Materials
- Color tiles – 10 red, 10 blue, 10 yellow per student
- **BLM** TM – completed Transition to Math sheet
- **BLM** – Ratio and Proportion

Math Vocabulary
ratio
proportion
equivalent ratios
variables

Literature Vocabulary
detective
victim
suspect
culprit
clue
evidence
motive

ELPS (*English Language* Proficiency Standards)
2B, 2C, 2D, 2I, 3A, 3C, 3H, 3J

CCRS *(College and Career Readiness Standards)*
I – BC
VIII – A1, A2, A3, A4, A5, B1, B2, C1, C2, C3
IX – A1, A2, A3, B1, B2, C1, C2, C3
X – B1

Unit 3, Lesson 1 — Grades 5-6

TV Lesson

Math Objectives:
- Give examples of ratios as multiplicative comparisons of two quantities describing the same attribute.

Language Objectives:
- Discuss problem solving strategies with peers.
- Write out solutions for solving problems.
- Justify their thinking and strategies.

Building Background
In your classroom lesson you looked carefully at a color chart which presented the number of each color of drops of primary colors it took to make a new color. (*Show copy of* ***BLM*** *TM that has been completed.*)

In all of your answers, you found a relationship between the drops of primary color and the total number of drops in the new color of paint. Just like your snack fractions, you were finding a fractional relationship. This “part” out of the “whole.”

Today, we’re going to look at a different relationship. We’re going to begin our study of PROPORTIONAL relationships. We will look at the part to the whole, but we will also look at the relationship of the different parts to one another.

We will express that relationship in a RATIO.

There are three ways to express RATIOS. Let’s look at your record sheet from your classroom lesson.

Celery Green
We can express each of these fractional relationships as a ratio. With a ratio, we are comparing what is in the numerator to whatever is in the denominator, so our language is different than when we are representing with fractions.

- We can represent our ratio using words:
  One drop of red paint ***to*** five total drops of paint
- Or we can express this same relationship using a colon:
  One drop of red paint ***:*** five total drops of paint *(read the colon as “to”)*
- Or we can express this same relationship using a fraction:

  1 drop of red paint (to)
  5 drops of paint

We have shown a proportional relationship. Every time we mix these colors together using this proportion, we will get celery green.

We are going to look at part to whole proportional relationships, and we are going to look at part to part proportional relationships during this unit. Let's get started.

Comprehensible Input
In our celery green example, we looked at the ratio of the drops of each individual paint color to the total number of drops in the color.

Now, let's look at the ratio of the number of drops in each color to another color. This is a "part-to-part" comparison.

Let's look at our record sheet for today, **BLM** Ratio and Proportion.
(Point to the appropriate areas on the chart.)
We're going to investigate Celery Green, but look at this first column.

We are going to compare the ratio of
- red drops of paint to yellow drops of paint;
- red drops of paint to blue drops of paint;
- and yellow drops of paint to blue drops of paint.

In other words, we are comparing parts of the new color to other parts of the new color. If you want celery green, you have to use these exact proportions of colors.

(*Use the **BLM** Ratio and Proportion TEACHER KEY as your guide to filling out the chart with the students.)*

Our first row is to compare the ratio of red drops to yellow drops.
- We want to model that in color tiles. Tell your teacher what you would use to model the number of red drops of paint to the number of yellow drops of paint. *(Pause, then use your color tiles to model 1 red and 3 yellow.)*

- Our next representation is to use the word "to." Tell your teacher how you would use this representation to show the ratio of the number of red drops of paint to the number of yellow drops of paint (*pause, then write and say 1 to 3*).
- Now let's use the colon representation of ratio. Tell your teacher what you would write to show this representation of the number of red drops of paint to the number of yellow drops of paint *(pause, then write 1:3 and read one to three).*

- Our last representation is to show this ratio in fraction form. This form is going to be very helpful to us as we use ratio for predicting answers. Tell your teacher how you would write and how you would read this representation of ratio. (*Pause then write 1 red/3 yellow, using the horizontal fraction bar, of course; and READ the ratio as 1 red to 3 yellow.)*

The next two columns are interesting. You are going to use this ratio to determine changes to the mixture. Remember, you can ONLY mix celery green if you use the same ratio or proportion of the drops of color. Sometimes you'll need more paint than just a little drop.

Suppose you needed THREE drops of red paint? Tell your teacher how you can use the fraction form of the ratio to find the number of yellow drops you need. Predict your answer, then we will work through a simple algorithm to verify our predictions. (*longer pause*)

We can set up our ratios to find EQUIVALENT RATIOS. Finding equivalent ratios is very much like finding equivalent fractions. Let's use this simple example to work through the steps.

We know that our original ratio is one red drop to three yellow drops. Let write that fraction representation *(do so, using the labels).*

Now I want to find another ratio, so let me draw that ratio line, and label the numerator and denominator. I must ALWAYS compare in the same way in each ratio. I have compared the original ratio, red to yellow, so my other ratio must also compare red to yellow. (*Write the fraction line and "red" in the numerator and "yellow in the denominator.)*

The problem gives me the red. I want three drops of red. I need to find out how many yellow drops I need. Let's use a VARIABLE to take the place of that number. It can be any letter, but I'm going to use *x* just because you will be seeing a lot of *x* as you begin to work in Algebra with equations. This *x* simply marks the spot of the number I'm trying to find, the UNKNOWN QUANTITY.

