The Mystery Ration

Grade Level: 6-12

Essential Skills: 1, 3, 4, 9

Math: 6.NS.2, 7.RP.2c, N-Q.2,

Time: 90 minutes

Materials:
4 Escape Boxes*
6 Group Scenario Cards*
18 Box Cards*
8 3-Digit Locks*
Treat for the final box *

***Materials Available from Oregon Agriculture in the Classroom.**

Vocabulary:
Ration: a nutrient balance meal for animals.

Dry Matter (DM): feed with the water content removed to reduce the dilution of nutrients.

Crude Protein(CP): the amount of nitrogen in feed.

Total Digestible Nutrients (TDN): the total amount of nutrients absorbed including protein, fiber, starch and sugars and fat.

More Lessons:
At Home on the Range
Beef: Making the Grade
Carbon Hoofprints: Cows and Climate Change
Double the Muscle: Probabilities and Pedigrees
The Remarkable Ruminant

Description:
Discover the nutrient requirements of dairy cows! Students will collaborate in teams to unlock feed examples through a series of escape boxes. As students work to unlock each escape box, they will be tasked with calculating rations using the Pearson Square method to provide a balanced meal for dairy cows to enjoy!
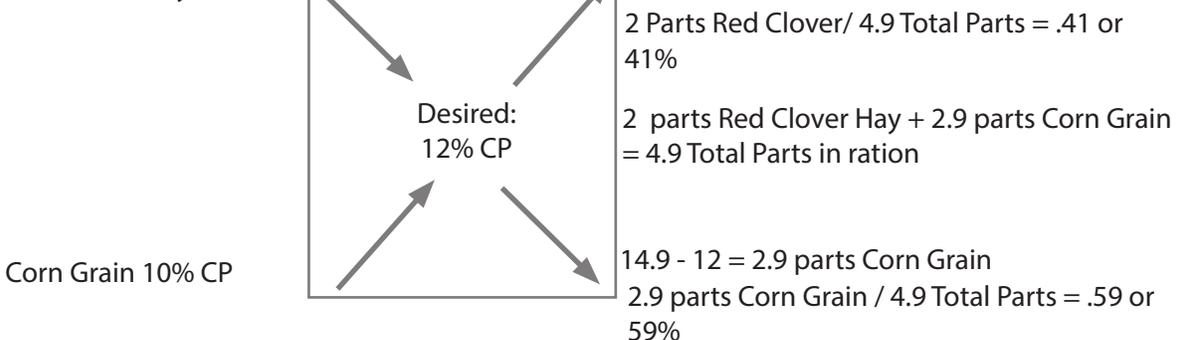
Background:
According to the USDA Census of Agriculture, in 2017 there were 54,599 dairy farms with over 9.5 million dairy cows in the United States. In 2018, dairy products ranked 4th in the top agricultural commodities in the United States with over $35 billion in cash receipts. In Oregon, dairy products are ranked 6th, with a value of over $70 million for exports in 2017. As one of our highest valued industries, caring for their animals is a top priority for dairy farmers.

Oregon dairy farmers care for their animals providing for their essential needs and collaborate with highly trained professionals such as nutritionists among others to ensure they are providing a well balanced meal for their cows to produce a nutritious wholesome product. 45-55% of a dairy farms operating cost goes to purchasing feed. This is one of the reasons producers pay special attention to ensure their herd's needs are met through the formulated ration's ingredients.

In this lesson, students will explore simple ration balancing through the Pearson Square method. In this mathematical computation, two feeds on a dry matter basis are balanced for one nutrient need. This can be helpful when grains are mixed for a ration or supplement to determine the amount of each ingredient needed to achieve your desired nutrient rate. In this method, you can calculate crude protein (CP), energy or total digestible nutrients (TDN). When using the Pearson Square method, there should be one feed with a nutrient concentrate above the desired rate and one with a lower rate. Begin by writing the desired nutrient rate in the center of the square, this rate is often set based on the National Research Council's Nutrient Requirement tables or by an experienced producer and their nutritionist. The two feeds are then placed on the corners of the left side (see diagram below). After the square is set up, begin by subtracting the smaller number from the larger number diagonally, follow the arrows below for reference, this will result in parts per ration. Total the sum of parts in the ration. Then using the dry matter parts on the right side, create a percentage of each feed's presence in the ration.

Example: Balance a ration for a desired Crude Protein (CP) rate of 12% using Red Clover Hay 14.9% CP and Corn Grain 10% CP

Red Clover Hay 14.9% CP

Desired: 12% CP

Corn Grain 10% CP

12 - 10 = 2 parts Red Clover Hay
2 Parts Red Clover/ 4.9 Total Parts = .41 or 41%

2 parts Red Clover Hay + 2.9 parts Corn Grain = 4.9 Total Parts in ration

14.9 - 12 = 2.9 parts Corn Grain
2.9 parts Corn Grain / 4.9 Total Parts = .59 or 59%

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In summary, with a desired rate of 12% Crude Protein using Red Clover Hay and Corn Grain, the ration should be 41% Red Clover Hay and 59% Corn Grain.

Check your work: 41(.149) + 59 (.10) = 12

Directions:
Part I: Watch the Rickreall Dairy Virtual Farm Field Trip
Watch the virtual field trip on our website called *Rickreall Dairy - The Scoop on Cow Nutrition*. This tour will provide students with background knowledge of a dairy cow's diet and how this relates directly to their production of milk and capability of producing a wholesome nutritious product that we can enjoy!

After watching the video, use these guiding questions to transition students into the next activity.
      a. Why is dairy cow nutrition an important aspect of managing a dairy farm?
      b. How do dairy farmers ensure that their animals are receiving adequate nutrition?
      c. When developing rations for their animals, what considerations would farmers use to determine the types of feeds that go into their animal's ration?

Part II: Introduction to Pearson Squares
1. Distribute the The Mystery Ration Activity Worksheet to students.
2. As a class, read through the background information provided at the top of the worksheet.
3. Explain to students that today we will be acting as a dairy farmer and determining the amount of different feeds to include in our cow's ration based on the desired rate of nutrients.
4. Using the example provided on the worksheet show students how to calculate rations using the Pearson Square method.
5. After demonstrating the Pearson Square method, have students practice this concept by completing the practice problems in Part 1 of the worksheet.
6. When students have completed the practice problems, have a few student volunteers show their work on the board to help reinforce the concepts of calculating the rations using the Pearson Square method.

