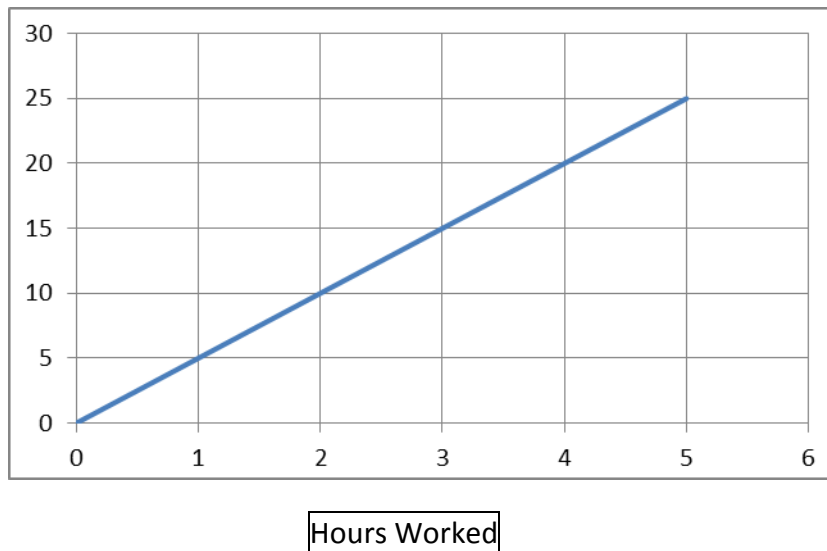| Task: Workers and Earnings	8th Grade

Part 1

In Part 1, we will talk about two workers, Worker A and Worker B. The pay that worker A receives is given in the graph below. Worker B's pay is represented by the equation $p = 6h$, where p is the pay in dollars and h is the number of hours worked.

Worker A's Pay

Pay in dollars

Hours Worked

a) Who makes more per hour? Explain how you determined your answer.

b) Explain how a graph for Worker B's pay compares to the graph for Worker A's pay.

Part 2

In Part 2, we will discuss two additional workers: Worker C and Worker D. Worker C earns $7.75 for each hour worked.

Worker C

hours worked	earnings
3	
5	
	$62.00
	$85.25

Worker D

hours worked	earnings
3	$24.45
7	$57.05
9	$73.35

a) Complete the table for Worker C. Describe any patterns you noticed.

b) Use rate language to compare the earnings for worker C and worker D.

c) Which of the four workers would earn $100 first? Explain how you determined your answer.

Teacher Notes:

- This task requires knowledge of slope given in a table, equation, graph, or in a verbal representation.   This task should help students become more comfortable working with linear equations in multiple representations and making connections.
- All of the parts have lines that pass through the origin. Advancing questions could change parts of this problem to have y-intercepts other than zero.

Common Core State Standards for Mathematical Content	Common Core State Standards for Mathematical Practice
8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change. **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	**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.** **7. Look for and make use of structure.** **8. Look for and express regularity in repeated reasoning.**

a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.	

Essential Understandings

- Functions provide a tool for describing how variables change together. Using a function in this way is called *modeling*, and the function is called a *model*.
- Functions can be represented in multiple ways—in algebraic symbols, situations, graphs, verbal descriptions, tables, and so on—and these representations, and the links among them, are useful in analyzing patterns of change.
- Some representations of a function may be more useful than others, depending on how they are used.