This is our equation to solve, then. One red drop to three yellow drops is the same as three red drops to how many yellow drops?
How would you solve this equation? Tell your classroom teacher.
(longer pause)

$$\frac{\text{1 red}}{\text{3 yellow}} = \frac{\text{3 red}}{x\text{ yellow}}$$

One way is just to look at the equation. What did you multiply the one red by to get three red? *(slight pause - 3)* So if you multiplied the numerator by three, what must you multiply the denominator by? Remember, you want the new ratio to be in the same proportion as the original ratio – they must be equivalent! *(pause - 3)* 3/3 is a form of one. When I multiply this first ratio by a form of one, the product might LOOK different, but it represents the same quantity, just in a different form.

So, if I multiply the original ratio by 3/3, what is my new denominator? *(pause - 9)*

$$\frac{3\text{ x}}{3\text{ x}}\ \frac{1\text{ red}}{3\text{ yellow}} = \frac{3\text{ red}}{x\text{ yellow}}$$

x = 9 yellow drops

Now I know that if I have three drops of red, I must also use nine drops of yellow to give me the correct proportion to make celery green.

The last column asks you to find the ratio of red to yellow if six drops of red were used. Work that as a class, then we'll verify the same way. (*Generous pause, then talk through this set up the same way.)*

$$\frac{6\text{ x}}{6\text{ x}}\ \frac{1\text{ red}}{3\text{ yellow}} = \frac{6\text{ red}}{x\text{ yellow}}$$

x = 18 yellow drops

1 to 3, 3 to 9 and 6 to 18 are all equivalent ratios. There is another way to solve for x. Sometimes the relationships will not be as obvious as they are in these examples. Sometimes you might need to cross – multiply. Cross multiplication works great, especially when the relationship is not as easy to see as in these two examples. Let's work through these two using cross multiplication.

We can set up our ratios in the same way as we did in our earlier example. This time, though, we are going to multiply in a cross shape.

1 x x = x $\frac{1\text{ red}}{3\text{ yellow}} = \frac{3\text{ red}}{x\text{ yellow}}$ **3 x 3 = 9**

I have x on one side of the equal sign and nine on the other.

x = 9

TV Lesson - continued

Why does this work? Because we are really shortcutting our process. I know that I have to multiply that original one red by three to get the new three red. If I multiply the numerator by three, I must also multiply the denominator by three. Let's work the second ratio this way so you can see the difference.

$$\mathbf{1 \text{ x } \mathit{x} = \mathit{x}} \qquad \frac{\textbf{1 red}}{\textbf{3 yellow}} \quad \frac{\textbf{6 red}}{\mathbf{\mathit{x}} \textbf{ yellow}} \qquad \mathbf{3 \text{ x } 6 = 18}$$

I have x on one side of the equal sign and 18 on the other.

$\boldsymbol{x} \mathbf{= 18}$

You may use either strategy, so long as you can explain why they work. Remember, a strategy is only a workable strategy if you can remember how to use it. Practice both ways of solving problems, and explain how each works.

Pirate's Corner

Tell us all the different strategies used today to solve the Fraction Action. Share any work you would like for the rest of us to see.

Objectives

Read through the math and language objectives, making sure that students understand how they accomplished each.

Unit 3 Lesson 1 – Transition to Math
One per group

Paint Store Relationships

Ellory Paint Store can mix just about any color of paint a customer wants. The following color chart tells the person mixing the colors how much of each color to add to a white base to make specific colors.

	Red	Yellow	Blue
Celery Green	1	3	1
Persimmon Orange	3	1	0
Lilac	1	0	3
Colonial Blue	0	1	4
Mango Yellow	4	6	0

Use the chart to answer the following questions:

We will consider the "whole" to be a combination of all of the colors for the paint.

What fractional part of Celery Green is: red _____ yellow _____ blue _____
Express each fraction as a decimal: red _____ yellow _____ blue _____
What percent of the new color is: red _____ yellow _____ blue _____

What fractional part of Persimmon Orange is: red _____ yellow _____ blue _____
Express each fraction as a decimal: red _____ yellow _____ blue _____
What percent of the new color is: red _____ yellow _____ blue _____

What fractional part of Lilac is: red _____ yellow _____ blue _____
Express each fraction as a decimal: red _____ yellow _____ blue _____
What percent of the new color is: red _____ yellow _____ blue _____

What fractional part of Colonial Blue is red _____ yellow _____ blue _____
Express each fraction as a decimal: red _____ yellow _____ blue _____
What percent of the new color is: red _____ yellow _____ blue _____

What fractional part of Mango Yellow is red _____ yellow _____ blue _____
Express each fraction as a decimal: red _____ yellow _____ blue _____
What percent of the new color is: red _____ yellow _____ blue _____

http://painting.about.com/library/blpaint/blcolormixingpalette1.htm Online Mixing Palette for Painters. Mix and name your own colors. What happens when you use secondary colors?

