. How many calves are able to fit on one level of the transport trailer? (Note: be sure to round down for this answer… you can't put a fraction of a calf into a trailer.)

Answer: _____

B. How many trailer loads will the Sloan family need to make in order to move all of the calves to the other pasture?

Answer: _____

C. If it costs $58 per trip to the other pasture, what will be the total cost to move just the calves for the winter?

Answer: _____

4. When transporting pairs of cattle, it is customary to split the cows and calves to put them into the different levels or compartments in livestock trailers. Double decker trailers are helpful in this way because they allow cows and calves to travel in the same trailer, with all the calves in the top deck and the cows down below. This is an animal husbandry practice that ensures the calves do not get trampled or knocked down by the much larger cows. When the cattle are released, the cows can find their calves resulting in less stress for the pairs.

   By strategically using both decks of the trailer, the Sloan family realizes they can combine one half load of calves with one half load of cows to lessen the total number of loads since the calves and cows can be separated on different decks of the trailer.

   A. How many total trailer loads will the Sloan family need to make in order to move all of the cows and calves to the other pasture?

Answer: _____

B. If it costs $58 per trip to the other pasture, what will be the total cost to move the all of the pairs for the winter? (Hint: it does not equal the sum of your answers from 2c. and 3c.)

Answer: _____

C. If the Sloan family wanted to make sure the cow and calf pairs were on the same trailer load, how many trailer loads would they need to transport all 574 pairs? What would be the cost of this?

Answer: _____

D. Based on what you have read above, would you spend the extra money to move the pairs together? Explain your answer.

Answer:

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Activity 1 Worksheet 1: The Wheat Farmer ANSWERS

Name: _____ **Date:** _____

Class/Hour/Teacher: _____

The Wheat Farmer

In Oklahoma, wheat is grown for the purpose of grain for human consumption and also for animal feed. The wheat farmer makes many decisions that go into producing a quality product that is both cost efficient and good for the land.

The Franklin family farms wheat in Oklahoma. They are proud of their wheat farming heritage, and for the past 50 years have harvested an average of 30 bushels per acre on their 550-acre family farm. Fifty years ago, the Franklin family produced about 25 bushels per acre, but with increased technology and germination rates, their family farm produces closer to 35 bushels per acre each year.

A BUSHEL OF FACTS

Did you know that 60 lbs. of wheat = 1 Bushel?

A bushel of wheat yields 42 commercial loaves of white bread (one-and-a-half pound loaves)

Using the additional information provided to the right, calculate the following answers. Remember to include units for your answers.

1. **On average, how many bushels of wheat are currently being produced each year on the Franklin family farm?**

Total acres x bushels per acre = 550 acres x 35 bushels per acre = 19,250 bushels per year

Answer: **19,250 bushels per year**

2. **How many potential loaves of bread does the wheat from the Franklin family farm currently produce each year?**

19,250 bushels per year x 42 loaves per bushel = 808,500 loaves per year

Answer: **808,500 loaves per year**

3. **Using the 50 year average, how many bushels of wheat have been produced on the Franklin Family Farm?**

Total acres x 50 yr avg bushels per acre = 550 acres x 30 bushels per acre = 16,500 bushels per year
50 years x 16,500 bushels per year = 825,000 bushels

Answer: **825,000 bushels**

4. **Using their farm average, how many pounds of wheat has been produced on the Franklin Family Farm in the past 50 years?**

   825,000 bushels x 60 pounds per bushel = 49,500,000 lbs of wheat

Answer: 49,500,000 lbs of wheat

5. **How many potential loaves of bread has the wheat from the Franklin family farm produced in the past 50 years, using the 50 year average?**

50 years x 16,500 bushels per year = 825,000 bushels
825,000 bushels x 42 loaves per bushel= 34,650,000 loaves

Answer: 34,650,000 loaves

6. **Using the information provided, create a math problem about the Franklin family wheat farm. Include the answer.**

Your Question:

Answers will vary

Answer: _____

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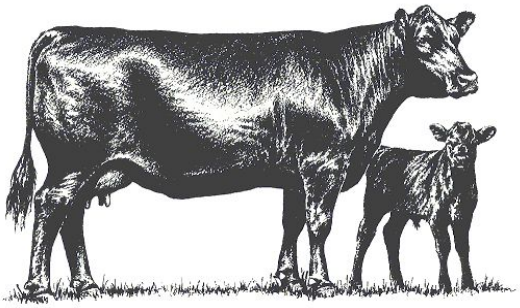
Activity 1 Worksheet 2: The Cattle Rancher ANSWERS

Name: _____ Date: _____

Class/Hour/Teacher: _____

The Cattle Rancher



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1. The Sloan family farm has a total of 574 pairs in their herd, a pair consists of a mother cow and a calf. Before winter comes, they decide they want to move their cattle to a different area of their ranch where it will be easier to feed and monitor the pairs through the winter.