Part III: The Escape Box Ration Challenge!
1. Place the escape boxes spaced out around the classroom in numerical order.
2. Divide students into 6 groups, distribute one Scenario Card to each group containing their desired nutrient rate that they will use in their Pearson Square math problems as they unlock each box.
3. Students will use Part II on their worksheet as they discover the contents of each box to do their Pearson Square math.
4. Each box will have two locks on it that students will unlock as they solve Pearson Squares. Each box will contain 6 cards and a feed example. Each group will take their designated card that's labeled with their group letter. Then each group will solve their Pearson Square using the information on the card. On the bottom of their card it provides instructions for which number students will use to unlock the next box. Each group's answer will be needed to unlock the locks on each box.

Reference materials used in creating this lesson:
Kellems, Richard O., and D. C. Church. Livestock Feeds and Feeding. Prentice Hall, 2010.
Nutrient Requirements of Dairy Cattle. National Academy Press, 2001.
Tisch, David. Animal Feeds, Feeding and Nutrition, and Ration Evaluation: with CD-ROM. Thomson Delmar Learning, 2006.

La ración misteriosa

Nombre del estudiante: _____

Los productores lecheros prestan especial atención a los componentes del alimento que se incluyen en la Ración Mixta Total (RMT) de sus vacas para asegurar que las necesidades nutricionales de sus vacas se satisfagan a través de los ingredientes de las raciones formuladas. La salud de su rebaño es crucial en la productividad general de su granja. Las necesidades nutricionales de las vacas lecheras cambian según su edad y etapa de producción (producir leche o no producir leche) similar a los cambios en las necesidades nutricionales de un ser humano. En una granja lechera, los costos de alimentación representan el 45-55% del costo operativo de las granjas. Esto significa que los agricultores toman decisiones críticas sobre el tipo de alimento, el costo y los niveles de nutrientes proporcionados para determinar las raciones más sabrosas y nutritivas para sus animales.

Hoy, explorarás el equilibrio simple de raciones a través del método de Pearson Square. En este cálculo matemático, dos alimentos en base a materia seca se equilibran para una necesidad de nutrientes. Esto puede ser útil cuando los granos se mezclan para obtener una ración o suplemento para determinar la cantidad de cada ingrediente necesario para alcanzar la tasa de nutrientes deseada. En este método, puede calcular la proteína cruda (PC), la energía o los nutrientes digestibles totales (NDT).

Cómo calcular usando el método cuadrado de Pearson
Cuando se utiliza el método de Pearson Square, debe haber un alimento con un concentrado de nutrientes por encima de la velocidad deseada y uno con una velocidad más baja.
Paso 1: Comience escribiendo la tasa de nutrientes deseada en el centro del cuadrado, esta tasa a menudo se establece en base a las tablas de Requisitos de nutrientes del Consejo Nacional de Investigación o por un productor experimentado y su nutricionista.
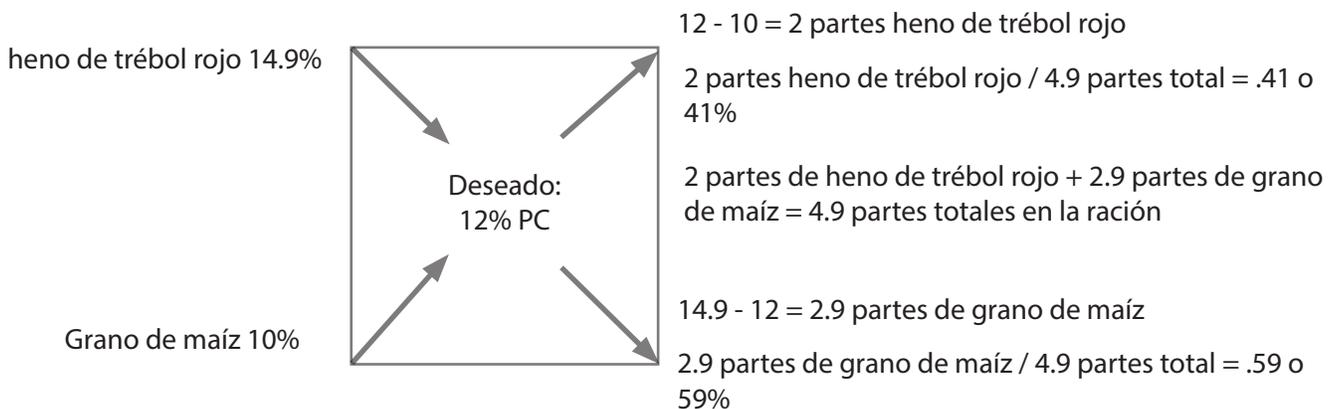**Paso 2:** las dos alimentaciones se colocan en las esquinas del lado izquierdo (ver el diagrama a continuación).
Paso 3: Después de configurar el cuadrado, comience restando el número más pequeño del número más grande en diagonal, siga las flechas a continuación como referencia. Esto dará como resultado partes por ración.
Paso 4: totaliza la suma de las partes en la ración.
Paso 5: Usando las partes de materia seca en el lado derecho, cree un porcentaje de la presencia de cada alimento en la ración.

Ejemplo: Equilibre una ración para obtener una tasa deseada de proteína cruda (PC) del 12% utilizando Red Clover Hay 14.9% PC y grano de maíz 10% PC

heno de trébol rojo 14.9%

Deseado:
12% PC

Grano de maíz 10%

12 - 10 = 2 partes heno de trébol rojo

2 partes heno de trébol rojo / 4.9 partes total = .41 o 41%

2 partes de heno de trébol rojo + 2.9 partes de grano de maíz = 4.9 partes totales en la ración

14.9 - 12 = 2.9 partes de grano de maíz

2.9 partes de grano de maíz / 4.9 partes total = .59 o 59%

En resumen, con una tasa deseada de 12% de proteína cruda usando heno de trébol rojo y grano de maíz, la ración debe ser 41% de heno de trébol rojo y 59% de grano de maíz.
Revisa tu trabajo: 41(.149) + 59 (.10) = 12

