Inspect

CCR Performance Task

Math Grade 8: Patterns and Linear Functions

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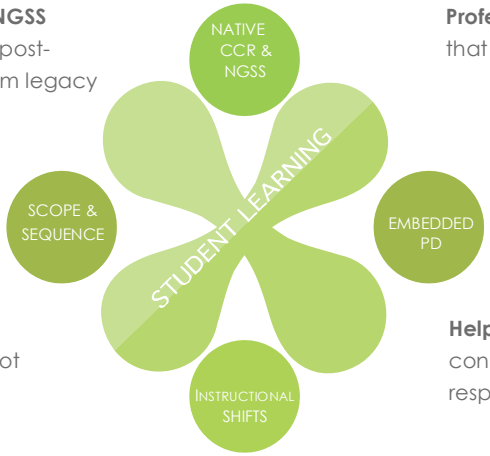
Inspect assessment content offers these benefits:

Native college- and career-ready and NGSS content prepares students to meet their post-secondary goals. Content re-aligned from legacy standards cannot do this.



Professional development embedded within content that

- shows the relationship between specific skills and higher-order thinking
- includes authentic, permissioned texts of appropriate complexity
- and documents student progress using DOK and learning progressions

Content that addresses your scope and sequence so that your assessments do not waste valuable instruction time

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CCR Performance Tasks

Math Grade 8: Patterns and Linear Functions

Student Test Booklet

Name:

Student Rubric

This problem is meant to test if you can:
- Identify a rule or a pattern that allows you to find missing values in a table;
- Look at functions presented in multiple ways and compare rates of change;
- Interpret the rate of change of a function in terms of the real-world situation.

Your teacher will rate your answer as a level 4, 3, 2, 1, or 0. The descriptions below explain the types of answers expected at each level.

Level 4:
Your answer is correct and complete.
Your answer includes:
- The table filled in with the correct values along with a correct rule or pattern;
- An accurate graph;
- A correct solution to the problem, with correct and complete work shown, and a correct explanation;
- A correct interpretation and application of the rates of change of the functions.

Level 3:
Your answer is correct but one or two of your explanations are incomplete or you have made minor calculation mistakes.
Your answer includes:
- The table filled out with no more than one minor error with a correct rule;
- An accurate graph;
- A correct solution to the problem with correct but possibly incomplete work and explanation provided;
- A correct interpretation of the rates of change of the functions, although the explanation may be incomplete.

Level 2:
You have answered one part correctly but your explanations are missing or weak.
Your answer includes:
- A table that contains several errors with a description of a rule that may be incomplete;
- A graph that contains several minor errors;
- An incomplete or partially incorrect solution to the problem;
- A partially correct but possibly vague or incomplete interpretation and explanation of the rates of change.

Level 1:
Your answers are incorrect.
Your answer includes:
- A table that contains several major errors with an incorrect rule;
- A graph that contains several major errors;
- An incorrect solution to the problem;
- An incorrect interpretation of the rates of change of the functions.

Level 0:
Your answer is not related to the question, the teacher cannot understand your answer, or you do not write anything.

