Rate of Change – A Co-Teaching Lesson Plan

Co-Teaching Approaches

A "(Y)" in front of the following list items indicates the approach is outlined in the lesson. An "(N)" in front of the following list items indicates the approach is not outlined in the lesson.

- (Y) Parallel Teaching
- (Y) Team Teaching
- (Y) Station Teaching
- (N) One Teach/One Observe
- (N) Alternative Teaching
- (Y) One Teach/One Assist

Subject

Algebra, Functions, and Data Analysis (AFDA)

Strand

AFDA.1 Linear Modeling

Topic

Graphing Quadratic Relationships

Standards

AFDA.1   The student will investigate and analyze linear, quadratic, exponential, and logarithmic function families and their characteristics. Key concepts include
b) intervals on which a function is increasing or decreasing;
g) connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs.

Outcomes

Students will be able to identify the differences between positive, negative, zero, and undefined rate of change using multiple representations.

Materials

- Computer hooked to a projector (for intro video)
- Meter stick

- Small ball that will bounce
- The Frame Routine Diagram (attached)
- Da Bounce Activity worksheet (attached)
- Race to the Wall Activity worksheet (attached)
- Zero and Undefined Slope worksheet (attached)
- Identifying and Interpreting Slope worksheet (attached)

Vocabulary
delta notation, function, rate of change

Co-Teacher Actions

Lesson Component	Co-Teaching Approach(es)	General Educator (GE)	Special Educator (SE)
Anticipatory Set	One Teach/One Assist	GE introduces slope dude video. Class watches slope dude video	SE facilitates class discussion summarizing slope dude.
Lesson Activities/ Procedures	Parallel Teaching/ Station Teaching	GE divides class into two groups. The left side works with teacher 1 and the right side works with teacher 2. Each teacher goes over the Frame Routine Diagram with their group (blank frame and answer key attached). Class reconvenes and GE answers any remaining questions. GE divides class into four groups (randomly select members of each group). The four groups rotate stations every 15 minutes (this may continue to the next day, depending on the schedule). Two stations are teacher assisted, two stations are independent.	SE facilitates station 2 - Negative Rate of Change – Race to the Wall lab worksheet (attached). Students stand against one wall and measure their distance to the opposite wall. They record their data on the attached sheet. Students then take one step toward the opposite wall and measure their distance to the opposite wall and record their data on the attached sheet. This continues until students have completed six steps. Students answer the questions given. Stations 3 and 4 are explained in Guided/Independent Practice

Lesson Component	Co-Teaching Approach(es)	General Educator (GE)	Special Educator (SE)
		Facilitate station 1 – Positive Rate of Change – Da Bounce Lab activity worksheet (attached). Students use a small bouncy ball to drop the ball from various heights (given) and record the number of bounces. They then answer the questions given. Stations 3 and 4 are explained in the Guided/Independent Practice Section.	Section.
Guided/Independent Practice	Team Teaching	Station 3 – Zero and Undefined Rate of Change worksheet (attached). Students work with their group to complete the zero and undefined rate of change worksheet. Station 4 – Identifying and Interpreting Slope worksheet (attached). Students work with their group to complete the Identifying and Interpreting Slope Worksheet.	Station 3 – Zero and Undefined Rate of Change worksheet (attached). Students work with their group to complete the zero and undefined rate of change worksheet. Station 4 – Identifying and Interpreting Slope worksheet (attached). Students work with their group to complete the Identifying and Interpreting Slope Worksheet.
Closure	One Teach, One Assist	**Exit ticket** Think of a real life situation (that we haven't used already) for each type of rate of change (positive, negative, zero, and undefined) and write each on a separate index card. Be prepared to share. GE assists students with the exit ticket.	SE assists students with the exit ticket.
Formative	Team Teaching	GE checks for understanding during	SE checks for understanding during

Lesson Component	Co-Teaching Approach(es)	General Educator (GE)	Special Educator (SE)
Assessment Strategies		station teaching. GE collects and grades stations activities. GE collects and grades exit tickets.	station teaching. SE collects and grades stations activities. SE collects and grades exit tickets.
Homework	Team Teaching	No homework is assigned	No homework is assigned

Specially Designed Instruction
- Teachers use the SIM Framing Routine taught through parallel teaching, thus reducing the teacher-to-student ratio and assuring understanding through observation and discussion (GE and SE)..
- Teachers use Walk Toward the Wall and Da Bounce activities which reinforce kinesthetic connections to mathematical concepts.

Accommodations
- Provide oral and written instructions (GE and SE), per students' IEP and 504 accommodations.
- Supply a graphic organizer (GE and SE), per students' IEP and 504 accommodations.
- Allow extra time for written work.
- Allow discussion responses for students with written expression deficits (SE).

Modifications
- For those students requiring a modified curriculum, content can be modified to include one type of function.