Parte I: Practicando con Cuadrados de Pearson

1. Balancee una ración con una tasa deseada de 10% PC usando Maíz molido 9% PC y semillas de soja 42.8% CP.

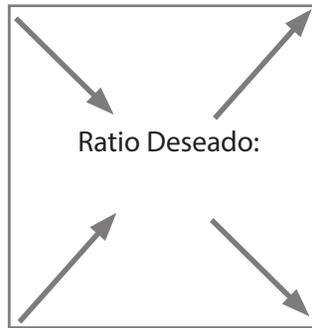**Alimento 1:**   **Alimento 1:**

Ratio Deseado:
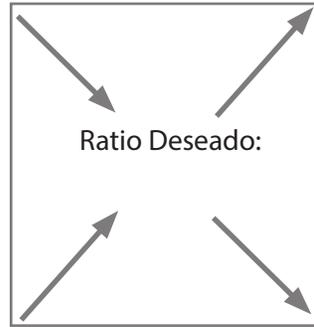
Alimento 2:   **Alimento 2:**

Revisa tu trabajo:

2. Equilibre una ración con una tasa deseada de 58% NDT usando grano de destilador de maíz 86% NDT y Fescue Hay 48% NDT.

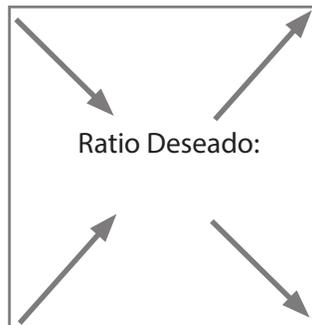**Alimento 1:**   **Alimento 1:**

Ratio Deseado:

Alimento 2:   **Alimento 2:**

Revisa tu trabajo:

3. Equilibre una ración con una tasa deseada de 10% de PC utilizando semillas de soja 42.8% de PC y Fescue Hay 9.5% de PC.

Alimentro 1:   **Alimentro 1:**

Ratio Deseado:

Alimentro 2:   **Alimentro 2:**

Revisa tu trabajo:

Parte II: El desafío de la caja de escape

Con su grupo asignado, su maestro le proporcionará una tarjeta de escenario. Lea el escenario y determine su tasa deseada para los cálculos de Pearson Square. Cada una de las primeras tres cajas contiene una tarjeta para cada grupo y ejemplos de feeds, utilizando la información de la tarjeta de su grupo, cree un cuadrado de Pearson y determine cuánto de cada uno de los feeds enumerados en la tarjeta de la caja se necesitaría en una ración para alcanzar la tasa de nutrientes deseada de su grupo. Después de que cada grupo haya terminado sus cálculos para una caja, usará la respuesta que la tarjeta de caja le indica que desbloquee la siguiente caja bloqueada. ¡La cuarta y última caja contiene un delicioso manjar para que su clase disfrute!

Combinación para el recuadro 1 (Uso de las tarifas deseadas para desbloquear el primer recuadro): los primeros tres dígitos (Grupo A, Grupo B, Grupo C) desbloquearán el bloqueo etiquetado como # 1 y los segundos tres (Grupo D, Grupo E, Grupo F) desbloqueará la cerradura etiquetada # 2. Después de desbloquear la primera casilla, obtenga la tarjeta de su grupo y comience a calcular la cantidad de cada ingrediente de alimento necesario en una ración para lograr la tasa deseada de su grupo. Use el método Cuadrado de Pearson para determinar las cantidades de cada alimentación, estos números desbloquearán la siguiente casilla.

	cerradura #1				**cerradura #2**	
	Grupo A	**Grupo B**	**Grupo C**	**Grupo D**	**Grupo E**	**Grupo F**

Box 1 _____ _____ _____   _____ _____ _____

Alimento 1:   **Alimento 1:**

Ratio Deseado:
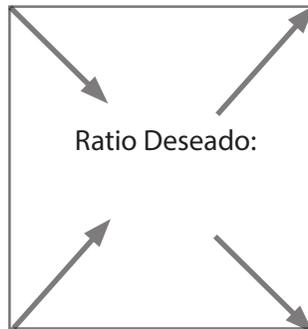
Alimento 2:   **Alimento 2:**
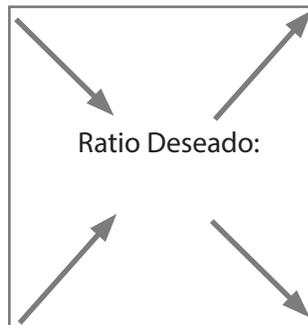
Revisa tu trabajo:

Combinación para la casilla 2 (usando las instrucciones en la parte inferior de la tarjeta de la casilla 1 para determinar el dígito): los primeros tres dígitos desbloquearán el candado etiquetado como # 3 y los segundos tres desbloquearán el candado etiquetado como **# 4.**

	cerradura #3				**cerradura #4**	
Grupo A	**Grupo B**	**Grupo C**	**Grupo D**	**Grupo E**	**Grupo F**

_____ _____ _____   _____ _____ _____

Box 2

Alimento 1:   **Alimento 1:**

Ratio Deseado:

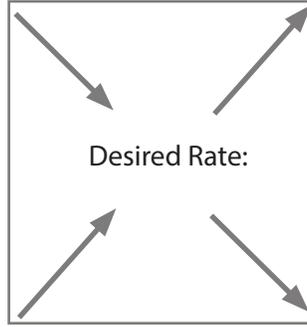**Alimento 2:**   **Alimento 2:**

Revisa tu trabajo:

Combinación para el recuadro 3 (Usando las instrucciones en la parte inferior de la tarjeta del recuadro 2 para determinar el dígito): Los primeros tres dígitos desbloquearán el candado etiquetado como # 5 y los segundos tres desbloquearán el candado etiquetado como # 6.

	cerradura #5				**cerradura #6**	
Grupo A	**Grupo B**	**Grupo C**	**Grupo D**	**Grupo E**	**Grupo F**

_____ _____ _____   _____ _____ _____

Box 3

Feed 1:

Feed 1:

Desired Rate:

Feed 2:

Feed 2:

Check your work:

Lock #7

Lock #8

Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	_____

Box 4

Enjoy your treat!

Tarjeta de escenario: Grupo A

El granjero Joe está trabajando con su nutricionista para determinar el costo de las diferentes opciones de alimentación que satisfacen las necesidades nutricionales de su hato lechero.

Su grupo calculará las opciones de alimentación de cada caja para determinar la cantidad necesaria en la ración de cada alimento en función de la tasa de nutrientes deseada a continuación. Use un cuadrado de Pearson para determinar las cantidades necesarias de cada alimento.