Name:_____

Math Grade 8: Patterns and Linear Functions

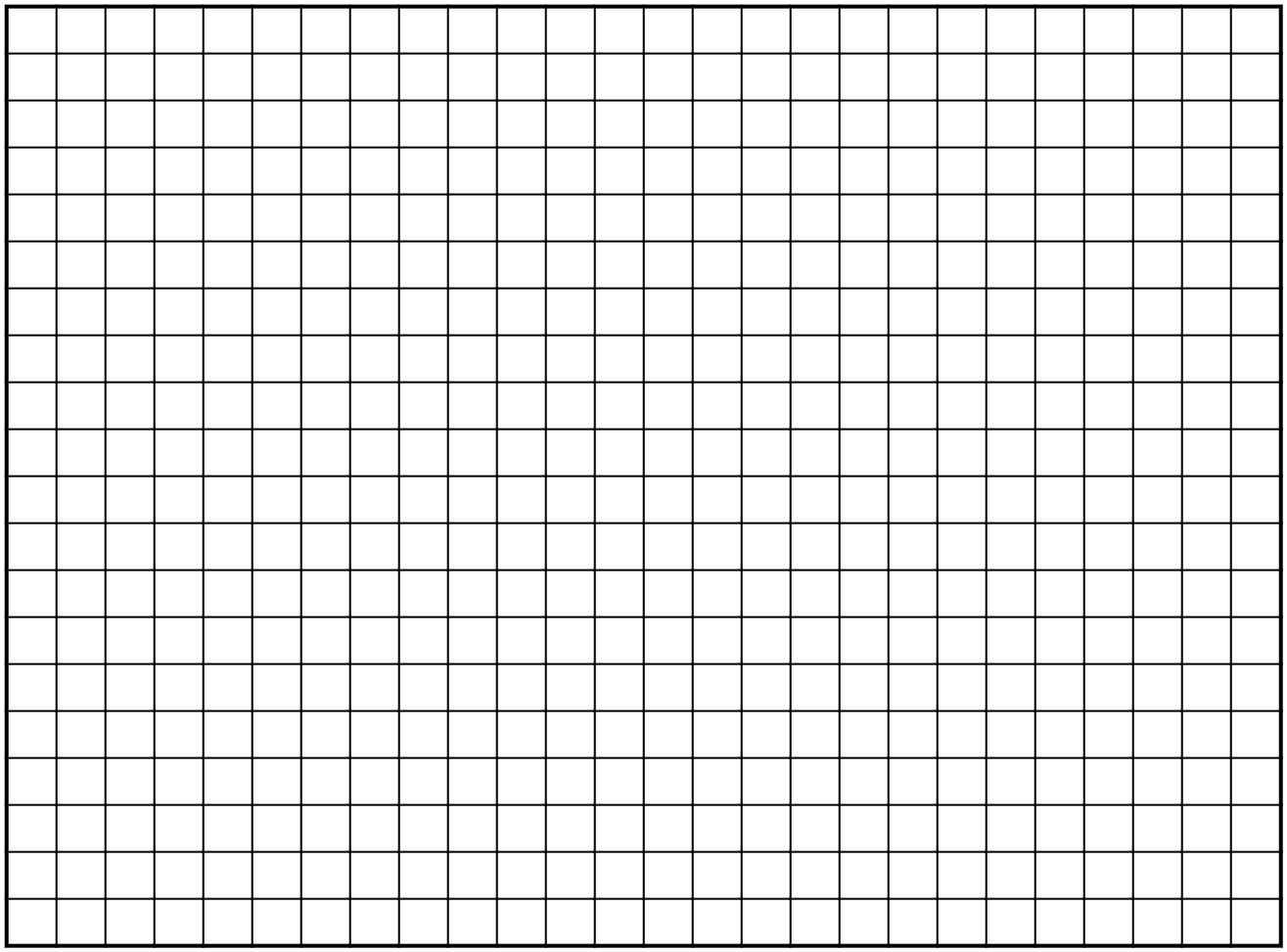
Complete all the tasks in the test booklet.

1 **Derrick owns a farm and sells produce at a local market. He sells 10 cucumbers for $3.00.**

A. Complete the table below that shows the prices for various numbers of cucumbers. Describe a rule or pattern for the values in the table.

Number of Cucumbers	Price
5	
10	$3.00
	$4.50
20	
	$7.50

B. Draw a graph of the function that describes the relationship between the number of cucumbers and the price.



C. Derrick also sells tomatoes at the market. The relationship between the number of tomatoes, *t*, and the price of the tomatoes, *p*, is described by the function below.

$$p = \frac{2}{5}t$$

Which has the greatest rate of change: the function relating number of cucumbers to price or the function relating number of tomatoes to price? Show your work or explain your answer.

D. What does the rate of change of each function represent in terms of the real-world situation? Explain how a shopper can use this information to compare Derrick's prices to the prices another farmer is charging.