Notes
- "Special educator" as noted in this lesson plan might be an EL teacher, speech pathologist, or other specialist co-teaching with a general educator.
- The co-teachers who developed this lesson plan received required professional development in the use of specialized instructional techniques which combine an explicit instructional routine with the co-construction of a visual device (graphic organizer). The *Framing Routine* in conjunction with "The Frame" helps to develop understanding of information and procedures by associating their main ideas and details. These Content Enhancement Routines were developed at the Center

for Research on Learning at the University of Kansas.
- Other graphic organizers should be used by teachers who have not received professional development in the *Framing Routine*. If Virginia teachers would like to learn the Content Enhancement Routines, contact your regional TTAC.
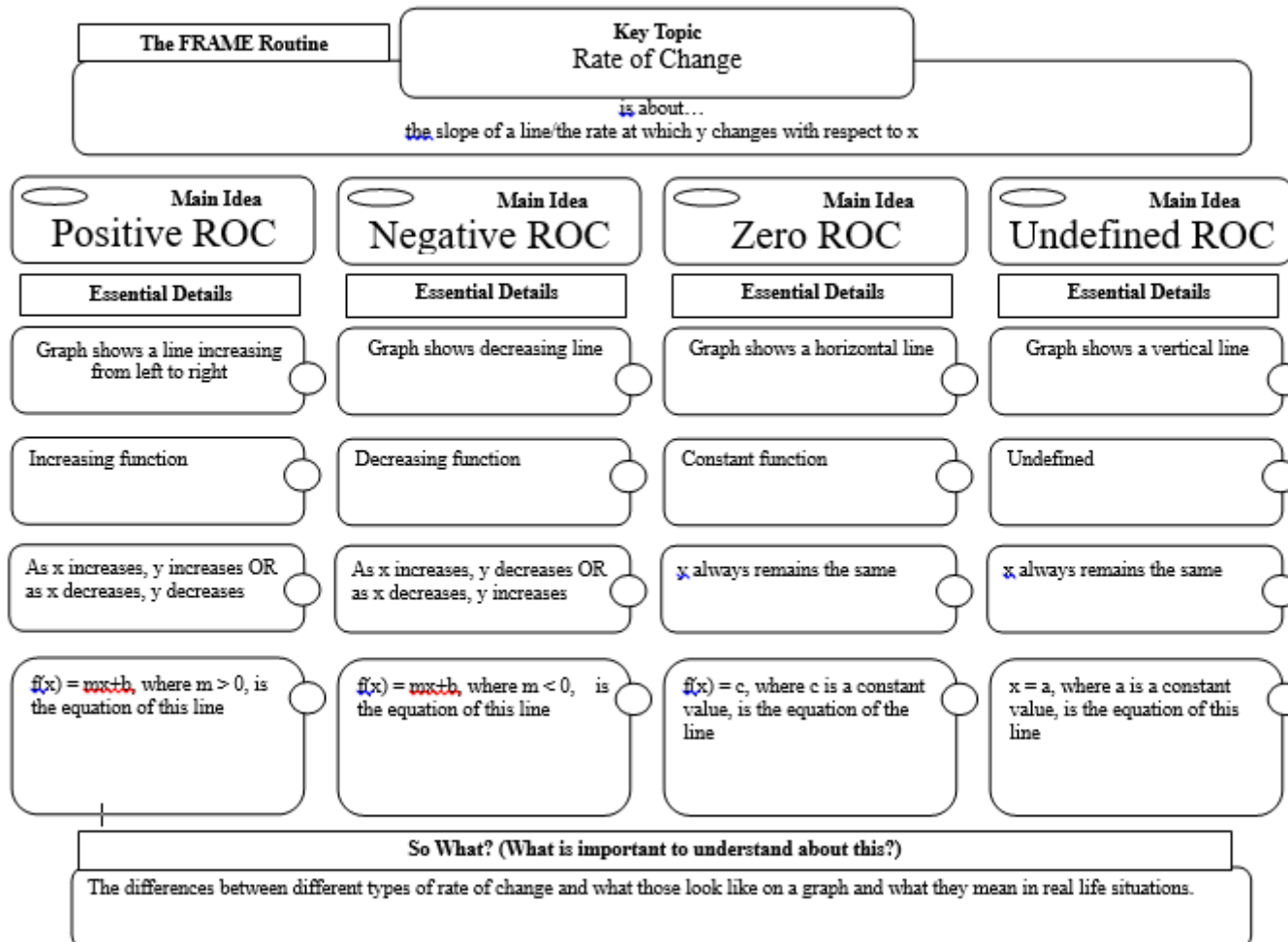
Note: The following pages are intended for classroom use for students as a visual aid to learning.

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The Frame Routine Organizer

The FRAME Routine	Key Topic

is about…

Main Idea	Main Idea	Main Idea	Main Idea
Essential Details	Essential Details	Essential Details	Essential Details

So What? (What is important to understand about this?)

