Ratey the Math Cat
Teacher Guide

Ratey the Math Cat is available on iTunes U (search "Math Snacks") and at www.mathsnacks.org

Topic: Rates and ratios

Time Required: Two days

Learning Objectives: After watching the animation, completing the activities in the Learner Guide, and completing at least one bonus activity, students will understand:

- Rates and unit rates
- The importance of units
- That proportions are multiplicative situations
- Patterns
- Translating unit rates to a table and a graph
- (Optional) Identification of independent and dependent variables

Vocabulary: Rate, unit rate, per, dependent variable, independent variable

Vocabulary in Spanish: Razón, tasa unitaria, por, variable dependiente, variable independiente

Materials and Technology required:

- Computer, LCD projector, access to Internet or animation
- Copies of station sheet for bonus activity
- Stop watches and various items for stations (jump rope, trash can, paper and pencils, can of soup, etc.)
- Copies of blank survey tables for bonus activity

Common Core State Standards Covered:

Standard	Standard Description
6.RP	**Understand ratio concepts and use ratio reasoning to solve problems.**
6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
6.RP.2	Understand the concept of a unit rate a/b associated with the ratio a:b with b not equal to 0, and use rate language in the context of a ratio relationship.
6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g. by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
7.RP	**Ratios and Proportional Relationships**
7.RP.1	Compute unit rates associated with ratios and fractions, including ratios of lengths, areas and other quantities measured in like or different units.
7.RP.2	Recognize and represent proportional relationships between quantities.
7.RP.3	Use proportional relationships to solve multistep ratio and percent problems.

Preliminary Preparation

1. Watch the "Teaching with *Ratey the Math Cat*" instructional video.
2. Make copies of learner guides.
3. Do all problems in the learner guide and compare answers with teacher guide answers.
4. Go to Mathsnacks.com website and make sure the *Ratey the Math Cat* animation is working for you. If you are using iPads to view the animation, make sure to download the animation from iTunes prior to class.
5. Obtain a jump rope, a set of timers, paper, and trashcan for stations. If this is not possible, get various items that may be used at a "rate" station.
6. Make copies of station sheet for each student. A sample station sheet is provided below

Animation Viewing and Discussion Questions

Show the *Ratey the Math Cat* animation and ask the following questions:

1. What do you think this animation is about?
2. What math words or concepts did you see in the animation?
3. Where were some of the spots where Ratey showed up in the animation?

Tell students: *Now we are going to watch the animation again, and I am going to stop it a few times to ask you some questions.*

Show the *Ratey the Math Cat* animation again.
PAUSE animation after the second rate sequence (shower scene).

1. What was the rate for the fish? (Answer: $3 per pound.)
2. So if I bought 5 pounds, how much would it cost? (Answer: $15)
3. Is there some way you could make a table to show how much it will cost for different amounts? (Hopefully a student will answer – you could make a table, or you could write down the pattern. Whatever the response is, write it on the board.)
4. Ok, now what was the rate for the shower? (Answer: 3 gallons per minute.)
5. How is this the same as the first rate? (Answer: It is 3 to 1.)
6. So can we use the same table or pattern to predict the number of gallons used for different amounts of time in the shower? (Answer: Yes.)
7. Point out the similarity in the tables.
8. What would I have to do to to make sure someone looking at my tables understand what I am talking about – dollars per pound or gallons per minute? (Answer: Labeling. Stress the importance of labeling.)

Tell students: *Ok, now, let's watch a little bit more of the animation*. Start animation again. **Pause after the apple scene and ask the students.**

- What is the pattern you see here? (Answer: 1 to 1.)
- Where have we seen this before? (Answer: *Bad Date*.)
- What does that mean? (Answer: There are the same numbers of apples as there are people.)

Start animation again. Pause after the 14 hours of games per week.

- What was the first rate it gave for video games? (Answer: 2 hours per day.)
- What was the rate after that? (Answer: 14 hours per week.)
- What changed between the two? (Answer: Days–weeks.)
- What happened there? Can they do that? (Answers will vary.)
- Can you give me other examples of where we can adjust or change the units? (Answers: Minutes to seconds, months to years, etc.)

Animation Viewing and Discussion Questions (continued)

Finish watching the animation. Start animation again and play until the end.

- What are some of the math words you heard in this animation? (Possible answers: Per, Rate, For)
- What do you think these words mean? (Record answers on board.)
- What are some things in your life that you could relate to rates? (Record answers on board.)
- Create a table using some of the rates. Remember to label.
- Discuss the labeling and patterns. Try to have students do prediction: given the left side of table, predict the right side and vice versa.
- How did you get your answer?
- Again, when we are doing these rates, what operations are we using? (Answer: Multiplication and division)
- When we create a table, what do we have to remember to do? (Answer: Label)

Bonus Activity and Discussion Questions

Creating some of our own rates. Tell students, *We have some stations set up around the room with some tools that will help us record our rates. We are going to divide the class into teams of 3. Each team member will be given a color. At each station, the job description for your color will be outlined. We are going to spend 5 minutes at each station, so you have to be ready to go when you get there and don't waste any time. I am going to demonstrate what you are going to do, so that you know. Can I have a few volunteers.* (Pick 2)

Volunteer 1: *You are going to be the Timer. Time me for one minute.*
Volunteer 2: *You are going to be the Counter. You count how many times I can jump up and down in 1 minute* (or pick something else).
On your mark, get set, go. After the minute is up, have the counter report your rate. Demonstrate how to write the rate down, and stress labeling.
At each station, everyone will get a chance to be a Timer, a Counter and a Player. At the end, record your rates from each station on your rate sheet.