STOP

CCR Performance Tasks

Math Grade 8: Patterns and Linear Functions

Teacher Guide

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About the Teacher Guide

This document contains support materials for “Math Grade 8: Patterns and Linear Functions.” This includes:

(a) The task
(b) The standards and depth of knowledge level of the task
(c) The scoring rubric
(d) Discussion questions
(e) Extension activities

These specifications have been included to help you connect the task to the Common Core content standards and the standards for mathematical practice. The rubric is designed to help you look for the development of mathematical practices in student work. It is also here to help you look for consistencies in student content errors that can help guide intervention and re-teach strategies.

Test Definition File

Item #	Correct Answer	Practice Standard	Content Standards
1	See Scoring Rubric	Mathematical Practice 8	8.F.1, 8.F.2, 8.F.4

SBAC Claims	PARCC Sub-Claims
1 and 4	A, B, and D

Performance Task

Derrick owns a farm and sells produce at a local market. He sells 10 cucumbers for $3.00.

A. Complete the table below that shows the prices for various numbers of cucumbers. Describe a rule or pattern for the values in the table.

Number of Cucumbers	Price
5	
10	$3.00
	$4.50
20	
	$7.50

B. Draw a graph of the function that describes the relationship between the number of cucumbers and the price.

C. Derrick also sells tomatoes at the market. The relationship between the number of tomatoes, *t*, and the price of the tomatoes, *p*, is described by the function below.

$$p = \frac{2}{5}t$$

Which has the greatest rate of change: the function relating number of cucumbers to price or the function relating number of tomatoes to price? Show your work or explain your answer.

D. What does the rate of change of each function represent in terms of the real-world situation? Explain how a shopper can use this information to compare Derrick's prices to the prices another farmer is charging.

Standards Alignment

Practice Standards

MP8 > DOK 3

Look for and express regularity in repeated reasoning. -- Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Content Standards

8.F.1

Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.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.F.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.

SBAC Claims

Mathematics Claim #1:
Concepts and Procedures. Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.

Mathematics Claim #4:
Modeling and Data Analysis. Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

PARCC Sub Claims

Sub Claim A:
Major Content with Connections to Practices. The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.

Sub Claim B:
Additional and Supporting Content with Connections to Practices. The student solves problems involving the Additional and Supporting Content for her grade/course with connections to the Standards for Mathematical Practice.

Sub Claim D:

Highlighted Practice MP.4 with Connections to Content: modeling/application. The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or, for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them (MP.1), reasoning abstractly and quantitatively (MP.2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).

Scoring Rubric

4 Point Response:

The response demonstrates a high level of understanding. A level 4 response is characterized by:

- The ability to identify repeated calculations and create shortcuts to use to obtain values;
- A strong understanding of graphing functions;
- The ability to determine the rates of change for functions presented in multiple ways;
- The ability to interpret and apply the rate of change in terms of the situation it models.

A level 4 response includes:

- A table that is completed correctly and an accurate description or rule for the pattern of values within the table;
- An accurate graph with accurate axis titles. (The student may add a graph title, but this element is not required);
- A correct answer to the problem of which has the greatest rate of change, with correct and complete work shown or a correct explanation;
- A correct interpretation and application of the rate of change in terms of this situation.

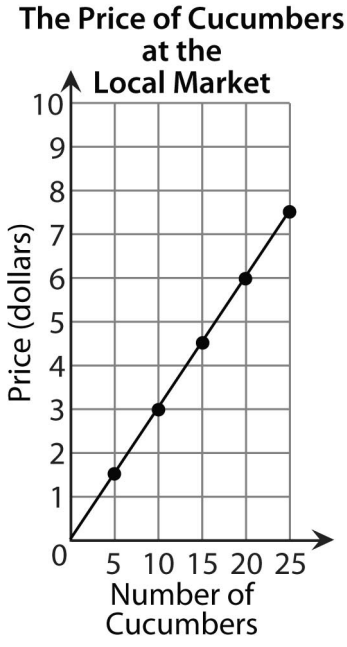
A sample level 4 response follows.

Part A:

Number of Cucumbers	Price
5	$1.50
10	$3.00
15	$4.50
20	$6.00
25	$7.50

"The pattern that I found in the table is that the price increases $1.50 every time five more cucumbers are added."