The Frame Routine Organizer (Sample)

The FRAME Routine	**Key Topic** Rate of Change

is about…
the slope of a line/the rate at which y changes with respect to x

Main Idea Positive ROC	Main Idea Negative ROC	Main Idea Zero ROC	Main Idea Undefined ROC
Essential Details	**Essential Details**	**Essential Details**	**Essential Details**
Graph shows a line increasing from left to right	Graph shows decreasing line	Graph shows a horizontal line	Graph shows a vertical line
Increasing function	Decreasing function	Constant function	Undefined
As x increases, y increases OR as x decreases, y decreases	As x increases, y decreases OR as x decreases, y increases	x always remains the same	x always remains the same
$f(x) = mx+b$, where m > 0, is the equation of this line	$f(x) = mx+b$, where m < 0, is the equation of this line	$f(x) = c$, where c is a constant value, is the equation of the line	$x = a$, where a is a constant value, is the equation of this line

So What? (What is important to understand about this?)

The differences between different types of rate of change and what those look like on a graph and what they mean in real life situations.

Rate and Change Bouncy Balls

Rate and Change and Bouncy Balls

We're measuring _____ per _____

Height (inches)	# Bounces
72	
64	
50	
36	
20	
15	
2	

1. Find the rate of change between 64 and 15 inches.

2. Find the rate of change between 36 and 2 inches.

3. Is the rate of change increasing or decreasing?

Rate and Change Bouncy Balls, cont.

4. Based on your results from #2 and #3, are the number of bounces a linear function of height?   Why or why not?

It's a Race to the Wall

_____'s racing toward the wall!

# of steps							
Distance from wall (feet)							

A.   Find the rate of change/slope between 0 and 3 steps.   Don't forget units.

B. Find the rate of change between 2 and 5 steps.

C.   Based on your results from #2 and #3, are the number of bounces a linear function of height?   Why or why not?

D. Is the rate of change increasing or decreasing?

Zero and Undefined Rate of Change

Zero and Undefined Rate of Change

Your town has just authorized funding to build a new ramp for skateboarding. When the ramp is complete, you and your friends will be able to pay a monthly fee of $12.50 to use the ramp for as many hours as you wish. Complete the table of values below where x is the number of hours per month that each person who pays the fee uses the ramp and y is the total cost per month for each person.

x, TIME (in hours)	5	10	15	20
y, COST (in $)				

Use the data points from the table to sketch a graph of the function.
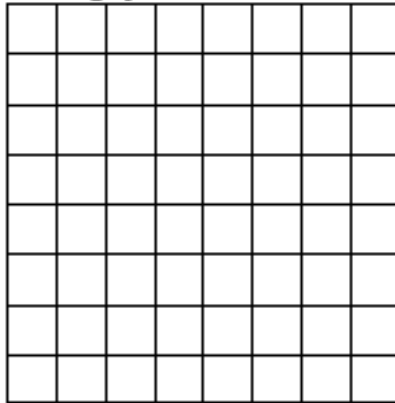
Describe this graph in words.

Choose two of the points on the graph and find the rate of change.

What does the rate of change mean in this situation?

The equation of this line is y = 12.50. Does this make sense? *WHY?*

Zero and Undefined Rate of Change, cont.

You apply for a part-time job at the skateboarding rink to help cover your weekly expenses. The following table gives your weekly salary, x, and corresponding weekly expenses, y, for a typical month.

x, WEEKLY SALARY IN DOLLARS	70	70	70	70
y, WEEKLY EXPENSES IN DOLLARS	45	35	50	60

Sketch a graph of the given data points.
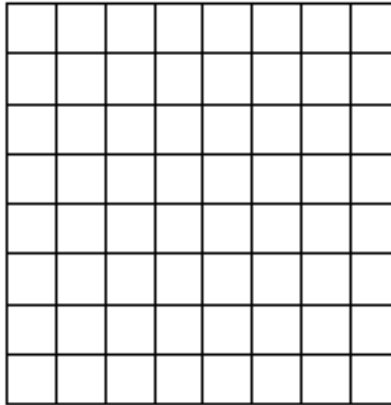
Describe this graph in words.

Choose two ordered pairs from the table and determine the rate of change.

Is y a function of x? Explain using the definition of a function.

Do the ordered pairs work in the equation $x = 70$? Can you graph this equation using your graphing calculator? Why or why not?

Zero and Undefined Rate of Change, cont.

Name_____

Identifying and Interpreting Slope

Determine whether the relationship shows a POSITIVE, NEGATIVE, ZERO, OR NO SLOPE.   Then explain.

	Positive, Neg, Zero, or No Slope?	How do you know?
$y = 4x + 5$		
$x = 4$		
Time (min): 0 2 4 6 8 Altitude (km): 12 10 8 6 4		
$2x + y = 10$		
Big Muscles Gym offers membership for $30 a month. You may work out as little or as much as you like.		
$f(x) = 25$		
(0, 1) (4, 1) (7, 1) (3, 1) (10, 1)		
Joe is gaining 2 lbs every 2 weeks.		
$y = -\dfrac{2}{3}x$		