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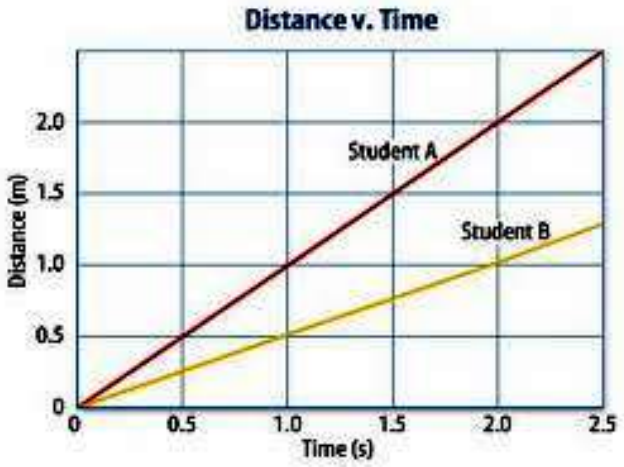
Part 2: Comparing Different Representations of a Function

Objective: SWBA to compare the rate of change of different functions in different representations **(8.F.2)**

Introduction/ Vocabulary:

Rate of change is the speed at which a variable changes over a specific period of time. Rate of change is often used when speaking about momentum and it can generally be expressed as a ratio between changes in one variable relative to a corresponding change in another. Graphically, the rate of change is represented by the **slope** of a line.

Last week we compared different lineal situations by comparing the rate of change or slope of each situation. For instance, last week we compare the speed at which two students covered certain distances. For instance, we learned that Student A is moving faster than Student B because the rate of change or slope of Student A is bigger than the slope of Student B.



Here is how we arrived at this conclusion.

The rate of change or slope of student A is $\frac{rise}{run} = \frac{1.5 meter}{1 \sec} = 1.5 meter\ per \sec$

The rate of change or slope of student B is $\frac{rise}{run} = \frac{1 meter}{1 \sec} = 1 meter\ per \sec$

The rate of change or slope of Student A is greater than the rate of change or slope of student B. Therefore, Student A is moving faster than Student B.

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Mini-Lesson (I do):

The above comparison was kind of easy. All we have to do is look at the two lines. The line that is the steeper has the bigger slope or rate of change. Or we can say that the line is closer to the y-axis has the most inclination and therefore has the larger slope or rate of change. But what if we had the following situation

Compare the following Cell phone plans:

Plan A costs a basic fee of $29.95 per month and 10 cents per text message

Plan B costs a basic fee of $49.95 per month and 5 cents per text message

Which plan would you choose? Use mathematics to justify your answer. Be sure to include any real-world constraints that may affect your decision.

Solution

Well, well… Things do not look as a simple as in the situation discussed earlier.

To solve this problem, we need to translate each plan into a linear equation in the form ***y= mx +b***, where ***m*** is the rate of change or slope and ***b*** is the y-intercept or initial value.

Plan A:

Plan has a flat basic monthly fee of $29.95 dollars per month. That means that the y-intercept or initial monthly fee, b, is $29.95. The rate of change is 10 cents per text-message or $0.10 per text. The independent variable in this situation is the number of text messages you send. Therefore, let's x represents the number of text messages. So we can say that

$y = \$0.10x + \$29.95$ can be used to represent Plan A

Plan B

Plan has a flat basic monthly fee of $49.95 dollars per month. That means that the y-intercept or initial monthly fee, b, is $49.95. The rate of change is 5 cents per text-message or $0.0.5 per text. The independent variable in this situation is the number of text messages you send. Therefore, let's x represents the number of text messages. So we can say that

$y = \$0.05x + \$49.95$ can be used to represent Plan B

Which Plan is better?"