Ratio Deseado: **17% Proteína cruda**

Para desbloquear el primer cuadro con la primera opción de combinación de alimentación, utilizará el dígito en la ubicación de las unidades de la velocidad deseada.

Tarjeta de escenario: Grupo B

El granjero Joe está trabajando con su nutricionista para determinar el costo de las diferentes opciones de alimentación que satisfacen las necesidades nutricionales de su hato lechero.

Su grupo calculará las opciones de alimentación de cada caja para determinar la cantidad necesaria en la ración de cada alimento en función de la tasa de nutrientes deseada a continuación. Use un cuadrado de Pearson para determinar las cantidades necesarias de cada alimento.

Ratio Deseado: **68%Nutrientes Digestibles Totales**

Para desbloquear el primer cuadro con la primera opción de combinación de alimentación, utilizará el dígito en la ubicación de las unidades de la velocidad deseada.

Tarjeta de escenario: Grupo C

El granjero Joe está trabajando con su nutricionista para determinar el costo de las diferentes opciones de alimentación que satisfacen las necesidades nutricionales de su hato lechero.

Su grupo calculará las opciones de alimentación de cada caja para determinar la cantidad necesaria en la ración de cada alimento en función de la tasa de nutrientes deseada a continuación. Use un cuadrado de Pearson para determinar las cantidades necesarias de cada alimento.

Ratio Deseado: **17.9% Proteína cruda**

Para desbloquear el primer cuadro con la primera opción de combinación de alimentación, utilizará el dígito en la ubicación de las unidades de la velocidad deseada.

Tarjeta de escenario: Grupo D

El granjero Joe está trabajando con su nutricionista para determinar el costo de las diferentes opciones de alimentación que satisfacen las necesidades nutricionales de su hato lechero.

Su grupo calculará las opciones de alimentación de cada caja para determinar la cantidad necesaria en la ración de cada alimento en función de la tasa de nutrientes deseada a continuación. Use un cuadrado de Pearson para determinar las cantidades necesarias de cada alimento.

Ratio Deseado: **78% Nutrientes Digestibles Totales**

Para desbloquear el primer cuadro con la primera opción de combinación de alimentación, utilizará el dígito en la ubicación de las unidades de la velocidad deseada.

Tarjeta de escenario: Grupo E

El granjero Joe está trabajando con su nutricionista para determinar el costo de las diferentes opciones de alimentación que satisfacen las necesidades nutricionales de su hato lechero.

Su grupo calculará las opciones de alimentación de cada caja para determinar la cantidad necesaria en la ración de cada alimento en función de la tasa de nutrientes deseada a continuación. Use un cuadrado de Pearson para determinar las cantidades necesarias de cada alimento.

Ratio Deseado: **14.1% Proteína cruda**

Para desbloquear el primer cuadro con la primera opción de combinación de alimentación, utilizará el dígito en la ubicación de las unidades de la velocidad deseada.

Tarjeta de escenario: Grupo F

El granjero Joe está trabajando con su nutricionista para determinar el costo de las diferentes opciones de alimentación que satisfacen las necesidades nutricionales de su hato lechero.

Su grupo calculará las opciones de alimentación de cada caja para determinar la cantidad necesaria en la ración de cada alimento en función de la tasa de nutrientes deseada a continuación. Use un cuadrado de Pearson para determinar las cantidades necesarias de cada alimento.

Ratio Deseado: **78% Nutrientes Digestibles Totales**

Para desbloquear el primer cuadro con la primera opción de combinación de alimentación, utilizará el dígito en la ubicación de las unidades de la velocidad deseada.

Grupo A

Casilla 1:

Semilla de algodón 23.9% PC

Heno de Alfalfa 13% PC

Calcule la cantidad de cada ingrediente necesario para alcanzar su tasa deseada utilizando el método Pearson Square. Para desbloquear la casilla 2, use el número en el punto de **las decenas** del porcentaje de **alfalfa** necesario para alcanzar la tasa de proteína cruda deseada.

Grupo B

Casilla 1:

Semilla de algodón 96% NDT

Heno de Alfalfa 50% NDT

Calcule la cantidad de cada ingrediente necesario para alcanzar su tasa deseada utilizando el método Pearson Square. Para desbloquear la casilla 2, use el número en el punto de **las decenas** del porcentaje de **alfalfa** necesario para alcanzar la tasa deseada de nutrientes digestibles totales.

Grupo C

Casilla 1:

Semilla de algodón 23.9% PC

Heno de Alfalfa 13% PC

Calcule la cantidad de cada ingrediente necesario para alcanzar su tasa deseada utilizando el método Pearson Square. Para desbloquear la casilla 2, use el número en el punto de **las decenas** del porcentaje de **alfalfa** necesario para alcanzar la tasa de proteína cruda deseada

Grupo D

Casilla 1:

Semilla de algodón 96% NDT

Heno de Alfalfa 50% NDT

Calcule la cantidad de cada ingrediente necesario para alcanzar su tasa deseada utilizando el método Pearson Square. Para desbloquear la casilla 2, use el número en el punto de **las decenas** del porcentaje de **alfalfa** necesario para alcanzar la tasa deseada de nutrientes digestibles totales.

Grupo E

Casilla 1:

Semilla de algodón 23.9% PC

Heno de Alfalfa 13% PC

Calcule la cantidad de cada ingrediente necesario para alcanzar su tasa deseada utilizando el método Pearson Square. Para desbloquear la casilla 2, use el número en el punto de **las decenas** del porcentaje de **alfalfa** necesario para alcanzar la tasa de proteína cruda deseada

Grupo F

Casilla 1:

Semilla de algodón 96% NDT

Heno de Alfalfa 50% NDT

Calcule la cantidad de cada ingrediente necesario para alcanzar su tasa deseada utilizando el método Pearson Square. Para desbloquear la casilla 2, use el número en el punto de **las decenas** del porcentaje de **alfalfa** necesario para alcanzar la tasa deseada de nutrientes digestibles totales.

Grupo A

Casilla 2:

Harina de Soja 49.9% PC
Maíz Molido 3.2% PC

Para desbloquear la casilla 3, use el número en el punto de **las decenas** del porcentaje de **harina de soya** necesaria para alcanzar la tasa de proteína cruda deseada.

