Building Concepts: Double Number Lines

TEACHER NOTES

Lesson Overview

This TI-Nspire™ lesson allows students to use number line diagrams to represent collections of equivalent ratios by visually displaying the relative sizes of two or more different quantities. Double number lines can be used as tools to organize and solve problems involving ratios, particularly in representing ratios that involve percents, although they are not treated in this lesson.

Multiplying *A* and *B* by a positive number, *n,* results in a pair of numbers whose distance from 0 is *n* times as far.

Learning Goals

1. Identify situations where double number lines are useful representations, that is, when the quantities have different units;
2. solve problems using a double number line;
3. recognize that unit rates appear paired with 1 and use unit rates to solve problems.

Prerequisite Knowledge

Double Number Lines is the seventh lesson in a series of lessons that explore the concepts of ratios and proportional relationships. This lesson builds on the concepts of the previous lessons. Prior to working on this lesson students should have completed *Comparing Ratios* and *Ratios and Fractions.* Students should understand:

- the concept of equivalent ratios;
- how to use number lines;
- the concept of unit rates.

Vocabulary

- **unit rate**: gives the number of units of one quantity per 1 unit of the other quantity.

Lesson Pacing

This lesson should take 50–90 minutes to complete with students, though you may choose to extend, as needed.

Lesson Materials

- Compatible TI Technologies:

  TI-Nspire CX Handhelds, TI-Nspire Apps for iPad®, TI-Nspire Software
- Double Number Lines_Student.pdf
- Double Number Lines_Student.doc
- Double Number Lines.tns
- Double Number Lines_Teacher Notes
- To download the TI-Nspire lesson (TNS file) and Student Activity sheet, go to http://education.ti.com/go/buildingconcepts.

©2015 Texas Instruments Incorporated

Class Instruction Key

The following question types are included throughout the lesson to assist you in guiding students in their exploration of the concept:

Class Discussion: Use these questions to help students communicate their understanding of the lesson. Encourage students to refer to the TNS lesson as they explain their reasoning. Have students listen to your instructions. Look for student answers to reflect an understanding of the concept. Listen for opportunities to address understanding or misconceptions in student answers.

Student Activity: Have students break into small groups and work together to find answers to the student activity questions. Observe students as they work and guide them in addressing the learning goals of each lesson. Have students record their answers on their student activity sheet. Once students have finished, have groups discuss and/or present their findings. The student activity sheet can also be completed as a larger group activity, depending on the technology available in the classroom.

Additional Discussion: These questions are provided for additional student practice, and to faciliate a deeper understanding and exploration of the content. Encourage students to explain what they are doing and to share their reasoning.

Mathematical Background

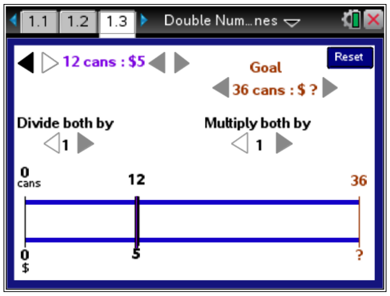
This TI-Nspire™ lesson allows students to use number line diagrams to represent collections of equivalent ratios by visually displaying the relative sizes of two or more different quantities. Double number lines can be used as tools to organize and solve problems involving ratios, particularly in representing ratios that involve percents, although they are not treated in this lesson. Double number line diagrams work well when the quantities have different units (otherwise the two diagrams might use different length units to represent the same amount, e.g., a ratio of 2 feet to 3 feet would mark off the same distance on two number lines). They show coordinated multiplying and dividing of quantities, which can also be represented in tables. On double number line diagrams, if quantities A and B are in the same ratio, then A and B are located at the same distance from 0 on their respective lines. Multiplying A and B by a positive number, n, results in a pair of numbers whose distance from 0 is n times as far. For example, $\frac{1}{2}$ times the pair $4 and 12 cans results in the pair $2 and 6 cans which is located $\frac{1}{2}$ the distance from 0 as the original pair. Double number line diagrams demonstrate that many pairs are in the same ratio, including those with rational number values.

One strategy in working with double number lines involves using a unit rate, the number of units of a quantity per one unit of the other quantity. The amount for n units of the other quantity is then found by multiplying by n.

