

Materials

- **BLM** Shadow Math Sailboat

Math Vocabulary
 unlike denominators
 like denominators
 unit price
 ratio
 proportion
 percent
 greatest common factor
 least common multiple

Literature Vocabulary
 theme
 point of view
 influence
 confident
 revolution

ELPS (*English Language Proficiency Standards*)
 2C, 2E, 2I, 3D, 3F, 3G, 4D, 4F, 4J, 5B, 5C

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 5, Lesson 3

Grades 5-6

TV Lesson



Math Objectives:

- Apply qualitative and quantitative reasoning to solve prediction and comparison of real world problems involving ratios and rates.
- 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

The poem “I Am Standing – Girl on Land, Boy at Sea” is a terrific read-aloud poem. It also triggered my math mind to see comparisons in where the girl and boy were standing. How high were the girl and boy when they were climbing up that tree and up that sail? Could they have been about the same height? We’re going to investigate today using your data that you gathered during the Transition to Math in the Classroom to find out.

As I looked at the sail in the illustration and researched sailboats, I decided that this was a Bermudan rig. And since the boy was apparently by himself, I perceived that the sailboat was a “day sailor,” or a sailboat that could be handled by one person. With that information, I decided that the Bermudan rig, the sail, was somewhere between 100 and 110 feet tall. We’ll consider that the sail was somewhere toward the middle, or 104 feet tall.

Now, I have a friend named Norma who is 5 feet 5 inches tall, and who measured her shadow at 10 AM yesterday. The shadow that she cast was 10 feet long. What can I find using the data that I have?

Norma’s height = 5 feet 5 inches
 Norma’s shadow length = 10 feet at 10 AM yesterday.
 The Bermudan rig height = 104 feet

Comprehensible Input

We have a mixture of feet and inches in this data, so let’s convert all of the measurements to inches.

5 feet 5 inches. Talk in your class about how to convert 5 feet 5 inches to inches. (*pause*)

Unit 5, Lesson 3
TV Lesson - continued

Grades 5-6



There are several ways, but I'm going to use a ratio. That way I never have to remember whether I have to multiply or divide. The ratio takes care of that for me.

First, how many inches in ONE foot? *(pause)* 12 inches = 1 foot
Remember that we have to compare the same things in each ratio.
What do we want to know? *(pause)* *(the inches)* That becomes our x .
And how many whole feet do we have? *(pause)* 5

$$\frac{12 \text{ inches}}{1 \text{ foot}} = \frac{x \text{ inches}}{5 \text{ feet}}$$

$$x = 60 \text{ INCHES}$$

What does the 60 represent? *(pause)*
There are 60 inches in 5 feet; now we add the extra 5" in Norma's height. 5 feet 5 inches = 65 inches. Let's record both the 5 feet 5 inches and the 65 inches on our record sheet. *(Do so.)*

Since we now have Norma's height in inches, what other measurement do we need to convert from feet to inches? *(pause)* There are two. We need Norma's shadow's length, and we need the height of the Bermudan Rig.

What was Norma's shadow's length yesterday at 10AM? *(pause)* 10 feet. Can we use number sense to convert 10 feet? How many inches in 1 foot? *(pause)* 12 In 2 feet? *(pause)* 24; in 3 feet? *(pause)* 36. What are we doing to 12 each time? *(pause)* *(multiplying the feet by 12)* So what is 12 x 10? *(pause)* 120

What does the 120 represent? *(pause)* The number of inches in 10 feet. Let's record both the 10 feet and the 120 inches on the record sheet. *(Do so.)*

One last conversion -- the Bermudan Rig Height. If we use the 104 feet as the height, how many inches is that? Figure that one with a partner. *(pause)*

I think I'll set up for equivalent ratios to solve that one.

$$\frac{12 \text{ inches}}{1 \text{ foot}} = \frac{x \text{ inches}}{104 \text{ feet}}$$

$$1248 = x \text{ inches}$$

Unit 5, Lesson 3
TV Lesson - continued

Grades 5-6



What does the 1248 represent? *(pause) the number of inches in 104 feet*
The height of the Bermudan Rig is 104 feet.

I should now have most of my table on the record sheet completed.
What is still left to find? *(pause) Bermudan Rig Shadow Height*

There are several ways to solve this problem. I'm going to solve with ratios. Here is how I'll set up for equivalent ratios.

Norma's height = 65 inches and I'm going to compare that to
Bermudan Rig = 1248 inches

So that is the REAL object's height to the second REAL object's height.

Now I want to compare the two shadow heights. Which shadow height has to be the numerator and why? Discuss. *(pause)*

Norma's height is the numerator of the first ratio; so Norma's shadow's height has to be the numerator of the second ratio. And that was 120 inches.