Grupo B

Casilla 2:

Harina de Soja 84% NDT
Maíz Molido 50% NDT

Para desbloquear la casilla 3, use el número en el punto de **las decenas** del porcentaje de **harina de soya** necesaria para alcanzar la tasa de nutrientes digestibles totales.

Grupo C

Casilla 2:

Harina de Soja 49.9% PC
Maíz Molido 3.2% PC

Para desbloquear la casilla 3, use el número en el punto de **las decenas** del porcentaje de **harina de soya** necesaria para alcanzar la tasa de proteína cruda deseada.

Grupo D

Casilla 2:

Harina de Soja 84% NDT
Maíz Molido 50% NDT

Para desbloquear la casilla 3, use el número en el punto de **las decenas** del porcentaje de **harina de soya** necesaria para alcanzar la tasa de nutrientes digestibles totales.

Grupo E

Casilla 2:

Harina de Soja 49.9% PC
Maíz Molido 3.2% PC

Para desbloquear la casilla 3, use el número en el punto de **las decenas** del porcentaje de **harina de soya** necesaria para alcanzar la tasa de proteína cruda deseada.

Grupo F

Casilla 2:

Harina de Soja 84% NDT
Maíz Molido 50% NDT

Para desbloquear la casilla 3, use el número en el punto de **las decenas** del porcentaje de **harina de soya** necesaria para alcanzar la tasa de nutrientes digestibles totales.

Grupo A

Casilla 3:

Destiladores Secos De Grano 29.7% PC

Heno de hierba 10.6% PC

Para desbloquear la casilla 4, use el número en el punto de **las decenas** del porcentaje de **heno de hierba** necesario para alcanzarsu tasa de proteína cruda deseada.

Grupo B

Casilla 3:

Destiladores Secos De Grano 79.5% TDN

Heno de hierba 56.3% TDN

Para desbloquear la casilla 4, use su número en el punto de **las decenas** del porcentaje de **heno de hierba** necesario para alcanzar la tasa deseada de nutrientes digestibles totales.

Grupo C

Casilla 3:

Destiladores Secos De Grano 29.7% PC

Heno de hierba 10.6% PC

Para desbloquear la casilla 4, use el número en el punto de **las decenas** del porcentaje de **heno de hierba** necesario para alcanzar su tasa de proteína cruda deseada.

Grupo D

Casilla 3:

Destiladores Secos De Grano 79.5% TDN

Heno de hierba 56.3% TDN

Para desbloquear la casilla 4, use su número en el punto de las **decenas** del porcentaje de **heno de hierba** necesario para alcanzar la tasa deseada de nutrientes digestibles totales.

Grupo E

Casilla 3:

Destiladores Secos De Grano29.7% PC

Heno de hierba 10.6% PC

Para desbloquear la casilla 4, use el número en el punto de **las decenas** del porcentaje de **heno de hierba** necesario para alcanzar la tasa de proteína cruda deseada.

Grupo F

Casilla 3:

Destiladores Secos De Grano 79.5% TDN

Heno de hierba 56.3% TDN

Para desbloquear la casilla 4, use su número en el punto de **las decenas** del porcentaje de **heno de hierba** necesario para alcanzar la tasa deseada de nutrientes digestibles totales. .

Part I: Practicing with Pearson Squares - Answer Key

1. Balance a ration with a desired rate of 10% CP using Ground Corn 9% CP and Soybean Seeds 42.8% CP.

Feed 1:
        Ground Corn 9% CP

Feed 2:
        Soybean Seed 42.8% CP

Desired Rate:
10% CP
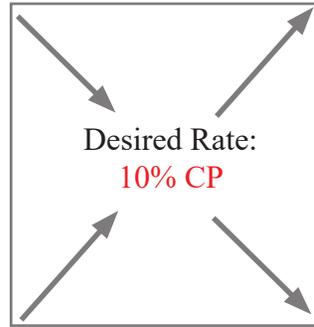
Feed 1:

42.8 - 10 = 32.8 parts Ground Corn
        32.8 / 33.8 = .97 or 97% Ground Corn

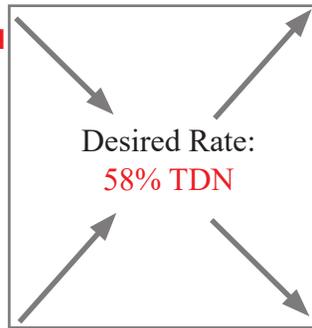32.8 parts Ground Corn + 1 part Soybean Seed = 33.8 total parts in ration

Feed 2:

10 - 9 = 1 part Soybean Seed
        1 / 33.8 = .029 or 3% Soybean Seed

Check your work: 97 (.09) + 3 (.428) = 10

2. Balance a ration with a desired rate of 58% TDN using Corn Distillers Grain 86% TDN and Fescue Hay 48% TDN.

Feed 1:
Corn Distillers Grain 86% TDN

Feed 2:

        Fescue Hay 48% TDN

Desired Rate:
58% TDN

Feed 1:

58 - 48 = 10 parts Corn Distillers Grain
        10 / 38 = .26 or 26% Corn Distillers Grain

28 parts Fescue Hay + 10 parts Corn Distillers Grain = 38 total parts in ration

Feed 2:

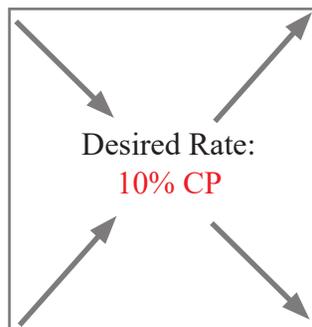86 - 58 = 28 parts Fescue Hay
        28 / 38 = .74 or 74% Fescue Hay

Check your work: 26 (.86) + 74 (.48) = 58

3. Balance a ration with a desired rate of 10% CP using Soybean Seeds 42.8% CP and Fescue Hay 9.5% CP.

Feed 1:
        Soybean Seeds 42.8% CP

Feed 2:

        Fescue Hay 9.5% CP

Desired Rate:
10% CP

Feed 1:

10 - 9.5 = .5 parts Soybean Seeds
        .5 / 33.3 = .02 or 2% Soybean Seeds

32.8 parts Fescue Hay + .5 parts Soybean Seeds = 33.3 total parts in ration

Feed 2:

42.8 - 10 = 32.8 parts Fescue Hay
        32.8 / 33.3 = .98 or 98% Fescue Hay

Check your work: 2 (.428) + 98 (.095) = 10

Part II: The Escape Box Ration Challenge - Answers for Group A
With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!
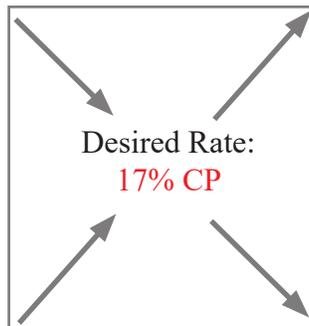
Combination for Box 1(Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

| | **Lock #1** | | | **Lock #2** | |
| **Group A** | **Group B** | **Group C** | **Group D** | **Group E** | **Group F** |

Box 1

7   _____   _____   _____   _____   _____

Feed 1:
  Cottonseed 23.9% CP

Desired Rate:
17% CP

Feed 2:
  Alfalfa Hay 13% CP

Feed 1:
17 - 13 = 4 parts Cottonseed
         4 / 10.9 = .366 or 37% Cottonseed
6.9 parts Alfalfa Hay + 4 parts Cottonseed = 10.9 total parts in ration

Feed 2:
23.9 - 17 = 6.9 parts Alfalfa Hay
         6.9 / 10.9 = .633 or 63% Alfalfa Hay

Check your work: 37 (.239) + 63 (.13) = 17

Combination for Box 2(Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

| | **Lock #3** | | | **Lock #4** | |
| **Group A** | **Group B** | **Group C** | **Group D** | **Group E** | **Group F** |

Box 2

6   _____   _____   _____   _____   _____

Feed 1:
  Soybean Meal 49.9% CP

Desired Rate:
17% CP

Feed 2:
  Ground Corn 3.2% CP

Feed 1:
17 - 3.2 = 13.8 parts Soybean Meal
         13.8 / 46.7 = .295 or 30% Soybean Meal
13.8 parts Soybean Meal + 32.9 parts Ground Corn = 46.7 Total parts in ration

Feed 2:
49.9 - 17 = 32.9 parts Ground Corn
         32.9 / 46.7 = .704 or 70% Ground Corn

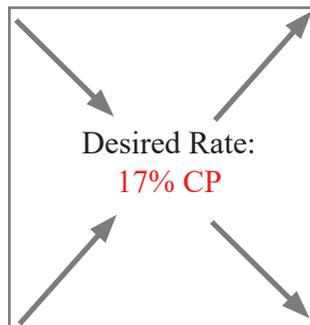**Check your work:**   30 (.499) + 70 (.032) = 17

Combination for Box 3(Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

| | **Lock #5** | | | **Lock #6** | |
| **Group A** | **Group B** | **Group C** | **Group D** | **Group E** | **Group F** |

3   _____   _____   _____   _____   _____

Box 3

Feed 1:

Dried Distillers Grain 29.7%CP

Desired Rate:
17% CP
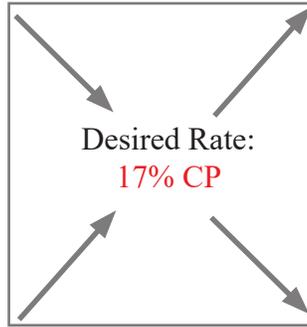
Feed 1:

17 - 10.6 = 6.4 parts Dried Distillers Grain

6.4 / 19.1 = .335 or 34% Dried Distiller Grain

6.4 parts Dried Distillers Grain + 12.7 parts Grass Hay = 19.1 total parts in ration

Feed 2:

Grass Hay 10.6% CP

Feed 2:

29.7 - 17 = 12.7 parts Grass Hay

12.7 / 19.1 = .664 or 66% Grass Hay

Check your work: 34 (.297) + 66 (.106) = 17.0

Combination for Box 4 (Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

	Lock #7				**Lock #8**	
Group A	**Group B**	**Group C**		**Group D**	**Group E**	**Group F**
6	_____	_____		_____	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group B
With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!
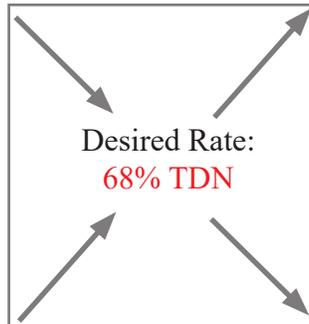
Combination for Box 1(Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1			**Lock #2**	
Group A	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**
_____	**8**	_____	_____	_____	_____

Box 1

Feed 1:
   Cottonseed 96% TDN

Desired Rate:
68% TDN

Feed 2:
   Alfalfa Hay 50% TDN

Feed 1:
68 - 50 = 18 parts Cottonseed
        18/ 46 = .391 or 39% Cottonseed
18 parts Cottonseed + 28 parts Alfalfa Hay = 46 total parts in ration
Feed 2:
96 - 68 = 28 parts Alfalfa Hay
        28 / 46 = .608 or 61% Alfalfa Hay

Check your work: 39 (.96) + 61 (.50) = 68

Combination for Box 2(Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3			**Lock #4**	
Group A	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**
_____	**6**	_____	_____	_____	_____

Box 2

Feed 1:
   Soybean Meal 84% TDN

Desired Rate:
68% TDN

Feed 2:
   Ground Corn 50% TDN

Feed 1:
68 - 50 = 18 parts Soybean Meal
        18 / 34 = .529 or 53% Soybean Meal
18 parts Soybean Meal + 16 parts Ground Corn = 34 total parts in ration
Feed 2:
84 - 68 = 16 parts Ground Corn
        16 / 34 = .470 or 47% Ground Corn

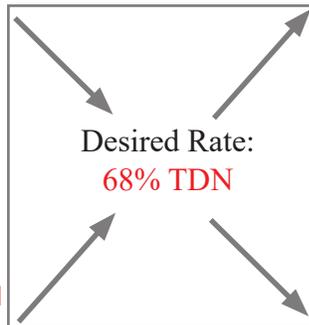**Check your work:**   47 (.5) + 53 (.84) = 68

Combination for Box 3(Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5			**Lock #6**	
Group A	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**
_____	**5**	_____	_____	_____	_____

Box 3

Feed 1:

Dried Distillers Grain 79.5% TDN

Desired Rate:
68% TDN

Feed 2:

Grass Hay 56.3% TDN

Feed 1:

68 - 56.3 = 11.7 parts Dried Distillers Grain

11.7 / 23.2 = .504 or 50% Dried Distillers Grain

11.7 parts Dried Distillers Grain + 11.5 parts Grass Hay = 23.2 total parts in ration

Feed 2:

79.5 - 68 = 11.5 parts Grass Hay

11.5 / 23.2 = .495 or 50% Grass Hay

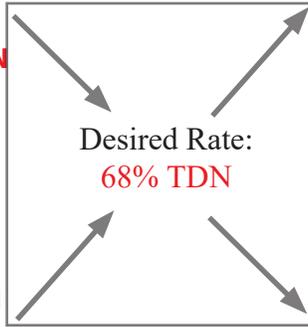**Check your work:** 50 (.563) + 50 (.795) = 67.9

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A	Lock #7 Group B	Group C		Group D	Lock #8 Group E	Group F
_____	**5**	_____		_____	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group C
With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

Combination for Box 1(Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1				**Lock #2**	
Group A	**Group B**	**Group C**		**Group D**	**Group E**	**Group F**
_____	_____	**7**		_____	_____	_____

Box 1

Feed 1:
  Cottonseed 23.9% CP

Desired Rate:
17.9% CP

Feed 1:
17.9 - 13 = 4.9 parts Cottonseed
4.9 / 10.9 = .449 or 45% Cottonseed
6 parts Alfalfa hay + 4.9 parts Cottonseed = 10.9 total parts in ration

Feed 2:
  Alfalfa Hay 13% CP

Feed 2:
23.9 - 17.9 = 6 parts Alfalfa Hay
6 / 10.9 = .550 or 55% Alfalfa Hay

Check your work: 45 (.239) + 55 (.13) = 17.9

Combination for Box 2(Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3				**Lock #4**	
Group A	**Group B**	**Group C**		**Group D**	**Group E**	**Group F**
_____	_____	**5**		_____	_____	_____

Box 2

Feed 1:
  Soybean Meal 49.9% CP

Desired Rate:
17.9% CP

Feed 1:
17.9 - 3.2 = 14.7 parts Soybean Meal
14.7 / 46.7 = .314 or 31% Soybean Meal
32 parts Ground Corn + 14.7 parts Soybean Meal = 46.7 total parts in ration

Feed 2:
  Ground Corn 3.2% CP

Feed 2:
49.9 - 17.9 = 32 parts Ground Corn
32 / 46.7 = .685 or 69% Ground Corn

Check your work: 31 (.499) + 69 (.032) = 17.9

Combination for Box 3(Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.
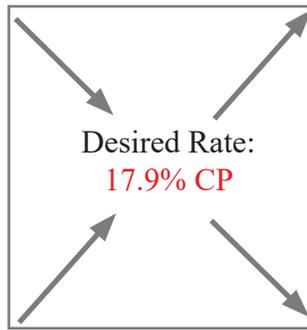
	Lock #5				**Lock #6**	
Group A	**Group B**	**Group C**		**Group D**	**Group E**	**Group F**
_____	_____	**3**		_____	_____	_____

Box 3

Feed 1:
Dried Distillers Grain 29.7% CP

Desired Rate:
17.9% CP

Feed 2:
Grass Hay 10.6% CP

Feed 1:
17.9 - 10.6 = 7.3 parts Dried Distillers Grain
7.3 / 19.1 = .382 or 38% Dried Distillers Grain

7.3 parts Dried Distillers Grain + 11.8 parts Grass Hay
= 7.7 total parts in ration

Feed 2:
29.7 - 17.9 = 11.8 parts Grass Hay
11.8 / 19.1 = .617 or 62% Grass Hay

Check your work: 38 (.297) + 62 (.106) = 17.85

Combination for Box 4 (Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

	Lock #7				Lock #8	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	**6**		_____	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group D

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

Combination for Box 1(Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1				Lock #2	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		**8**	_____	_____

Box 1

Feed 1:
    Cottonseed 96% TDN

Desired Rate:
78% TDN

Feed 2:
    Alfalfa Hay 50% TDN

Feed 1:
78 - 50 = 28 parts Cottonseed
    28 / 46 = .608 or 61% Cottonseed

28 parts Cottonseed + 18 parts Alfalfa Hay = 46 total parts in ration

Feed 2:
96 - 78 = 18 parts Alfalfa Hay
    18 / 46 = .391 or 39% Alfalfa Hay

Check your work: 61 (.96) + 39 (.50) = 78

Combination for Box 2(Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3				Lock #4	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		**3**	_____	_____

Box 2

Feed 1:
    Soybean Meal 84% TDN

Desired Rate:
78% TDN

Feed 2:
    Ground Corn 50% TDN

Feed 1:
78 - 50 = 28 parts Soybean Meal
    28 / 34 = .823 or 82% Soybean Meal

28 parts Soybean Meal + 6 parts Ground Corn = 34 total parts in ration

Feed 2:
84 - 78 = 6 parts Ground Corn
    6 / 34 = .176 or 18% Ground Corn

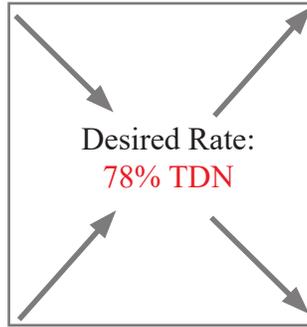**Check your work:**   82 (.84) + 18 (.50) = 78

Combination for Box 3(Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5				Lock #6	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		**8**	_____	_____

Box 3

Feed 1:

Dried Distillers Grain 79.5% TDN

Feed 2:

Grass Hay 56.3% TDN

Desired Rate:
78% TDN

Feed 1:

78 - 56.3 = 21.7 parts Dried Distillers Grain

21.7 / 23.2 = .935 or 94% Dried Distillers Grain

21.7 parts Dried Distillers Grain + 1.5 parts Grass Hay
= 23.2 total parts in ration

Feed 2:

79.5 - 78 = 1.5 parts Grass Hay

1.5 / 23.2 = .064 or 6% Grass Hay

Check your work: 6 (.563) + 94 (.795) = 78.10

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

	Lock #7				Lock #8	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		**0**	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group E
With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!
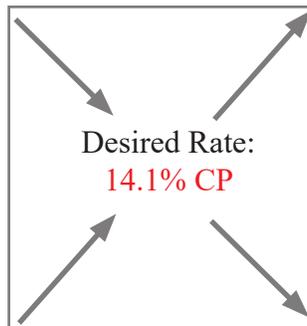
Combination for Box 1(Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1			**Lock #2**	
Group A	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**