Unit 3 Lesson 1 – Transition to Math
One per group

Paint Store Relationships

La tienda de pinturas Ellory Paint Store puede crear cualquier color de pintura que pueda requerir un cliente. La próxima carta de colores indica a la persona que mezcla los colores cuánta cantidad de cada color debe añadir a una base blanca para crear colores específicos.

	Rojo	Amarillo	Azul
Verde apio	1	3	1
Anaranjado	3	1	0
Lila	1	0	3
Azul colonial	0	1	4
Amarillo mango	4	6	0

Usa la carta de colores para contestar las siguientes preguntas:

Consideraremos el "entero" como una combinación de todos los colores para crear la pintura.

Qué fracción de Verde Apio es: rojo _____ amarillo________ azul _________
Expresa cada fracción como decimal: rojo ______ amarillo _______ azul _________
Qué por ciento del nuevo color es: rojo ______ amarillo _______ azul _________

Qué fracción de anaranjado es: rojo _____ amarillo________ azul _________
Expresa cada fracción como decimal: rojo ______ amarillo _______ azul _________
Qué por ciento del nuevo color es: rojo ______ amarillo _______ azul _________

Qué fracción de lila es: rojo _____ amarillo________ azul _________
Expresa cada fracción como decimal: rojo ______ amarillo _______ azul _________
Qué por ciento del nuevo color es: rojo ______ amarillo _______ azul _________

Qué fracción de azul colonial es: rojo _____ amarillo________ azul _________
Expresa cada fracción como decimal: rojo ______ amarillo _______ azul _________
Qué por ciento del nuevo color es: rojo ______ amarillo _______ azul _________

Qué fracción de amarillo mango es: rojo _____ amarillo________ azul _________
Expresa cada fracción como decimal: rojo ______ amarillo _______ azul _________
Qué por ciento del nuevo color es: rojo ______ amarillo _______ azul _________

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Ratio and Proportion - KEY

Color Chart

	Red	Yellow	Blue
Celery Green	1	3	1
Persimmon Orange	3	1	0
Lilac	1	0	3
Colonial Blue	0	1	4
Mango Yellow	4	6	0

Use the chart to answer the following questions:

We are going to look at different relationships on the chart.

Celery Green	**color tiles**	part TO part	**part:part**	$\frac{\textbf{part}}{\textbf{part}}$	**What would the ratio be if you increased the red paint to 3 drops?** (fraction form)	**What would the ratio be if you increased the red paint to 6 drops?** (fraction form)
Compare ratio of red and yellow drops		1 to 3	1:3	$\frac{\textbf{1 red}}{\textbf{3 yellow}}$	$\frac{\textbf{3 red}}{\textbf{9 yellow}}$	$\frac{\textbf{6 red}}{\textbf{18 yellow}}$
Compare ratio of red and blue drops		1 to 1	1:1	$\frac{\textbf{1 red}}{\textbf{1 blue}}$	$\frac{\textbf{3 red}}{\textbf{3 blue}}$	$\frac{\textbf{6 red}}{\textbf{6 blue}}$
Compare ratio of yellow and blue drops		3 to 1	3:1	$\frac{\textbf{3 yellow}}{\textbf{1 blue}}$	$\frac{\textbf{9 yellow}}{\textbf{3 blue}}$	$\frac{\textbf{6 yellow}}{\textbf{2 blue}}$

Ratio and Proportion

Color Chart

	Red	Yellow	Blue
Celery Green	1	3	1
Persimmon Orange	3	1	0
Lilac	1	0	3
Colonial Blue	0	1	4
Mango Yellow	4	6	0

Use the chart to answer the following questions:

We are going to look at different relationships on the chart.

Celery Green	**color tiles**	part TO part	**part:part**	$\frac{\textbf{part}}{\textbf{part}}$	**What would the ratio be if you increased the red paint to 3 drops?**	**What would the ratio be if you increased the red paint to 6 drops?**
Compare ratio of red and yellow drops						
Compare ratio of red and blue drops						
Compare ratio of yellow and blue drops						

Ratio and Proportion

Carta de colores

	Rojo	Amarillo	Azul
Verde apio	1	3	1
Anaranjado	3	1	0
Lila	1	0	3
Azul colonial	0	1	4
Amarillo mango	4	6	0

Usala carta de colores para contestar las siguientes preguntas:

Consideremos las relaciones diferentes en la carta.

Verde apio	**Azulejos de colores**	Parte a parte	**Parte:parte**	$\frac{\textbf{Parte}}{\textbf{parte}}$	**¿Cuál sería la razón (“ratio”) si añadieras 3 gotas adicionales de pintura roja?**	**¿Cuál sería la razón (“ratio”) si añadieras 6 gotas adicionales de pintura roja?**
Compara la razón de gotas de amarillo y rojo						
Compara la razón de gotas de rojo y azul						
Compara la razón de gotas de amarillo y azul						