CRITICAL TASK #2

FORMATIVE ASSESSMENT

March 2019

Grade Level	8th grade intensive mathematics
Topic and Learning Objectives	**Topics**: • Linear vs. nonlinear functions • Modeling with linear functions **Learning Objectives**: Students will • Distinguish between linear and nonlinear functions • Compare linear functions by discussing their slopes and initial values both graphically and algebraically • Create scenarios to model linear functions with different slopes in real-life contexts
Standards	**Content Standards**: • **MAFS.8.F.1.2**: 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. • **MAFS.8.F.1.3**: Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line. • **MAFS.8.F.2.4**: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. • **MAFS.8.F.2.5**: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. **ELL Standards**: • **ELD.K12.ELL.MA.1**: English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics. • **ELD.K12.ELL.SI.1**: English language learners communicate for social and instructional purposes within the school setting.

	FEAPs: • **FEAP 1d**: Selects appropriate formative assessments to monitor learning. • **FEAP 4b**: Designs and aligns formative and summative assessments that match learning objectives and lead to mastery. • **FEAP 4c**: Uses a variety of assessment tools to monitor student progress, achievement and learning gains.
Language Skills	**Reading**: • Read selection from Florida Glencoe Math, Course 3, Chapter 4, Lesson 7 on linear vs. nonlinear functions; informally assessed using a Kahoot review game **Listening**: • Listen, follow along, and take notes of Khan Academy video, "Linear & nonlinear functions: word problem" [03:34]; informally assessed using Kahoot review • Listen to peers as they discuss and brainstorm ideas for their scenario and linear model; informally assessed via teacher observation of student collaboration in groups, looking to see interaction and discussion with groupmates • Listen to other groups' presentations in order to compare one of these models to their own; formally assessed using a rubric **Speaking**: • Discuss with peers as they brainstorm ideas for their scenario and linear model; informally assessed in the students' groups as described above • Present their scenario and linear model to the class; this will be assessed formally, using a rubric **Writing**: • Create a scenario that incorporates the use of a linear model; formally assessed using a rubric • Compare and contrast their own linear model to another model that was presented in the class; formally assessed using a rubric
Language Components	**Semantics**: Assessing students' correct usage of relevant vocabulary terms (linear, nonlinear, rate of change, slope, y-intercept, positive, negative, zero, undefined). **Discourse**: Assessing students' ability to write a cohesive and coherent scenario (narration) that incorporates a linear function, specifying how that function models their scenario (exposition).

	Pragmatics: Assessing students' ability to discuss and brainstorm collaboratively with their peers in cooperative settings.
Vocabulary	Linear function, nonlinear function, rate of change, slope, initial value, positive slope, negative slope, zero slope, undefined slope
Proficiency Level	**Level IV—Expanding** Students possess language skills that are adequate for most day-to-day communication, although high contextual support may be needed for academic language production. They may make occasional significant errors, but their meaning can be understood in relation to the relevant content material. In addition, students may have to rephrase to be understood in new contexts, though they will generally be understood in familiar situations. *(Adapted from pg. 22, ELL Procedural Handbook, revised August 2016)*
BICS and CALP	**Basic Interpersonal Communication Skills (BICS)** The BICS will mostly be assessed informally through observation and oral questioning in the students' groups. The assessed BICS will include: • Reacts to social greetings • Listens closely to oral presentations and identifies details verbally and non-verbally • Asks questions using one- to two-word phrases • Shows use of vocabulary • Answers questions with appropriate simple sentence response • Keeps a vocabulary notebook • Breaks down unfamiliar words • Copies vocabulary • Expresses thoughts through illustrations • Writes one- to two-word responses • Writes familiar words and sentences without prompting **Cognitive Academic Language Proficiency (CALP)** The CALP will be assessed formally with rubrics for their class presentations, written scenario and model, and comparison between two linear models. The assessed CALP will include: • Follow directions for an academic text • Understands academic vocabulary • Comprehends multi-step directions • Listens to academic discourse and identifies main ideas and details • Uses academic vocabulary • Asks and answers questions about academic topics • Able to give short oral presentations • Participates freely in class discussion

