FUNCTIONS TASKS: OVERVIEW

Resources:

Attached you will find a set of **10 tasks for Functions**. The tasks are best used by partners or small groups. Since these tasks are more in-depth than the practice items, you can use them as the foundation of your lesson, especially if they address a standard you are working on that day.

The purpose of using tasks is to help you see how students solve problems, and understand their thought processes while they work. Being able to work with others to get productive discourse, to be able to explain their thinking to another student, and develop a solution, is the most effective way to assess student understanding. These tasks require students to do just that – think about an efficient strategy to solve the problem, show their work and justify their reasoning. This is the ultimate goal for what we want students to be able to do. Being able to gather evidence of student learning and misconceptions in the moment, will give you the flexibility to change your instruction to meet their needs. As the instructional decision-maker, you are able to adjust your methods for whole class or small groups to address student misconceptions and move them toward proficiency.

The goal is to have tasks that can be used as the lesson of the day along with or in lieu of the practice items. There are tasks for each day per week that represent the 5 domains in 8^{th} grade. We would like for you to use these tasks along with the practice items for a 10 week period between the time you receive them and the end of January. If used daily, in accordance with our recommendations or tips, for student and teacher practice, the outcome will be an improvement in ACT ASPIRE test scores.

At the end of each task packet, you will find an answer key for your use. **Although answer keys are provided, students should explain their thinking during the discussion of the tasks.** Some tasks include several representations of the solution.

Recommendations or Tips:

When implementing the tasks with your students, please allow students read through the tasks before starting to see if they have any questions about vocabulary or what the task is asking them to do. Taking the time to do these things now, will help assure that the students are familiar with mathematical vocabulary and different question types before the actual test.

Providing Feedback to Students:

An important process for understanding student thinking, is to debrief and provide feedback. This can be done during the exploration phase of the sharing out process by asking effective questions similar to the ones below which will also help students verbalize their reasoning :

- What did the problem ask you to do?
- What information do you see in the problem?
- What did you do <u>first</u> to solve this problem?
- What did you do next?
- What strategy did you use to solve the problem? Why did you use that particular strategy?
- Is there another strategy that you could use to solve the problem?
- Who else started this same way?
- Who started a different way?

- What are some strategies that you heard today that you would like to try when solving a similar problem in the future?

Another option is to let the groups record their solution(s) to the task on chart paper. They can then share out with the whole class. With this option the students are able to present their thinking, justify their reasoning, and answer questions from the other students.

Answer Key:

The information above is intended to help teachers get at student understanding of the mathematical idea(s) in each problem. Also provided is an Answer Key for each set of tasks. The Answer Key provides more information on the expected student response for each task. While it is important for students to get the answer right, it is equally important for them to understand how their thinking leads or does not lead to a correct solution. Incorrect solutions set the stage for teachable moments!!!!

Name____ Date_______________________

Set 2 - Standard(s): 7.RP.3, 8.F.4, 8.F.5

Illustrative Mathematics

Day 1 Task – Tax and Tip

After eating at your favorite restaurant, you know that the bill before tax is $52.60 and that the sales tax rate is 8%. You decide to leave a 20% tip for the waiter based on the pre-tax amount. How much should you leave for the waiter? How much will the total bill be, including tax and tip? Show work to support your answers.

Name____ Date_______________________

Set 2 - Standard(s): 7.RP.3, 8.F.4

Illustrative Mathematics

Day 2 Task - Video Streaming

You work for a video streaming company that has two monthly plans to choose from:

- Plan 1: A flat rate of $7 per month plus $2.50 per video viewed
- Plan 2: $4 per video viewed

a. What type of functions model this situation? Explain how you know.

b. Define variables that make sense in the context, and then write an equation with cost as a function of videos viewed, representing each monthly plan.

c. How much would 3 videos in a month cost for each plan? 5 videos?

d. Compare the two plans and explain what advice you would give to a customer trying to decide which plan is best for them, based on their viewing habits.