©2015 Texas Instruments Incorporated

Part 1, Page 1.3

Focus: Use double number lines to solve problems.



The following directions are also provided in the TNS document for the students.

- Students will set the ratio using the arrows or arrow keys. This will display the ratio on the number double number line.
- Use the arrows next to **Goal** to set the target for one value in an equivalent ratio.
- Use the arrows for **Divide both by** to divide the starting ratio by a common factor.
- Use the **Multiply both by** arrows to generate multiples of the smallest ratio displayed.

TI-Nspire Technology Tips

Students may find it easier to use the tab key to toggle between the sets of arrows

Reset returns to the original screen or press ctrl del to reset.

Students should relate the top number line to the first term in the ratio and the bottom number line to the second term. As students explore ratios on double number lines have them use their knowledge of multiples and common factors to predict the missing term in the goal.

Students use double number lines to solve questions that involve finding a value for ***x*** when ***a*:*b*** is equivalent to ***c*:*x***. The discussion questions are designed as an informal approach to a general solution for solving a ratio problem of the form $\frac{a}{b} = \frac{c}{x}$ where ***a*** and ***c*** are whole numbers: $ax = bc$, $x = \frac{bc}{a}$.

At this level, students are investigating informal but useful strategies for solving problems involving proportions and moving to the formal equation can lead to misunderstanding and support longstanding student misconceptions. Students will formalize this work in later grades.

Class Discussion

Have students…

- ***Find at least three equivalent ratios to 7:4 where at least one of the values in the ratio is not a whole number. Explain why you know the ratios are equivalent.***

Look for/Listen for…

Possible answer: Equivalent ratios are generated by multiplying or dividing both values in the ratio pair by the same non-zero number. 7:4 is equivalent to $\frac{7}{2}$:2 because you can divide both 7 and 4 by 2. $\frac{7}{8} : \frac{1}{2}$ is equivalent to 7:4 because you can divide both 7 and 4 by 8; 1:$\frac{4}{7}$ is equivalent to 7:4 because you can divide both 7 and 4 by 7.

©2015 Texas Instruments Incorporated

Class Discussion (continued)

Have students…	Look for/Listen for…
A special advertises 12 cans of juice for $5. The top number line on page 1.3 represents the number of juice cans and the bottom number line the cost. The goal represents the question, "How much would 36 cans of juice cost?"	
• ***Use the right "divide both by" arrow once and describe what is displayed on the two number lines. What is displayed when you select the "multiply both by" arrows twice?***	Answers will vary: For the division arrow, 6: $\frac{5}{2}$ is displayed, half of the original ratio. Selecting the multiplication arrow once returns to the original ratio, twice will display 24:10, twice the values of the original ratio 12:5.
• ***Find a way to partition the number lines to answer the question, "What is the cost of 36 cans of juice?" Explain what the partitions on each of the number lines represent.***	Answers may vary depending on the strategy used. Dividing by 2 produces 6: $\frac{5}{2}$, multiplying by 6 produces the ratio 36:15. In this case, the bottom number line displays copies of $\frac{5}{2}$; 2 copies of $\frac{5}{2}$ or $\frac{10}{2}$, 3 copies of $\frac{5}{2}$ or $\frac{15}{2}$ and so on. The top number line displays multiples of 6 or the number of copies of 6. Another strategy is to multiplying the original ratio by 3 to produce a ratio of 36:15. In this case the top number line displays multiples of 12 and the bottom number line multiples of 5. 36 cans of juice would cost $15.
• ***Suppose a special advertises 9 cans of juice for $4. How much would 36 cans of juice cost now? Change the initial ratio and find a strategy to use the TNS lesson to answer the question.***	Answers may vary: A possible answer could be to multiply each value in the ratio 9:4 by 4 to get 36: $\frac{48}{3}$, which is equivalent to 36:16 so it would cost $16 for 36 cans.
Suppose a special advertises 8 cans of juice for $5. How much would 36 cans of juice cost? Be sure to change the initial ratio on the TNS page.	
• ***Is 36 a multiple of 8?***	Answer: 36 is not a multiple of 8 because no whole number times 8 equals 36.
• ***What happens when you divide both by 2?***	Answer: You get a new ratio 4:2.5.