If we look at the rate of change or slope of each equation, we can see that $0.10 is greater than $0.05; 10¢ is greater than 5¢. This means that Plan A will be more expensive if you are the type person that likes to text a lot. As a matter of fact, if you send exactly 400 text messages per month, Plan A and Plan

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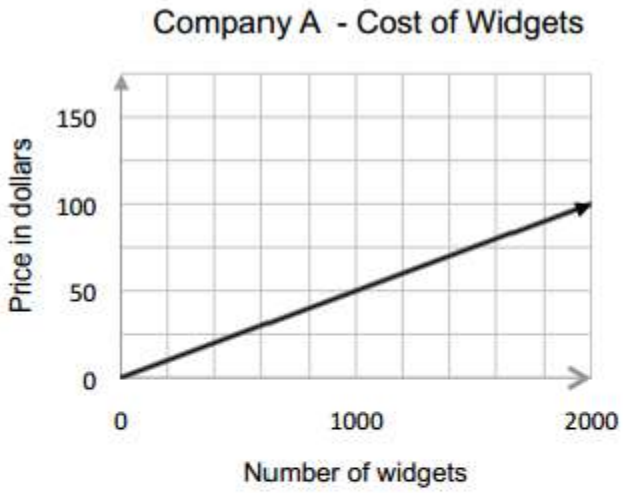
B will be equally in cost. If you send less than 400 text messages, Plan B is the way to go. If you text more than 400 text massages per month then Plan A will be the most expensive.

Guided Practice (*We Do)*

Company A and B both sell widgets. The company you work for wants you to buy widgets for them.



Company B
Cost of Widgets

Number of Widgets	Price in Dollars
200	8
400	16
600	24

a) Which company sells widgets at the lower price?
b) Explain to your boss how you know which company sells widgets at the lower price.

Solution:

Company A's rate of change or slope is: $\frac{Rise}{run} = \frac{50}{1000} = \frac{1}{20}$

Company B's rate of change or slope is: $\frac{Rise}{run} = \frac{8}{200} = \frac{1}{25}$

Company B gets the lowest price because its rate of change is smaller.

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Independent Practice (*You Do)*

Problem 1

Three students are saving different amounts of money, as displayed below.

SAMANTHA'S SAVINGS

- Started with $20
- Added $7.50 per hour worked

DAN'S SAVINGS

Number of Hours Worked	Total Savings
0	$10
2	$21
4	$32
6	$43

CHERI'S SAVINGS

Which list shows the students in order of least to greatest dollar amounts added per hour worked?

Show or explain your work.

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Problem 2:

Which function representation or option has a greater rate of change or slope?

Option 1

x	0	1	2	3
y	4	8	12	16

Option 2

$$y = \frac{1}{3}x + 4$$

Explain your reasoning:

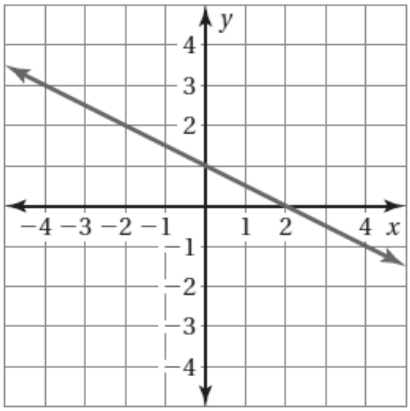
Problem 3:

Which representation has a greater slope or rate of change?

Function 1

x	3	6	9	12
y	40	32	24	16

Function 2



Explain:

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Problem 4:

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

Part A:
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.

Part B:
How much would 3 videos in a month cost for each plan? 5 videos?

Part C:
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.

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Problem 5:

Ivan's furnace has quit working during the coldest part of the year, and he is eager to get it fixed. He decides to call some mechanics and furnace specialists to see what it might cost him to have the furnace fixed. Since he is unsure of the parts he needs, he decides to compare the costs based only on service fees and labor costs. Shown below are the price estimates for labor that were given to him by three different companies. Each company has also given him an estimate of the time it will take to fix the furnace.

Company A charges $35 per hour to its customers.
Company B charges a $20 service fee for coming out to the house and then $25 per hour for each additional hour.
Company C charges a $45 service fee for coming out to the house and then $20 per hour for each additional hour.

For which time intervals should Ivan choose Company A, Company B, Company C? Support your decision with sound reasoning and representations. Consider including equations, tables, and graphs.

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Final Summary

In a U-Shape:

1. Re-state the objective to assess if students learn it
2. Elicit from students what they have learned and what they want to learn more about.
3. Tie what they learn to the lesson, and upcoming lessons—scatter plots