   In order to move the herd, they need to load them onto cattle hauling trailers that have two decks (think double decker bus) and are 53 feet long by 8'5" wide.

   A. What is the total square foot measurement of the bottom deck of the trailer?

53 feet x 8.5 feet = 450.5 ft^2

Answer: **450.5 ft^2**

B. What is the total square foot measurement of the trailer (account for both decks)

450.5 ft^2 x 2 decks = 901 ft^2

Answer: **901 ft^2**

2. To transport the cows, ranchers use an average weight and square footage comparison to calculate the amount of space needed per head. For cattle that are 1400 lbs, it is recommended that they have 18 square feet of space to move around within the hauling trailer. Taking this into consideration calculate the following:

A. How many cows are able to fit on one deck/level of the transport trailer? (Note: be sure to round down for this answer… you can't put a fraction of a cow into a trailer.)

450.5 ft^2 per deck x 1 cow per 18 ft^2 = 450.5 ft^2/18 ft^2 = 25 cows per deck

Answer: 25 cows per deck

B. How many trailer loads will the Sloan family need to make in order to move all of the cows to the other pasture?

25 cows per deck x 2 decks per trailer = 50 cows per load
574 cows/50 cows per load = 11.48 loads

Answer: 11.48 loads

C. If it costs $58 per trip to the other pasture, what will be the total cost to move just the cows for the winter?

11.48 loads = 12 total trips x $58 = $696 to move the cows

Answer: $696 to move the cows

3. Now that we know how we will be moving the cows, we need to calculate the transportation for the calves. When transporting cattle that are less than 400 lbs, it is recommended that they have 5.25 square feet of space to move around. Taking this into consideration calculate the following:

A. How many calves are able to fit on one level of the transport trailer? (Note: be sure to round down for this answer… you can't put a fraction of a calf into a trailer.)

450.5 ft^2 per deck x 1 calves per 5.25 ft^2 = 450.5 ft^2/5.25 ft^2 = 85 calves per deck

Answer: 85 calves per deck

B. How many trailer loads will the Sloan family need to make in order to move all of the calves to the other pasture?

85 calves per deck x 2 decks = 170 calves per load
574 calves/170 calves per load = 3.37 loads

Answer: 3.37 loads

C. If it costs $58 per trip to the other pasture, what will be the total cost to move just the calves for the winter?

3.37 loads = 4 total trips x $58 = $232 to move the calves

Answer: $232 to move the calves

4. When transporting pairs of cattle, it is customary to split the cows and calves to put them into the different levels or compartments in livestock trailers. Double decker trailers are helpful in this way because they allow cows and calves to travel in the same trailer, with all the calves in the top deck and the cows down below. This is an animal husbandry practice that ensures the calves do not get trampled or knocked down by the much larger cows. When the cattle are released, the cows can find their calves resulting in less stress for the pairs.

By strategically using both decks of the trailer, the Sloan family realizes they can combine one half load of calves with one half load of cows to lessen the total number of loads since the calves and cows can be separated on different decks of the trailer.

A. How many total trailer loads will the Sloan family need to make in order to move all of the cows and calves to the other pasture?

11.48 loads of cows + 3.37 loads of calves =
12 + 3 = 15 total trips
*We can put a load of calves in the top deck of the last load of cows

Answer: 15 total trips

B. If it costs $58 per trip to the other pasture, what will be the total cost to move the all of the pairs for the winter? (Hint: it does not equal the sum of your answers from 2c. and 3c.)

15 total trips x $58 = $870 to move all the cattle

Answer: $870 to move all the cattle

If the Sloan family wanted to make sure the cow and calf pairs were on the same trailer load, how many trailer loads would they need to transport all 574 pairs? What would be the cost of this?

We would load the bottom decks with the cows, so 25 cows per trailer, and the calves would go in the top.

574 cows/25 cows per load = 22.96 loads = 23 trips
23 total trips x $58 = $1334 to move the cattle with their pairs

Answer: $1334 to move the cattle with their pairs

D. Based on what you have read above, would you spend the extra money to move the pairs together? Explain your answer.

Answer: Answers will vary