©2015 Texas Instruments Incorporated

Class Discussion (continued)

Have students…	Look for/Listen for…
• ***Multiply both by different factors and describe how the ratios change.***	Answer: The ratios are consecutive multiples of 4.
• ***What is the cost of 36 cans juice?***	Answer: \$22.50
Suppose the goal is 32 cans of juice. Dividing the values in the ratios by which of the following divisors will lead to the price for 32 cans of juice? Explain your reasoning. (Reset the TNS page for each new ratio.)	
• ***The original ratio is 10:7, dividing by 2, 3 or 5.***	Answer: 5 is the only one that works because that gives the equivalent ratio of 2: $\frac{7}{5}$ and 16 times that ratio will reach the goal of 32. (32: $\frac{112}{5}$ or 32 cans for $22\frac{2}{5}$ dollars or \$22.40).
• ***The original ratio is 6 cans: \$9, dividing by 2, 3 or 6.***	Answer: Dividing by 2 does not work because it gives 3: $\frac{9}{2}$, but 32 is not a multiple of 3. Dividing by 3 gives 2:3 and 16 times this ratio pair is 32 cans: \$48. Dividing by 6 gives 1: $\frac{9}{6}$ and multiplying the ratio pair by 32 will give 32 cans for \$48.
• ***The original ratio 12 cans: \$7.***	Answer: 3. Dividing by 2 or 4 do not give a result that divides 32. Dividing both values by 3 gives 4: $\frac{7}{3}$ and 8 times this ratio pair is 32: $\frac{56}{3}$. Dividing by 6 gives 2: $\frac{7}{6}$ and multiplying this ratio pair by 16 gives 32 cans: $\frac{112}{3}$ or $37\frac{1}{3}$ dollars.

©2015 Texas Instruments Incorporated

Student Activity Questions—Activity 1

1. **The goal is to find the cost of 32 cans of juice. For each ratio of number of cans to cost, describe what the ratio means. Then predict which numbers you might divide by that will lead to the cost of 32 cans of juice. Check your predictions using the TNS lesson.**

   a. **6 cans:$5**

   Possible answer: The ratio 6:5 means 6 cans of juice cost $5. Dividing by 3 or by 6 will help you find the answer for how much 32 cans will cost with the original ratio. Multiply the values in 2: $\frac{5}{3}$ by 16 to get 32:40.

   b. **8 cans:$9**

   Possible answer: The ratio 8:9 means for 8 cans of juice, it costs $9. Dividing by 4 or 2 (or by 8 although the TNS lesson does not go that high) will help you find the answer for how much 32 cans will cost with the original ratio. Multiply the values in 4: $\frac{9}{2}$ by 8 to get 32:36.

2. **Change the goal to 30 cans of juice. How much would it cost for 30 cans of juice in each of the following? Check your thinking using the TNS lesson.**

   a. **If 12 cans cost $5; how much will 30 cans cost?**

   Answer: Divide both values by 2 and multiply both of those values by 5 to get the ratio 30: $\frac{25}{2}$ or 30 cans for $12.50.

   b. **If 10 cans cost $7, how much will 30 cans cost?**

   Answer: Multiply both values by 3 to get the ratio 30:21 or 30 cans cost $21.

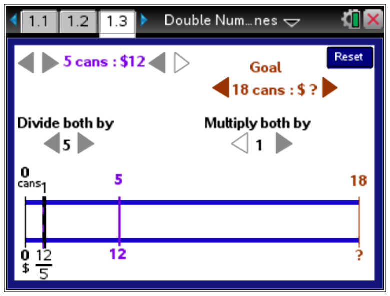
> **Teacher Tip:** The following question is designed to lead to the use of a unit rate strategy to solve the problem. The ratio ***a:b*** is equivalent to 1:($\frac{b}{a}$); an equivalent ratio is $c(1)$:$c(\frac{b}{a})$.

3. **Timon claimed that his strategy for using a double number line to find the second value in an equivalent ratio worked every time: divide both values in the given ratio by the first value, and then multiply by the goal. Do you agree or disagree with Timon? Explain why or why not and give an example supporting your answer.**

Answer: Timon is correct. If the original ratio is 4:3 and the goal is 15; his strategy would give the ratio 1: $\frac{3}{4}$ and multiply the values by 15 would give you 15: $\frac{45}{4}$ or 15: $11\frac{1}{4}$.

