

Task: Speed Limit

A new road has opened up in Texas which has no speed limit. Kana and her father are on their way back from a softball tournament. Kana promises her mother she will not drive even close to 100 mph. Her mother keeps track of her trip home and fears Kana and her father are not telling the truth about Kana’s speed. Kana’s mother has logged the distance from town to town and the time it took driving at a constant speed to reach the next stop on Kana’s drive home. It is up to you to determine if Kana and her father are telling the truth. Verify your answer by a graph and equations.

Distance Traveled	Speed	Time to travel the distance	Miles per hour equation
55 miles		45 minutes	
15 miles		10 minutes	
98 miles		1 hour	
25 miles		15 minutes	

Common Core State Standards for Mathematical Content

8.EE.B.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed

Common Core State Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision/accuracy.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

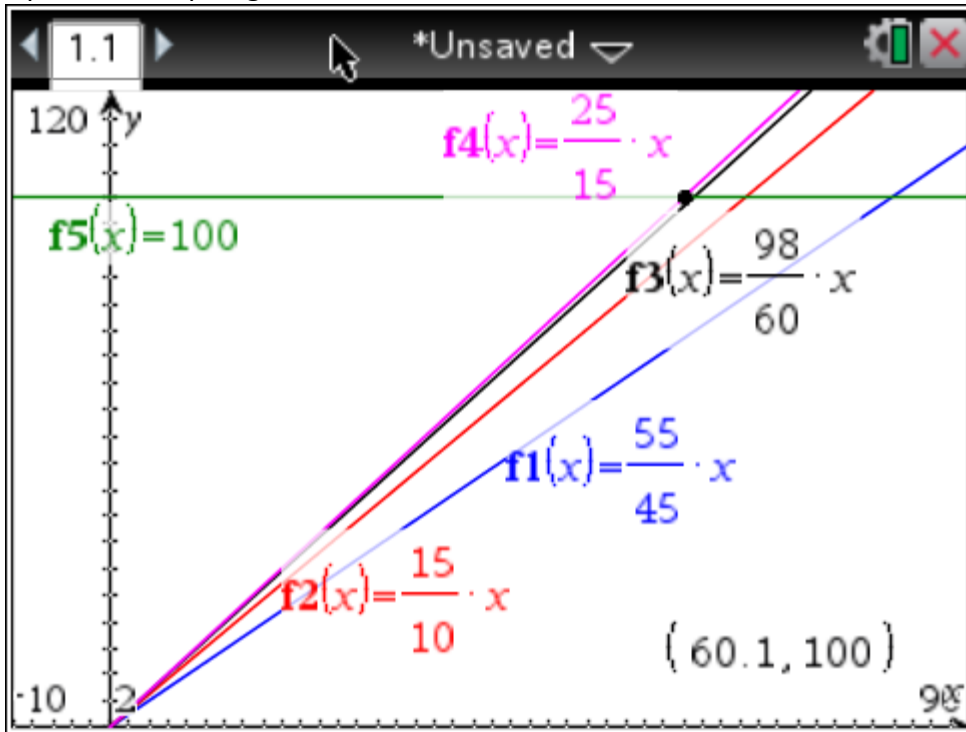
Essential Understandings

- Reasoning with ratios involves attending to and coordinating two quantities.
- Ratios can be meaningfully reinterpreted as quotients.

Explore Phase

Possible Solution Paths

Option 1: Graphing



Assessing and Advancing Questions

Assessing Questions: How did you determine the values of your rise and run in the equations in order to make sure you were comparing the same units?

Advancing Questions:

Is there a way to apply the $D=rt$ formula in your graph? If there is, how will you decide what unit you should use to describe the x and y values of your graph? What does the slope of each line represent?

Option 2: Comparing fractions $100\text{miles}/60\text{ minutes} = 1.66\text{.....}$

Assessing Questions:

How did you find the value in a decimal format of 100 miles in 1 hour? Why or why not should your decimal value be 100?

1.2	1.3	1.4	*Unsaved
$\frac{55}{45}$		1.22222	
$\frac{15}{10}$		1.5	
$\frac{25}{15}$		1.66667	
$\frac{100}{60}$		1.66667	
			4/99

Advancing Questions:

As you search for a correct answer using ratios, how will you determine what number should be in the denominator when trying to find miles per hour? Does this matter when making these comparisons?

Assessing Question:

When setting up the proportion how did you decide on the design

1.3 1.4 2.1 *Unsaved

$$\frac{55}{45} = \frac{x}{60} \quad 45x = 55 \cdot 60 \quad x = 73.33 \dots \text{ mph}$$

$$\frac{15}{10} = \frac{x}{60} \quad 10x = 15 \cdot 60 \quad x = 90 \text{ mph}$$

$$\frac{25}{15} = \frac{x}{60} \quad 15x = 25 \cdot 60 \quad x = 100 \text{ mph}$$

$$\frac{98}{60} = \quad 98 \text{ mph}$$

of your proportion (numerator versus denominator and the units of measure used)?

Advancing Questions:

Since most of the distances are expressed in minutes can you write a proportion in miles per minute instead of miles per hour? What math operation do you believe “per” describes? How can you use the words “Miles” “per” “Hour or minute” to form your proportion? What is the relationship between these rates and the slopes of the lines on your graph?

Possible Student Misconceptions	
Students often do not compare using the same units. Either units of speed should all be in minutes or in hours.	<p>Assessing Question: How do you know you are comparing the same units of measure?</p> <p>Advancing Question: Should you compare units of measure if some values are in minutes, where as other units are in hours?</p>
Entry/Extensions	Assessing and Advancing Questions
If students can't get started.... You might ask them to think about a simpler problem such as how can you compare the value of 20 cents to 1 dollar and 75 cents to 100 pennies? Would one penny be the same as 1 dollar? How could you use a fraction to describe the differences in the use of the “ones” in this comparison?	In an advancing question.... How could the fractional value help to find the slope of the equation when modeling the different speeds Kana may be driving?
If students finish early....	Ask the students to graph hours per mile. Then have the students compare and contrast the two graphs.

Discuss/Analyze**Whole Group Questions**

- Is it necessary to use the same units of measure in comparing the speeds Kana traveled on her way home? Why or why not?
- How did you determine if the speed was 100 mph or over?
- What is the relationship between the speed at which Kana traveled and the slopes of the graphs?