	• Understands rules of punctuation and capitalization • Follows along during oral reading activities • Uses resources and text features to gather meaning • Understands the mechanics of writing (punctuations, paragraphs) • Generates simple sentences on academic topics • Writes short paragraphs
Bloom's Taxonomy	**Analysis**: Students will categorize equations according to their slopes and examine similarities and differences between the different types of slope. **Evaluation**: Students will compare their own linear model to a second linear model in the class and discuss the similarities and differences between the models, relating each to its respective context. **Creation**: Students will create a scenario using a linear function to model a real-life context.
Assessment	**Textbook and Khan Academy** • Students will read a selection from Florida Glencoe Math, Course 3, Chapter 4, Lesson 7 on linear vs. nonlinear functions; assessed using the Kahoot review • Students will then watch a Khan Academy video on linear and non-linear functions; assessed using the Kahoot Review. **RESOURCES:** Florida Glencoe Math, Course 3 Textbook Laptop computer with access to internet **ADMINISTRATION:** Whole Group At the beginning of class **DURATION:** 10-15 minutes to read and review the text lesson 3:34 minutes of video **ACCOMODATIONS:** Students will be able to use the online textbook version and utilize the text-to-speech option. ELL students will be able to read the transcript for the video and/or listen to the video in their home language.
	Kahoot Review • Based on their reading, students will participate in a Kahoot review session where students will be able to identify and demonstrate

	mastery of linear and non-linear functions represented in the form of equations, tables, and graphs. • https://create.kahoot.it/share/linear-vs-nonlinear-functions/ffb96d17-7fdc-49cc-9353-7935fd68ef38 **RESOURCES:** Personal cell phones or classroom laptops **ADMINISTRATION:** Students will complete the review in pairs, immediately after classroom discussion, following the text and Khan Academy video. **DURATION:** 7 questions will take approximately between 10-15 minutes. **ACCOMODATIONS:** ELL students can be paired with a non-ELL student
	Sorting Activity • Students will be given a sorting activity with multiple representations of linear and non-linear functions given an equation, a graph, a table, and a verbal description. Students will categorize the visual examples through an analysis of their properties and classifications. • Students will then complete a Venn Diagram graphic organizer to compare and contrast the linear functions and non-linear functions represented in the sorting activity. **RESOURCES:** Venn Diagram graphic organizer Sorting cards with visual representations of linear/non-linear functions **ADMINISTRATION:** Students will complete their sorting activity after the Kahoot review. Using the results of their activity, students will then complete their Venn Diagrams in pairs. **DURATION:** Students will have about 20 minutes to complete the sorting activity and 20 minutes to complete their Venn Diagrams. **ACCOMODATIONS:** Students will work in pairs to complete sorting activity and diagram. ELL students will be paired with a non-ELL student. ELL students will be able to use a translator.
	Scenario

	• Students will build scenarios constructing a function that models a linear relationship between two quantities. Students must determine the rate of change and initial value of the function, describe the relationship between x and y using a table and a graph, and present the function algebraically, graphically, in a table, and with a verbal description. • Students will interpret the rate of change and initial value of a linear function in terms of the situation it models, the graph, or a table of values as represented in their scenarios. **RESOURCES:** Paper and pencil Colored pencils or crayons Markers **ADMINISTRATION:** Students will brainstorm and begin working on their scenarios at home. Students will come back on Day 2 and continue to work on scenarios in class. **DURATION:** Students will have 30-45 minutes of class time to complete their scenarios before working on their presentations. **ACCOMODATIONS:** ELL students can continue to work in pairs with their non-ELL partner in class.
	Presentation • Students will be able to present using a poster board or a digital application using a computer. • Students will choose two examples of functions to present in different ways (algebraically, graphically, numerically in tables, or by verbal descriptions) from their scenarios. • Students will include a sketch of their graph and tables that exhibit qualitative features of a function and describe the function verbally. • Students will describe their examples qualitatively and discuss the functional relationship between two quantities on a graph. • Students will compare properties of the two examples of functions listed above in their presentations. **RESOURCES:** Poster paper and markers Laptop and presentation application **ADMINISTRATION:**