©2015 Texas Instruments Incorporated

4. **A television station has 5 minutes of advertising for every 12 minutes of programming. Marsie used the double number line below to answer the question: *How many minutes of programming would there be for 18 minutes of advertising?* The picture below shows the double number line adapted for her problem.**



What would you say to Marsie?

Answer: Both of the number lines represent minutes, but the length of 5 minutes is different from the length of 12 minutes. Marsie should use another strategy.

5. **Units are important in working with double number lines. Which of the following might be solved by using a double number line? Explain why or why not.**

   a. **If 18 pounds of grass seed cost $10 dollars, how much will 50 pounds of grass seed cost?**

   Answer: This problem could be solved using a double number line as one number line would represent pounds and the other dollars.

   b. **If the garden store recommends 3 pounds fertilizer per 10 pound bag of grass seed, how many pounds of fertilizer would be needed for 35 pounds of grass seed?**

   Answer: This problem should not be solved using a double number line as both number lines would represent pounds.

   c. **Orangeade juice calls for 3 cups of water for every 2 cups of orange concentrate. How many cups of concentrate will be needed for 25 cups of juice?**

   Answer: This problem should not be solved using a double number line as both number lines would represent cups.

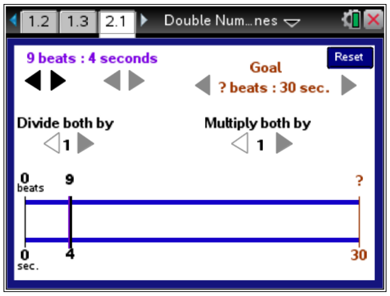
   d. **Shelly ran 5 meters in 2 seconds. How long would it take her to run 18 meters?**

   Answer: This problem could be solved using a double number line as one number line would represent meters and the other seconds.

©2015 Texas Instruments Incorporated

Part 2, Page 2.1

Focus: Using double number lines to solve problems when *a*:*b* is equivalent to *x*:*c*.



The arrows and number lines on page 2.1 work in the same way as those on page 1.3.

Part 2 involves a problem when *a*:*b* is equivalent to *x*:*c* (or $\frac{a}{b}=\frac{x}{c}$).

The formal equation is not written anywhere in the activity.

Note that a new TNS page is not really necessary because ratios have no predetermined order so *a*:*b* could be rewritten as *b*:*a* and page 1.3 could be used for a problem of that form.

Class Discussion

Have students…	Look for/Listen for…
***Suppose a pulse rate is about 9 beats every 4 seconds and you were interested in how many beats you would expect in 30 seconds*.**	
• ***What would the ratio be in the TNS lesson? The goal? How is this activity different from the one on page 1.3?***	Answer: The ratio would be 9:4, and the goal would be 30 seconds. In this TNS lesson, the missing part of the ratio is the first value. On page 1.3, the missing value was the second value.
• ***Use the TNS lesson to answer the question. How many beats would you expect inn 30 seconds?***	Answer: Dividing both values in the ratio by 2 to produce $\frac{9}{2}$ beats every 2 seconds and a multiply both of the values of the new ratio by 15 to produce $15\times\frac{9}{2}$ beats for every 30 seconds, or $67\frac{1}{2}$ beats for every 30 seconds.

Student Activity Questions—Activity 2

> **Teacher Tip:** The following question is designed to lead to the use of a unit rate strategy to solve the problem. The ratio ***a*:*b*** is equivalent to $1:(\frac{b}{a})$; an equivalent ratio is $c(1):c(\frac{b}{a})$.

1. **Consider the question: How long would it take a pulse to beat 27 times?**

   a. **How is this question different from the pulse question you solved in the Class Discussion?**

   Answer: This question fits the number line on page 1.3 because you know the first value in the equivalent ratio and are looking for the second value, which is what we did on page 1.3. On page 2.1, we know the second value in the ratio and are looking for the first.

   b. **What is your answer? Explain how you found it.**

   Answer: It will take 12 seconds to beat 27 times. Different strategies will work; one is to use the ratio 9:4 and multiply by 3 to produce 27:12.