Explore Phase

Possible Solution Paths	Assessing and Advancing Questions
Part 1a - Students should say that Worker B makes more per hour. They could graph the equation for Worker B and find the slope. They could come up with the equation *p = 5h* for Worker A and compare the rate from the equations. They could make a table for both Workers and find the hourly rate from the table.	Assessing – Why did you pick Worker B over Worker A? Advancing – What is another way to determine your answer other than how you stated it?
Part 1b – Students could use the existing graph to sketch the other graph. Students should see that the graph for Worker B is "higher" or has a steeper slope.	Assessing – How do you know how these two graphs compare? How can you be sure which graph is for which Worker? Advancing – Why does the graph for Worker B seem get farther away from the Worker A line as you go to the right? How far apart would the lines be after 10 hours?
Part 2a – Students should multiply 7.75(3) to start the table. They could then use repeated addition or division and multiplication to complete the rest of the table.	Assessing – Can you tell me how you determined 3 hours equated to $23.25? Advancing – What would Worker A's earnings be for 10 hours of work? 9.5 hours of work?
Part 2b – Students should see that Worker D makes more per hour ($8.15 per hour compared to $7.75 per hour for Worker C)	Assessing - Why did you choose Worker D? Why does the rate tell you who makes more per hour? Will this always be true for these types of equations? Advancing – What would have to happen to your equations for Worker C to make more per hour? How can you come up with an equation where Worker C makes more per hour?
Part 2c – Worker A = 100/5 = 20 hours	Assessing – How did you know to divide 100 by the rate? Why did Worker

Worker B = 100/6 = 16.67 hours Worker C = 100/7.75 = 12.90 hours Worker D = 100/8.15 = 12.27 hours Students could see that the worker with the greatest rate of pay would earn $100 faster, so worker D because $8.15 is the greatest rate of pay. Students could graph all of the workers' pay and see which one has the steepest slope or which one gets to $100 in the least amount of time.	A need the most hours to earn $100? Advancing – How are you sure that the correct unit is hours? Can you come up with a formula that would tell you the number of hours it would take any worker to earn $250?
Possible Student Misconceptions	**Assessing and Advancing Questions**
Part 1a – In their explanation, students may simply say 6 is bigger than 5.	Assessing – How did you know that Worker B made more than Worker A? Advancing – Did you have to have a graph to answer this question? What are other questions that could have been asked about this situation?
Part 1b - Students may incorrectly graph the Worker B graph, since it is not given.	Assessing – How did you know what the graph of Worker B looked like? What is the meaning of this ordered pair your graphed? (Refer to one of the points they graphed to ensure they understand the meaning of (1,6)) Advancing – How did you know that the graph for Worker B was a line? What is the slope of this line? What significance does the slope have in the context of the problem?
Part 2a – Students may see the 3 and 5 on the left side of the table and blindly insert 3,5,7,9.	Assessing – How much would the worker make for 1 hour of work? 2 hours? Advancing – Could we redo the table for 1- 10 hours? Why is this easier to do than what we were given?
Part 2b – Students may get confused about earnings and not show a rate.	Assessing – How do you know that Worker D makes more per hour? Advancing – If you had to justify your answer graphically how would you do that?
Part 2c – Students may struggle with what they are supposed to do to determine this answer.	Assessing - How long would it take Worker A to earn 10 dollars? 20 dollars? Advancing – How long does it take Worker A to earn 25 cents? 50 cents?

	75 cents? 1 dollar?
Entry/Extensions	**Assessing and Advancing Questions**
If students can't get started….	Assessing- How much would each worker make for 1 hour of work? 2 hours? Advancing- How much does each worker make per hour?
If students finish early….	Assessing Questions - Can you build your own scenario for worker E that other students could work on? Advancing Questions – Could you redraw the worker A graph if he received $20 for reporting to work plus the same rate of pay in the original graph? What do you notice about the new and old graph for worker A? How would your equation change?

Discuss/Analyze

Whole Group Questions

Part 1a - How could we answer this question using another method? What would have been different in this problem if the axes were switched? Is it better to use an equation, table, or graph to answer this question?
Part 1b – How fast are the two lines getting farther apart? If we made tables for both Workers, what would be similar if we compared the graphs and tables? Do both of these lines pass through the origin? What is the significance of this in terms of the problem?
Part 2a - What do you notice as we progress down the chart? What is different about this chart than we usually have? Are the workers' earnings increasing or decreasing? What is the significance of 7.75? Is it more helpful to have a table, equation, or graph to determine the answer?
Part 2b - What is the most helpful thing you were given to answer this question? Is it more helpful to have a table, equation, or graph to determine the answer? Could you do this part without the table? What is the minimum amount of information needed to answer this question?
Part 2c– Who took the least amount of hours to earn $100? Would this be true if you had been asked to find who took the least amount of time to earn $200? What did you need to know to determine the answer to this question? To answer a question such as this is which representation is the easiest to work with? Why?