	Students will conclude these assessments in class immediately after completing scenarios. **DURATION:** Students will have an hour of class time to finish their presentations and work on the poster boards or presentation applications, e.g., PowerPoint, Sway, Excel, Prezi, etc. **ACCOMODATIONS:** Students will have the choice of how to present their analysis. Students will be able to continue to work in pairs. Students will have access to dictionaries and textbook glossaries to assist with their academic vocabulary terms.
Instructional Purposes	These assessment activities will be used to ensure that students have gained mastery of the learning objectives. They will also help identify any areas of difficulty for the students, which could be readdressed in future lessons. In addition, these activities include integration of literacy skills so that students engage with mathematics content in tandem with foundational literacy skills.
Instructions	**Reading Textbook:** • Highlight and annotate (modeled on Promethean) the textbook as we review the information. • Write down any key terms you are not familiar with or that you don't understand to review during the lesson. • Take notes in your composition notebooks of today's lesson. What I write down, you copy in your notebooks. **Khan Academy Video:** • Listen carefully and take notes while you watch the video. • Replay any section if you need to. • Read the transcript/subtitles of the video to help you gain understanding of the problem presented. **Sorting Activity:** • Sort the cards given by types of functions, including the types of slope (positive slope, negative slope, zero slope and undefined). • Use the sorted cards to compare and contrast between linear functions and non-linear functions. • Complete the Venn diagram to show similarities and differences between functions. **Scenario:** • Given your understanding of linear and non-linear relationships and functions, construct two examples/scenarios that represent a function.

	• Your examples must include: an equation, a table, a graph and a verbal description. • You should be able to interpret the rate of change and initial value of each function in terms of the situation it models, the graph, or a table of values as represented in your scenarios. **Presentation:** • Use the scenarios you've created and create a visual representation of each. • You may use the poster boards, crayons and markers provided, or you may use a digital application to create your presentation online (e.g., PowerPoint, Excel, Prezi, Sway). • Be creative in your presentations.
Scoring Instruments	**Rubric: Modeling with Linear Functions** to assess scenario and presentation (see below) **Rubric: Venn Diagram** used to assess comparison between functions following sorting activity (see below)
Justification of Scoring Instruments	An analytical rubric allows us to assess multiple criteria at once. It allows students to see differences in mastery of the learning objectives by assigning different point values to different achievement levels. As a result, students gain specific and detailed feedback about their scenarios and the applicability of their linear models to the real world. Therefore, students are assessed on their ability to compare properties of linear functions in multiple forms, construct and interpret a model of a linear function, and describe a function using a graph. This rubric is used to assess student mastery of content standards MAFS.8.F.1.2, MAFS.8.F.2.4, and MAFS.8.F.2.5, as well as the ELL standards. For the Venn diagram, a single-point rubric is used to assess the students. A single-point rubric allows the educator to quickly gauge student mastery (in this case, differentiating and distinguishing between linear and nonlinear functions). It also communicates clearly and directly to the students the expectations of the assessment. This rubric is used to assess student mastery of content standard MAFS.8.F.1.3.
Pros and Cons of Traditional Assessment	Mathematics teachers often rely on multiple-choice and other selected-response assessments to assess their students. These have many benefits. As described by James McMillan, multiple-choice items are "efficient and easy to score and grade" and "provide wide content sampling and coverage" (2018). As a result, students are assessed on a wide range of material that they are likely to encounter on an end-of-year summative assessment. In addition, because they are easy to score, teachers can focus their attention on remediation for future lessons by taking a quick look at their students' results to see what the students understood and which topics should be reviewed