Use either page 1.3 or 2.1 to help you think about the following problems.

2. **Given 12 inches per 1 foot, how many feet would be in 32 inches?**

   a. **What is the ratio of inches to feet?**

   Answer: 12:1

   b. **Describe how you could use the TNS lesson to answer the question.**

   Answer: One strategy is to divide by 3 to obtain 4 inches: $\frac{1}{3}$ foot and then multiply this ratio by 8 to obtain 32 inches: $\frac{8}{3}$ feet using the TNS lesson. There are $2\frac{2}{3}$ feet in 32 inches.

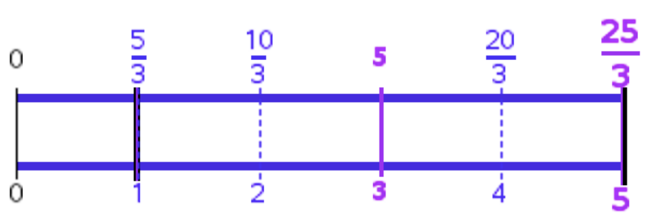
3. **TJ and Sam drove at the same speed along the same road. It took TJ 5 minutes to drive 3 miles. How long did it take Sam to drive 5 miles? Sara solved the problem reasoning that Sam drove 2 more miles so it should take him 2 more minutes than TJ; or 7 minutes to go 5 miles.**

   a. **What would you say to Sara?**

   Possible answer: You have to find the rate per mile. If you just add 2 more minutes for 2 more miles, you are assuming the rate is 1 mile per minute. But then it would have taken TJ only 3 minutes to drive the 3 miles not 5 minutes. You have to set the problem up as 5 minutes to 3 miles is equivalent to *x* minutes per 5 miles.

   b. **How would you solve the problem?**

   Possible answer: Using a double number line you would get $\frac{25}{3}$ or $8\frac{1}{3}$ minutes for Sam to drive 5 miles.



Additional Discussion

Can you find a multiplier for the following ratios that will generate an equivalent ratio of the form 24:x for some number x? Explain why or why not.

- **4:1**

  Yes because 6 × 4 = 25 so 4:1 will be equivalent to 24:6.

- **3:2**

  Yes because 3:2 is equivalent to 8 × 3:8 × 2 or 24:16.

- **5:2**

  Yes because 5:2 is equivalent to $(\frac{24}{5} \times 5):(\frac{24}{5} \times 2)$ or 24: $\frac{48}{5}$.

Use your previous work to decide whether each of the following describes a good strategy for using the TNS lesson to find a number to divide both values in the ratio that will enable you to reach a given goal. Explain your thinking in each case.

- ***Divide the initial ratio by any of the factors of the first value in the ratio*.**

  Answer: This will not always work; In a question above, 3 is a factor of 12 but does not work to reach the goal because the top number line will be divided into multiples of 4 and reach 30 is not a multiple of 4.

- ***Divide the initial ratio by a factor of the goal*.**

  Answer: This will not work in general because 4 is not a factor of 30 for question 4a but works to reach the goal.

- ***Divide the initial ratio by a factor of the first value in the ratio that produces a result that is a factor of the goal.***

  Answer: This will always work. Suppose a factor of the first value in the ratio is 3 (like in 6:7) and when you divide the goal say 32 by 2 (from 6 divided by 3) you get a whole number like 16, it means that 16 times the answer from the division 2 will reach the goal. This will always work.

- ***Divide the initial ratio by a common factor of the goal and the first value in the ratio.***

  Answer: This is not a good strategy because for 6:5, dividing by 3 works to get to the goal, but 3 is not a factor of 32.

Additional Discussion (continued)

Timon's strategy in Student Activity 1 used a unit rate, dividing to make the first value in the given ratio a 1 and multiplying the values in the ratio by the goal. Will Timon's strategy work for problems when the second value is given and the first value is missing? Why or why not? Give an example to support your reasoning.

Answer: If the problem is going from *a*:*b* to find *x*:*c* for a given *a*, *b*, and *c*, then the strategy will be almost the same except you will have to divide by the second value in the ratio to get $\frac{a}{b}$:1 and then multiply the values in the ratio by *c* to get $\frac{ca}{b} : c$, so *x* would be $\frac{ca}{b}$.