Name____ Date_________________________

Set 2 - Standard(s): 8.F.5

Day 3 Task – Downhill

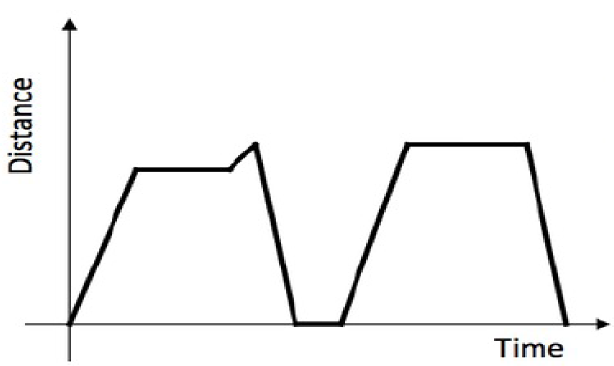
A car is traveling down a long, steep hill. The elevation, *E*, above sea level (in feet) of the car when it is *d* miles from the top of the hill is given by $E = 7500 - 250d$, where *d* can be any number from 0 to 6. Find the slope and intercepts of the graph of this function and explain what they mean in the context of the moving car.

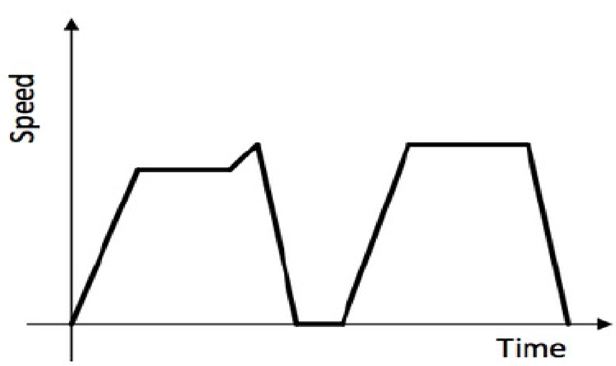
Name____ Date_________________________

Set 2 - Standard(s): 8.F.4, 8.F.5

Day 4 Task - Distance

Below are two graphs that look the same. Note that the first graph shows the speed of a car as a function of time and the second graph shows the distance of a different car from home as a function of time. Describe what someone who observes the car's movement would see in each case.





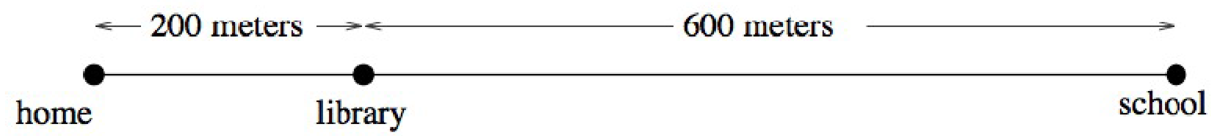
Name______________________________________ Date______________________

Set 2 - Standard(s): 7.RP.3, 8.F.4, 8.F.5

Illustrative Mathematics

Day 5 Task - Riding by the Library

Nina rides her bike from her home to school passing by the library on the way, and traveling at a constant speed for the entire trip. (See map below.)



a. Sketch a graph of Nina's distance from school as a function of time.

b. Sketch a graph of Nina's distance from the library as a function of time.

Set 2 - Standard(s): 7.RP.3, 8.F.4, 8.F.5

Day 1 Task – Tax and Tip - KEY

Solution: An exact answer

To figure out the tip, you need to find 20% of $52.60.

$$0.2 \times 52.6 = 10.52$$

You should leave $10.52 for the waiter if you want to leave him exactly 20%.

To figure the tax, you need to find 8% of $52.60.

$$0.08 \times 52.6 = 4.208$$

Next, add them up:

$$52.6 + 10.52 + 4.208 = 67.328$$

The total bill, including tax and tip, will be $67.33.

Solution: Estimating an answer

If you are not concerned whether you give the waiter exactly 20%, you can simply estimate the total bill. Tax and tip together are a little less than 30% and the bill is a little more than $50. Since 30% of 50 is 15, the tax and tip together are approximately $15. (Note that the exact calculation is $14.73.)

We can also estimate the total bill as $52 + $15 = $67, which is very close to the exact calculation of $67.33. This kind of estimating is a good way to check the answer to an exact calculation, and more like the way you would probably compute tax and a tip in a real restaurant.

Solution: Exact tax, approximate tip

In a real-world context, restaurant patrons generally estimate the tip, but pay the exact tax based on the calculation of their bill. Therefore, a third solution possibility is for students to estimate the tip portion of the calculations and to find the exact tax when calculating the total bill.

If you wish to estimate the tip, you can round \$52.60 to \$50. Twenty percent of \$50 is \$10. So, you would leave a \$10 tip.