	once again. Finally, multiple-choice tests have consistent reliability, which maintains objectivity in scoring. Despite its many benefits, a multiple-choice test "provides limited feedback to students" and "tends to focus on lower level cognitive skills" (McMillan, 2018). The extent of feedback to students is whether they got the item correct or incorrect, without explaining why that option was incorrect or providing a model of the correct problem-solving process. In addition, students are often asked to "solve for x" without justifying their answer or applying that knowledge to a real-life scenario. This focuses their attention on the lower levels of Bloom's Taxonomy (i.e., remembering and understanding), without extending their cognitive skills to the higher levels (e.g., evaluating and creating). Finally, student performance on multiple-choice tests is often "influenced by reading ability and testwiseness," which may lead ELLs to demonstrate lower mastery than they would otherwise (McMillan, 2018).
Pros and Cons of Alternative Assessment	In contrast to the traditional assessment, the alternative assessment, which would fall under the category of performance assessment, will "measure complex thinking targets" and "engage the students in active learning" (McMillan, 2018). Students must now access the upper levels of Bloom's Taxonomy by evaluating different linear functions and creating their own scenarios to model linear functions, rather than merely identifying a linear function among nonlinear functions. In addition, students must actively create and participate in a collaborative setting, which allows the educator to assess their skills and not just their ability to recall information. However, the alternative assessment will be more time-intensive to assess on the part of the educator, since many factors and facets will be assessed simultaneously. Additionally, due to the subjective nature of the assessment, reliability would be lower for the alternative assessment than it would be for the traditional assessment. Nevertheless, ensuring that the rubric is clear, with "multiple, specific criteria for judging success" may help the assessor remain as objective as possible (McMillan, 2018).

Works Cited

McMillan, J. (2018). *Classroom assessment: Principles and practice that enhance student learning and motivation.* New York, NY: Pearson

NAMES: _____ DATE: _____ PERIOD: _____

RUBRIC: MODELING WITH LINEAR FUNCTIONS

Criteria	4	3	2	1	Score
Equation	The x and y variables are identified correctly and used in a linear function with form $y = mx$ or $y = mx + b$.	The x and y variables are not clearly identified but are used correctly in a linear function with form $y = mx$ or $y = mx + b$.	The x and y variables are identified incorrectly but used in a linear function with form $y = mx$ or $y = mx + b$.	The x and y variables are identified incorrectly and not used in a linear function with form $y = mx$ or $y = mx + b$.	
Table of Values	A table of values with at least 5 points that have been labeled correctly as x and y terms is included.	A table of values with at least 3 points that have been labeled correctly as x and y terms is included.	A table of values with at least 1 point that has been labeled correctly as x and y terms is included.	A table of values is not included.	
Graph	The graph includes all 4 of these components: • Title • x- and y-axis, scaled appropriately • Represents a linear function • Correct initial value	The graph includes 3 of these components: • Title • x- and y-axis, scaled appropriately • Represents a linear function • Correct initial value	The graph includes 2 of these components: • Title • x- and y-axis, scaled appropriately • Represents a linear function • Correct initial value	The graph includes 0-1 of these components: • Title • x- and y-axis, scaled appropriately • Represents a linear function • Correct initial value	
Verbal Description	A verbal description is included that expresses the linear model in words and identifies the variables using correct vocabulary, sentence structure, and punctuation.	A verbal description is included that expresses the linear model in words and uses mostly correct vocabulary, sentence structure, and punctuation.	A verbal description is included that uses mostly correct vocabulary, sentence structure, and punctuation but does not express a linear model.	A verbal description is not included.	
Creativity	The scenario is interesting and models a real-world context. The presentation is colorful and engaging.	The scenario models a real-world context, and the presentation is colorful and/or engaging.	The scenario does not model a real-world context, but the presentation is colorful and/or engaging.	The scenario does not model a real-world context, and the presentation is boring and lacks color.	
Collaboration	Students use all of their time to work with their partner productively and efficiently.	Students use most of their time to work with their partner productively and efficiently.	Students use some of their time to work with their partner productively and efficiently.	Students do not use their time to work with their partner productively and efficiently or are off task.	
Presentation	*1 point earned for each criterion met below:* Each student speaks during the presentation (1 point per student); scenario is read; model is fully explained; delivery is somewhat energetic and interesting; communication is clear				

Comments:

TOTAL: _____/30

RUBRIC: VENN DIAGRAM

YES	CRITERIA	NO
	1 point for each similarity:	
	• Similarity #1	
	• Similarity #2	
	• Similarity #3	
	• Similarity #4	
	2 points for each pair of differences:	
	• Pair of Differences #1	
	• Pair of Differences #2	
	• Pair of Differences #3	
	TOTAL	**_____ / 10**