Petra claims you should always use a unit fraction or a unit rate for solving missing value ratio problems. Do you agree? Give an example to support your thinking.

Answers will vary. In some cases such as those where the first value in the ratio has no divisors other than itself and 1, it is an efficient strategy and in other cases, different strategies are easier to use. For example, if the problem 3 sets: $10, how many sets for $35? You might use a unit rate strategy to get 3 $0.3 : 1 = .3 \times 35 : 35 = \frac{10.5}{35}$. A ratio table would work as well.

3	9	1.5	10.5
10	30	5	35

Sample Assessment Items

After completing the lesson, students should be able to answer the following types of questions. If students understand the concepts involved in the lesson, they should be able to answer the following questions without using the TNS lesson.

1. Tamie ran 35 meters in 6 seconds.

    a. If she keeps the same pace, how long will it take her to run 100 meters?

    Answer: It will take her $17\frac{1}{7}$ seconds to run 100 meters.

    b. If she runs for 10 seconds, how far will she run?

    Answer: She will run $58\frac{1}{3}$ meters in 10 seconds.

2. 8 km is approximately 5 miles.

    a. How many km is 32 miles?

    Answer: 32 miles is about $51\frac{1}{5}$ km. This is because 5:8 is equivalent to 1:$\frac{8}{5}$; multiplying by 32 gives 32:$\frac{256}{5}$.

    b. How many miles is 3 kilometers?

    Answer: 3 km is about $1\frac{7}{8}$ miles. This is because 8:5 is equivalent to 1:$\frac{5}{8}$; multiplying by 3 gives 3:$\frac{15}{8}$.

3. Johnson Elementary School likes to have a ratio of 22 or fewer students for every teacher. How many students can they have in school if they have 9 teachers?

    Answer: 198 students

4. In the mountains, the temperature drops about 3.5º for every thousand feet higher you climb. If you plan on climbing 4000 feet, how much of a drop in temperature should you anticipate?

    Answer: 14º drop in temperature

©2015 Texas Instruments Incorporated

Student Activity Solutions

In these activities you will work together to use double number lines to solve problems. After completing each activity, discuss and/or present your findings to the rest of the class.

Activity 1 [Page 1.3]

1. The goal is to find the cost of 32 cans of juice. For each ratio of number of cans to cost, describe what the ratio means. Then predict which numbers you might divide by that will lead to the cost of 32 cans of juice. Check your predictions using the TNS lesson.

   a. 6 cans:$5

   Possible answer: The ratio 6:5 means 6 cans of juice cost $5. Dividing by 3 or by 6 will help you find the answer for how much 32 cans will cost with the original ratio. Multiply the values in 2: $\frac{5}{3}$ *by 16 to get 32:40.*

   b. 8 cans:$9

   Possible answer: The ratio 8:9 means for 8 cans of juice, it costs $9. Dividing by 4 or 2 (or by 8 although the TNS lesson does not go that high) will help you find the answer for how much 32 cans will cost with the original ratio. Multiply the values in 4: $\frac{9}{2}$ *by 8 to get 32:36.*

2. Change the goal to 30 cans of juice. How much would it cost for 30 cans of juice in each of the following? Check your thinking using the TNS lesson.

   a. If 12 cans cost $5; how much will 30 cans cost?

   Answer: Divide both values by 2 and multiply both of those values by 5 to get the ratio 30: $\frac{25}{2}$ *or 30 cans for $12.50.*

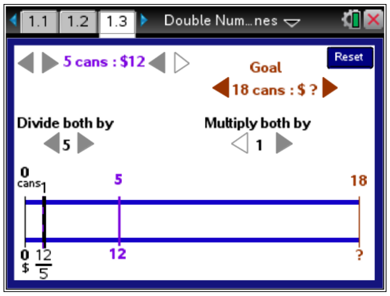
   b. If 10 cans cost $7, how much will 30 cans cost?

   Answer: Multiply both values by 3 to get the ratio 30:21 or 30 cans cost $21.

3. Timon claimed that his strategy for using a double number line to find the second value in an equivalent ratio worked every time: divide both values in the given ratio by the first value, and then multiply by the goal. Do you agree or disagree with Timon? Explain why or why not and give an example supporting your answer.