Box 1
_____ _____ _____   _____ **4** _____

Feed 1:
Cottonseed 23.9% CP

Desired Rate:
14.1% CP

Feed 2:
Alfalfa Hay 13% CP

Feed 1:
14.1 - 13 = 1.1 parts Cottonseed
          1.1 / 10.9 = .100 or 10% Cottonseed

1.1 parts Cottonseed + 9.8 parts Alfalfa = 10.9 total parts in ration

Feed 2:
23.9 - 14.1 = 9.8 parts Alfalfa Hay
          9.8 / 10.9 = .899 or 90% Alfalfa Hay

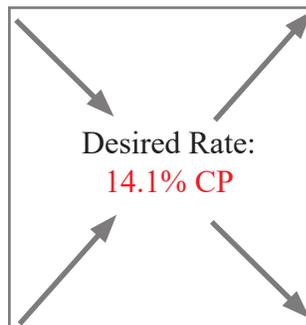**Check your work:** 10 (.239) + 90 (.13) = 14.1

Combination for Box 2(Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3			**Lock #4**	
Group A	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**

Box 2
_____ _____ _____   _____ **9** _____

Feed 1:
Soybean Meal 49.9% CP

Desired Rate:
14.1% CP

Feed 2:
Ground Corn 3.2% CP

Feed 1:
14.1 - 3.2 = 10.9 parts Soybean Meal
          10.9 / 46.7 = .233 or 23% Soybean Meal

35.8 parts Ground Corn + 10.9 parts Soybean Meal = 46.7 total parts in ration

Feed 2:
49.9 - 14.1 = 35.8 parts Ground Corn
          35.8 /46.7 = .766 or 77% Ground Corn

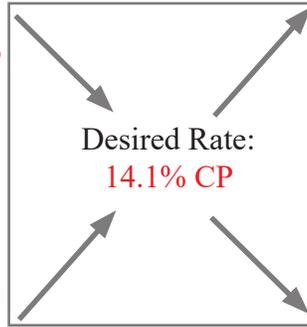**Check your work:** 23 (.499) + 77 (.032) = 14

Combination for Box 3(Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5			**Lock #6**	
Group A	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**

_____ _____ _____   _____ **2** _____

Box 3

Feed 1:
Dried Distillers Grain 29.7% CP

Desired Rate:
14.1% CP

Feed 2:
Grass Hay 10.6% CP

Feed 1:
14.1 - 10.6 = 3.5 parts Dried Distillers Grain
3.5 / 19.1 = .183 or 18% Dried Distillers Grain

3.5 parts Dried Distillers Grain + 15.6 Grass Hay =
19.1 total parts in ration

Feed 2:
29.7 - 14.1 = 15.6 parts Grass Hay
15.6/19.1 =.816 or 82% Grass Hay

Check your work: 18 (.297) + 82 (.106) = 14.038

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

	Lock #7			Lock #8	
Group A	Group B	Group C	Group D	Group E	Group F
_____	_____	_____	_____	**8**	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group F

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!
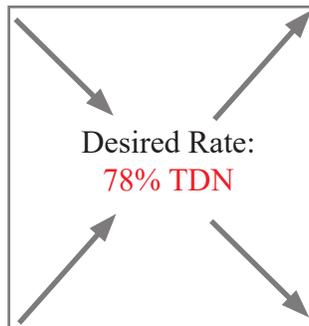
Combination for Box 1(Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1				Lock #2	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	**8**

Box 1

Feed 1:
   Cottonseed 96% TDN

Desired Rate:
78% TDN

Feed 1:
78 - 50 = 28 parts Cottonseed
         28 / 46 = .608 or 61% Cottonseed

28 parts Cottonseed + 18 parts Alfalfa Hay = 46 total parts in ration

Feed 2:
   Alfalfa Hay 50% TDN

Feed 2:
96 - 78 = 18 parts Alfalfa Hay
         18 / 46 = .391 or 39% Alfalfa Hay

Check your work: 61 (.96) + 39 (.50) = 78 or 78%
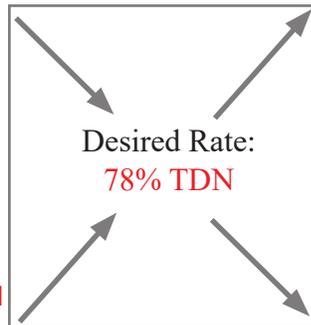
Combination for Box 2(Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3				Lock #4	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	**3**

Box 2

Feed 1:
   Soybean Meal 84% TDN

Desired Rate:
78% TDN

Feed 1:
78 - 50 = 28 parts Soybean Meal
         28 / 34 = .823 or 82% Soybean Meal

28 parts Soybean Meal+ 6 parts Ground Corn = 34 total parts in ration

Feed 2:
   Ground Corn 50% TDN

Feed 2:
84 - 78 = 6 parts Ground Corn
         6 / 34 = .176 or 18% Ground Corn

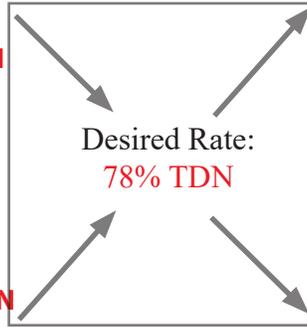**Check your work:**   82 (.84) + 18 (.50) = .778 or 78%

Combination for Box 3(Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5				Lock #6	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	**8**

Box 3

Feed 1:

Dried Distillers Grain 79.5% TDN

Desired Rate:
78% TDN

Feed 1:
78 - 56.3 = 21.7 parts Dried Distillers Grain
  21.7 / 23.2 = .935 or 94% Dried Distillers Grain

21.7 parts Dried Distillers Grain + 1.5 parts Grass Hay = 23.2 total parts in ration

Feed 2:

Grass Hay 56.3% TDN

Feed 2:
79.5 - 78 = 1.5 parts Grass Hay
  1.5 / 23.2 = .064 or 6% Grass Hay

Check your work: 6 (.563) + 94 (.795) = 78.10

Combination for Box 4 (Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

	Lock #7				Lock #8	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	0

Box 4

Enjoy your treat!