1. Describe each station and the supplies provided. Below are samples for four stations. Depending on the class size, you may need to have more stations with different items. Not all teams will go to each station; perhaps each team can do three different rotations, depending on time.
2. Send groups to their first station and allow 5 minutes to collect data at each station. Do three rotations of the stations.

STATION SUPPLIES:
Station #1: A timer and a jump rope
Station #2: A timer, a stack of blank paper and writing utensils
Station #3: A timer, a trashcan and crumpled up balls of paper
Station #4: Only a timer

Bonus Activity and Discussion Questions (continued)

STATION DESCRIPTIONS:

Station 1 has a timer and a jump rope. What can you do with a jump rope?
Station 2 has a stack of paper and pens. Think of some rates you could record with that.
Station 3 has a trashcan and some crumpled paper. What can you do there?
Station 4 just has a timer, so be creative in what you do at that station.

1. Gather group back together for discussion.

Talk about the rates we collected.

Write one of them on the board and have the students do the following:
This rate is baskets "purrrr" minute This rate is jumps "purrrr" minute. This rate is [whatever] "purrrr" minute.

2. Select one of the rates that you like the best. You are going to take that one rate and create a table using that rate. (Demonstrate how to create a table and how to use multiplication to find equivalent rates.) Have students create a table with one of the rates they recorded.
3. Does everyone have their table of rates completed? Now we are going to transfer the data from this table into a graph. (Demonstrate how to create a graph to match the table. Stress the importance of labeling and of the units used for the graph.) Have students transfer the information in their table into a graph.

Have students share their tables and graphs with the class.
Ask: *How many _____ can you do in 20 minutes, or 100 minutes?* This question will require them to extrapolate data even if their table does not go that high or their graph is not big enough.

Learner Guide Discussion

Once students have created their table and graph, pass out the Learner Guide. When you pass out the Learner Guide, briefly go over each question. Have students work individually or with a partner to complete the Learner Guide. Walk around to answer questions or to find misconceptions. It is critical to discuss the Learner Guide and the different strategies students use to solve each problem. Go over the Learner Guide and clear up any misconceptions in a large group discussion. **This discussion is critical to elicit student thinking**. Learning opportunities are lost if this discussion does not occur.

Concepts for using the Learner Guide:
1. Transferring a rate into a table and graph (1)
2. Defining rates in everyday life (2)
3. Creating a table and graph from real life data (2b, 2c))
4. The importance of labeling and scales in a graph (2C)
5. Recognizing how "PER" is used in food labels (3)

Questions for the Learner Guide discussion:
1. Look at the scale on the graph for number 1. What scale did they use for the lawns? Why? What scale did they use for the money earned? Why?
2. Who wants to share some of the rates for number 2?
3. Was it difficult to create a table and a graph for the rate you selected?
4. What do you have to remember when you create the table?
5. How did you label your graph?
6. What scale did you use? Could you have used a different scale?
7. For the food label, go over the answers. Ask students: How did you get the answer for part C? Did anyone get answers a different way? What about the bonus? How did you get the answer for that?

The Bow
(Tie it all together to bring out the main ideas)

1. What are some of the math vocabulary words that we learned from *Ratey the Cat* and these activities? (Some possible answers: Rate, unit rate, per, labels, x-axis, y-axis, scale)
2. When we are discussing rate and unit rate, what word are we looking for? (Answer: Per)
3. What are the different ways that you can represent a rate? (Possible answers: Pattern, table, graph)
4. When you are identifying the patterns, what operations are you using for rates that have the word *PER*? (Answer: Multiplication)
5. Draw a table representing one of the rates from the animation. Ask the students to create a "rate" situation that would match the table. (There will hopefully be a lot of different answers.)
6. How do we know which situation this rate table goes with?
7. Why is it important to label your tables and graphs?

Follow up with a lesson from your curriculum teaching unit rates.

WHAT IS YOUR RATE? For Bonus Activity

1. RATE FROM STATION 1:
2. RATE FROM STATION 2:
3. RATE FROM STATION 3:
4. SELECT ONE OF THE RATES FROM ABOVE AND COMPLETE THE FOLLOWING:
5. Describe your RATE using the word PER:

_____

_____ _____

_____ _____

Create a table using the rate you described above, and then create a graph.
Don't forget to label the table and the graph properly, and use the best scale possible for your graph!