

Linear Relationships Using “Graphing Lines - PhET Simulation”

Designed for a 7th Grade Math Academic Support Class - (55 Minutes)

Pre-Planning:

Students will come into this lesson with prior knowledge and exposure to rates. Most, and probably all, students will have seen these representations and concepts in a previous math class.

Materials:

- Each student will need a Chromebook to access <https://phet.colorado.edu/en/simulation/graphing-lines>
- [Student Handout](#) for each student
- [Exit Slip: Linear Relationships](#)

Learning Goals:

Students should be able to...

- This problem introduces ways to represent linear relationships between two variables using tables, graphs, and equations. It is also the first time that students are asked to explain why a relationship is linear and to recognize a linear relationship from a table or an equation.
 - How can you predict whether a relationship is linear from a table, a graph, or an equation that represents the relationship?
 - Recognize problem situations that involve linear relationships
 - Construct tables, graphs, and symbolic equations that represent linear relationships
 - Connect equations that represent linear relationships to the patterns in tables and graphs of those equations

Develop understanding Linear Relationships

7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems. (7.RP.A.2, 7.RP.A.2a, 7.RP.A.2b, 7.RP.A.2c)

7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations. (7.EE.B.4)

Standards: (from <http://www.corestandards.org/Math/>)

Curriculum Alignment

- Aimed at gap filling for middle school students in a math support class.
- Supports CMP3 books “Moving Straight Ahead” - Investigation 1.1

	Teacher will...	Student will...
WARM UP & INTRODUCTION		
Warm-Up/ Part 1: (7 min)	<ul style="list-style-type: none"> ● Direct students to Graphing Lines PhET Simulation. ● Distribute Student Handout ● Vocabulary: <ul style="list-style-type: none"> ○ Find keywords within the vocabulary ○ <i>Constant Rate of Change</i> <ul style="list-style-type: none"> ■ <i>An object moving uniformly with respect to time</i> ○ <i>Linear Relationship</i> <ul style="list-style-type: none"> ■ <i>All points lie on a straight line</i> ● Lead a short debrief of student's observations of simulation and answers to Part 1. <ul style="list-style-type: none"> ○ <i>What happens after you save a line?</i> ○ <i>What tool do you use to find a ordered pair?</i> ○ <i>What do each color coordinate represent?</i> 	<ul style="list-style-type: none"> ● Fill in vocabulary ● Explore PhEt simulation "Graphing Lines" ● Fill Part 1. ● Participate in class discussion.
GUIDED EXPLORATION		
Activity Part 2: (8 min)	<ul style="list-style-type: none"> ● Introduce story and rate of change of each students and what each means. <ul style="list-style-type: none"> ○ <i>What does "Rate" mean?</i> ○ <i>If the rate is a low number, what does that mean about their speed?</i> ○ <i>"Rate of Change" is how that quantity changes over time</i> ● Using the rate of change, have students complete the table. <ul style="list-style-type: none"> ○ <i>Where should each student be at zero seconds?</i> ○ <i>After 10 seconds, who is the farthest?</i> 	<ul style="list-style-type: none"> ● Use PhET sim to complete Part 2 ● Have students discuss at their table what each rate means ● Have students complete tables and compare their work with each other. ● Participate in class discussion
Activity Part 3: (10 min)	<ul style="list-style-type: none"> ● Support students in using PhET sim to answer Part 3. ● Lead debrief of strategies and how to use the lines on an example problem: <ul style="list-style-type: none"> ○ <i>5 yards per second</i> ○ $d=5t$ ● Provide students time to create the three graphs and share and compare <ul style="list-style-type: none"> ○ <i>Which axis should represent time?</i> 	<ul style="list-style-type: none"> ● Use PhET sim to complete Part 3 ● Students will create lines for each student rollerblading. ● Discuss and share lines in groups ● Participate in class discussion

	<ul style="list-style-type: none"> ○ <i>Which axis should represent distance? How do you know?</i> ○ <i>What does steepness mean? What does it look like on a graph?</i> 	
Activity Part 4: (5 min)	<ul style="list-style-type: none"> ● Students will determine the <i>rate of change</i> in the table. ● Students will then write an equation for each student. Let <i>t</i> represent time and the <i>d</i> represent distance traveled for each student. ● Students will work on proportional vs non proportional table. <ul style="list-style-type: none"> ○ <i>What makes something proportional?</i> ○ <i>What would be an example of a student rollerblading that would be non proportional?</i> 	<ul style="list-style-type: none"> ● Discuss with partner(s) about similarities and differences of the rate of changes. ● Students write down rate of changes ● Student writes down equations ● Discuss and share what students wrote down for rate of change and equations as a small group and compare <ul style="list-style-type: none"> ○ Then discuss as a class ● Student will then complete proportional vs non proportional table. <ul style="list-style-type: none"> ○ <i>What makes a table or graph proportional?</i>
Activity Part 5: (5 min)	<ul style="list-style-type: none"> ● New student (Diana) is added to the information, introduce her and the rate of change. Students will find the rate of change on the graph. ● Introduce situation for Diana to be at the same rate as Jose <ul style="list-style-type: none"> ○ <i>What would you change on the graph so that Diane and Jose are at the same rate?</i> ○ <i>Could Jose get a head start?</i> 	<ul style="list-style-type: none"> ● Students will look at the graph and find Diana's rate of change. ● Have students come up to the board and discuss how students found the information as a class. ● Provide students time to have Diana's line be the same as Jose's line.
Activity Part 6: (10 min)	<ul style="list-style-type: none"> ● Introduce the yards traveled with different times <ul style="list-style-type: none"> ○ Provide an example for 10 seconds ○ <i>Do you need to convert the minutes and hours to seconds?</i> ○ <i>How many yards would each student be at in 45 seconds? 50 minutes? 3 hours?</i> 	<ul style="list-style-type: none"> ● Provide students time to convert yards for the given time.

SUMMARY

Summary:
(5 min)

- Lead summary of activity
 - Rate of change
 - Steepness of a line
- Questions to ask:
 - *How does the constant travel rate show up in the table, the graph, and the equation?*
 - *For those situations, compare the rollerblading rates to those of the original three students. Who is the fastest? Who is the slowest?*
 - *Describe what is happening in each situation.*
 - *Describe the patterns of change between the two variables.*
 - *How does the pattern of change between two variables in a linear relationship show up in a table, graph, and an equation?*

- Participate in class summary

Students should be able to determine a linear relationship. The students should be able to create a table, graph, and equation for each student.

INFORMAL ASSESSMENT

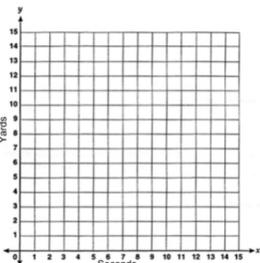
Exit Ticket:
(5 min)

Exit Slip: Linear Relationships
Complete the a table, graph, and write an equation for each student rollerblading.

Name:	Rollerblading Rate
Maria	3.5 yards per second
Jack	2 yards per second

	1 sec	2 sec	3 sec	4 sec	5 sec
Maria					
Jack					

	Equations:
Maria	
Jack	



Complete Exit Ticket

LOOKING FORWARD

Students will begin to be introduced to independent and dependent variables. The word *slope* and *y-intercept* will be new terms. Students will begin to use each rollerblading rate as a way to raise money for a fundraiser.