Then the denominator of the second ratio has to be the Bermudan Rig's shadow. What will represent that length? *(pause) x*

$$\frac{65 \text{ inches}}{1248 \text{ inches}} = \frac{120 \text{ inches}}{x \text{ inches}}$$

Cross Multiply. $65x = 149,760$

What do we do next? *(pause)*

We want x to be on one side of the equation and the numbers without a variable on the other side of the equation. If I am multiplying x by 65, what can I do to have x by itself? *(pause) DIVIDE by 65.*

65 divided by 65 is ONE, and any number divided by one is that number. So x divided by one is x .

And of course, if we divide one side of the equation by 65, we have to do the same to the other side of the equation to keep both sides equal, or balanced. Divide 149,760 by 65. *(pause) 2304* What does 2304 represent? *(pause) The length in inches of the sail's shadow.* Record that on the record sheet.

Unit 5, Lesson 3
TV Lesson - continued

Grades 5-6



Did anyone solve that a different way? Please put a star on your paper, and discuss your strategy during the Follow-up Lesson. Mine is NOT the only ratio set up that represents this relationship!

Only one space left to solve for now. What is the length of the Bermudan Rig's Shadow in feet?

How would you convert the 2304 inches to feet? Very quickly, talk to your partner and decide how you would convert 2304 inches to feet.
(generous pause)

You know I'm going to use a ratio. As long as you do the arithmetic correctly, and set up the ratios correctly, the ratio will not let you down! You also know that the ratio I'll show you is NOT the only ratio that represents this relationship -- so see if you have a different equivalent ratio set up from mine.

OK

What do I know? 2304 inches = Bermudan Rig Shadow length
And that there are 12 inches in 1 foot.

What do you want to know?
How many feet there are in 2304 inches?

$$\frac{12 \text{ inches}}{1 \text{ foot}} = \frac{2304 \text{ inches Bermudan Rig Shadow}}{x \text{ feet Bermudan Rig Shadow}}$$

$$12x = 2304$$

$$x = 192$$

What does the 192 represent? The number of FEET in 2304 inches.
Where do we record this data? In the Feet column.

So what do we know now based on Norma's data and my research data?
(Go over the chart on the BLM.)

I know that today is Family Fun Game Day, but you will need to finish this assignment first, please. Your job in the Follow-up Lesson before the game will be to determine the height of the highest tree on your campus.

Unit 5, Lesson 3
TV Lesson - continued

Grades 5-6



Pirate's Corner

Tell us the height of the tallest tree on your campus! Which state do you think will have the tallest tree?

Objectives

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

Bermuda Rig Sailboat



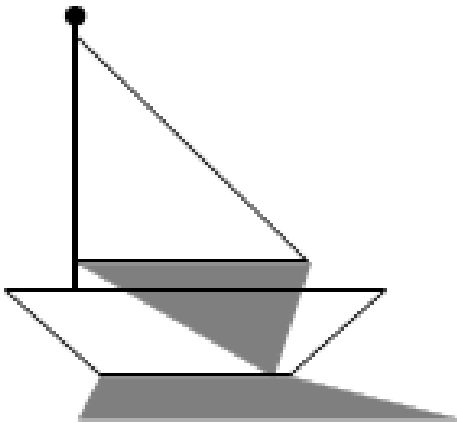


Shadowy Math – Sailboat

Work with your teacher and in groups to complete the table below.

Label Length	Length in Feet (and inches)	Length in inches only
Friend’s height		
Friend’s Shadow Length		
Bermudan Rig Height		
Bermudan Rig’s Shadow Height		

Show your work for the Sail here. Be sure that you label all portions of your ratios.

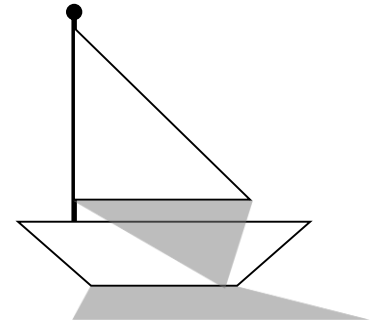


What does your final answer represent? _____



1 por estudiante

Longitud Etiqueta	Longitud en Pies (y pulgadas)	Longitud solo en pulgadas
Altura de un amigo		
Largo de la sombra de un amigo		
Altura de aparejo bermuda		
Altura de la sombra del aparejo bermuda		



Muestra tu trabajo para la Vela aquí. Asegúrate de etiquetar todas las porciones de tus razones.

¿Qué representa tu respuesta final? _____