   Answer: Timon is correct. If the original ratio is 4:3 and the goal is 15; his strategy would give the ratio 1: $\frac{3}{4}$ *and multiply the values by 15 would give you 15:* $\frac{45}{4}$ *or 15:*$11\frac{1}{4}$.

4. A television station has 5 minutes of advertising for every 12 minutes of programming. Marsie used the double number line below to answer the question: *How many minutes of programming would there be for 18 minutes of advertising?* The picture below shows the double number line adapted for her problem.



What would you say to Marsie?

Answer: Both of the number lines represent minutes, but the length of 5 minutes is different from the length of 12 minutes. Marsie should use another strategy.

5. Units are important in working with double number lines. Which of the following might be solved by using a double number line? Explain why or why not.

   a. If 18 pounds of grass seed cost $10 dollars, how much will 50 pounds of grass seed cost?

      Answer: This problem could be solved using a double number line as one number line would represent pounds and the other dollars.

   b. If the garden store recommends 3 pounds fertilizer per 10 pound bag of grass seed, how many pounds of fertilizer would be needed for 35 pounds of grass seed?

      Answer: This problem should not be solved using a double number line as both number lines would represent pounds.

   c. Orangeade juice calls for 3 cups of water for every 2 cups of orange concentrate. How many cups of concentrate will be needed for 25 cups of juice?

      Answer: This problem should not be solved using a double number line as both number lines would represent cups.

   d. Shelly ran 5 meters in 2 seconds. How long would it take her to run 18 meters?

      Answer: This problem could be solved using a double number line as one number line would represent meters and the other seconds.

Activity 2 [Page 2.1]

1. Consider the question: How long would it take a pulse to beat 27 times?

   a. How is this question different from the pulse question you solved in the Class Discussion?

   Answer: This question fits the number line on page 1.3 because you know the first value in the equivalent ratio and are looking for the second value, which is what we did on page 1.3. On page 2.1, we know the second value in the ratio and are looking for the first.

   b. What is your answer? Explain how you found it.

   Answer: It will take 12 seconds to beat 27 times. Different strategies will work; one is to use the ratio 9:4 and multiply by 3 to produce 27:12.

Use either page 1.3 or 2.1 to help you think about the following problems.

2. Given 12 inches per 1 foot, how many feet would be in 32 inches?

   a. What is the ratio of inches to feet?

   Answer: 12:1

   b. Describe how you could use the TNS lesson to answer the question.

   Answer: One strategy is to divide by 3 to obtain 4 inches: $\frac{1}{3}$ *foot and then multiply this ratio by 8 to obtain 32 inches:* $\frac{8}{3}$ *feet using the TNS lesson. There are* $2\frac{2}{3}$ *feet in 32 inches.*

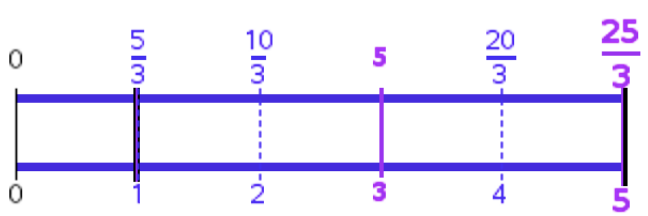
3. TJ and Sam drove at the same speed along the same road. It took TJ 5 minutes to drive 3 miles. How long did it take Sam to drive 5 miles? Sara solved the problem reasoning that Sam drove 2 more miles so it should take him 2 more minutes than TJ; or 7 minutes to go 5 miles.

   a. What would you say to Sara?

   Possible answer: You have to find the rate per mile. If you just add 2 more minutes for 2 more miles, you are assuming the rate is 1 mile per minute. But then it would have taken TJ only 3 minutes to drive the 3 miles not 5 minutes. You have to set the problem up as 5 minutes to 3 miles is equivalent to x minutes per 5 miles.

   b. How would you solve the problem?

   Possible answer: Using a double number line you would get $\frac{25}{3}$ *or* $8\frac{1}{3}$ *minutes for Sam to drive 5 miles.*



©2015 Texas Instruments Incorporated