To figure tax, you need to find 8% of \$52.60:

$$0.08 \times 52.6 = 4.208.$$

Next, add the estimated tip, the calculated tax, and the pre-tax bill:

$$52.60 + 10 + 4.208 = 66.808.$$

The total bill will be \$66.81.

Set 2 - Standard(s): 7.RP.3, 8.F.4

Illustrative Mathematics

Day 2 Task - Video Streaming - KEY

a. Each plan can be modeled by a linear function since the constant rate per video indicates a linear relationship.

b. We let C_1 be the monthly cost of Plan 1, C_2 be the monthly cost of Plan 2, and V be the number of videos viewed in a given month. Then

$$C_1 = 7 + 2.5V$$
$$C_2 = 4V$$

c.

3 videos on Plan 1: $C_1 = 7 + 2.5(3) = \$14.50$

5 videos on Plan 1: $C_1 = 7 + 2.5(5) = \$19.50$

3 videos on Plan 2: $C_2 = 4(3) = \$12$

5 videos on Plan 2: $C_2 = 4(5) = \$20$

d. Plan 1 is best for 5 or greater videos. Plan 2 is best for less than 5 videos.

Set 2 - Standard(s): 8.F.5

Illustrative Mathematics

Day 3 Task – Downhill – KEY

The slope is -250, which can be interpreted as a rate of change:

The elevation will decrease by 250 feet for every mile it travels.

The E intercept is 7500, which means the elevation of the car is 7500 feet above sea level at mile 0.

The d intercept is 30, which means that if the car traveled in this same manner for 30 miles, it would be at an elevation of 0 (in other words, at sea level), but since this function is only valid for $0 \leq d \leq 6$, it doesn't really mean anything for this particular car.

Set 2 - Standard(s): 8.F.4, 8.F.5

Illustrative Mathematics

Day 4 Task - Distance – KEY

For the distance function, output values tell us how far from home the car is. For a speed function, output values tell us how fast the car is moving. Since we don't have scales on either axis, we can't talk about specific values of time, distance and speed, but we can make qualitative statements about distance and speed.

Distance Graph: The car starts its trip at home. It moves away from home at a constant rate. When the graph is horizontal, the car's distance from home is not changing, which probably means it has come to a stop for awhile.* Then the car moves farther away from home before turning around and coming back home. After staying at home for a time, the car moves away from home at a constant rate. It comes to a stop for a while* before coming back home.

*If the distance from home is not changing, it is also possible that the car is driving along a circle with the driver's home at the center.

Speed Graph: The car starts at rest and speeds up at a constant rate. When the graph becomes a horizontal line, the car is maintaining its speed for a while before speeding up for a short time and then quickly slowing down until it comes to a complete stop. It stays stationary for a little while where the graph is on the horizontal axis. Then the car speeds up, goes at a constant speed for a while and then slows down and comes to a complete stop.

Set 2 - Standard(s): 7.RP.3, 8.F.4, 8.F.5

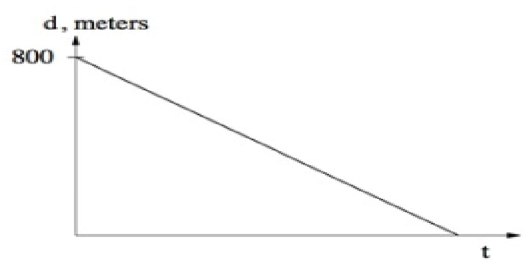
Illustrative Mathematics

Day 5 Task - Riding by the Library – KEY

a.

We can describe the important features of the graph:

- Nina's distance function from school starts with the largest output value at $t = 0$ when she starts her ride to school.
- When Nina arrives at school, her distance from school is 0 and the ride is over. Therefore, the last point on the graph is on the t-axis.
- Nina's speed is constant throughout her ride, so the graph is a line with negative slope.
- In this problem we don't know how long it takes Nina to ride to school. We only know the distance she is riding. We can label the vertical intercept because we know that Nina's home is 800 meters from her school.



In this case the situation has not changed, we still have to sketch a distance graph, but the distance is now measures from the library and not from home. We can imagine a person standing at the library watching Nina's ride. Again, we can describe the important features of the graph:

- The initial distance from the library is 200 meters.
- The distance decreases until it reaches 0 meters when Nina arrives at the library.
- The distance from the library then increases and reaches its maximum when Nina arrives at school.
- The absolute values of the slopes of the two lines are equal since Nina rides at a constant speed.
- We can label the function values of the starting and ending points of the graph with 200 meters and 600 meters, respectively.