Part B:



Part C:

"The relationship between the number of tomatoes and the price has the greatest rate of change. Its rate of change is $\frac{2}{5}$ or 0.4. The rate of change is also the slope of a line. Since the equation $p=\frac{2}{5}t$ is in slope-intercept form, the slope is $\frac{2}{5}$ or 0.4. To find the slope of the cucumber line, I chose two points on that line and found the slope. Using (5,1.50) and (10,3.00), I found $m = \frac{(3.00 - 1.50)}{(10 - 5)} = \frac{1.5}{5}$ or $m = \frac{3}{10}$ or 0.3."

Part D:

"The rate of change for each function is the price of an individual cucumber or tomato, in dollars. So Derrick charges $0.40 for a single tomato and $0.30 for a single cucumber. Shoppers can use this information to compare against what other farmers are charging for single cucumbers and tomatoes."

3 Point Response:
The response demonstrates a strong understanding, but the work contains minor errors. A level 3 response is characterized by:

- The ability to identify repeated calculations and create shortcuts to use to obtain values, although the table may contain one minor error;
- A strong understanding of graphing functions although axis labels may be missing;
- The ability to determine the rates of change for functions presented in multiple ways, although the explanation may be incomplete, or the work may contain minor calculation errors;
- The ability to interpret the rate of change in terms of the situation it models, although the explanation may be incomplete.

2 Point Response:
The response demonstrates a basic but incomplete understanding. A level 2 response is characterized by:

- A basic ability to identify repeated calculations and create shortcuts to use to obtain values. The description of the rule may be incomplete;
- A basic understanding of graphing functions. The axis titles may be missing and the scales may have minor inconsistencies;
- A basic ability to determine the rates of change for functions presented in multiple ways. The explanation may be incomplete or vague, and may include an incorrect answer due to calculation errors, but the setup indicates a basic understanding of how to solve the problem;
- A basic understanding of what the rates of change of the functions represent in real-world terms, although the explanation may be vague or missing.

1 Point Response:
The response demonstrates minimal understanding. A level 1 response is characterized by:

- A weak ability to identify repeated calculations and create shortcuts to use to obtain values. The rule or pattern is incorrect;
- Little or no understanding of graphing linear functions. The student may not be able to connect the table of values with the graph;
- A weak ability to determine the rates of change for functions presented in multiple ways. The explanation contains errors, and the steps do not follow logically from one to another;
- Little or no understanding of how the rates of change of the functions relate to the real-world situation.
- The response to part D may be incorrect or missing.

0 Point Response:
There is no response, or the response is off topic.

Discussion Questions

Use the following questions to help students struggling to access the problem:

1. Describe a situation you have encountered in which one variable is a function of another variable.

Answers will vary, as every student is likely to have different examples from his or her life. In describing the situation, though, the student should mention a situation in which one of the variables is dependent on the other variable. Also, in each situation there must be one and only one dependent value for every independent value. Some examples include the price of gas and the number of gallons of gas, or the number of petals and the number of flowers.

2. What are some ways that you can represent these situations?

Possible response: *You can use a table, or a graph, or an equation.*

3. What is the unit rate of change of a function?

Possible response: *The unit rate tells how much one variable increases (or decreases) when the other variable increases by one unit.*

Extension Activities

Extending the understanding of linear compared to nonlinear relationships.

1. In this task, the relationship between the price and the number of cucumbers or tomatoes is a linear relationship. Frequently, though, you can buy items at a discounted price when you buy the item in larger quantities. Suppose the price for 5 cucumbers is $0.30 per cucumber, but the price for 10-20 cucumbers is $0.25 per cucumber, and the price for more than 20 cucumbers is $0.20 per cucumber. Can the relationship between the price and the number of cucumbers still be modeled by a linear function? Why or why not?

Sample response: *If the price per individual cucumber changes, then the slope changes and it's not a linear function. If you graph this function, it has three pieces; each piece is linear (while the price per cucumber is the same), but you cannot use a single linear function to model the price for any number of cucumbers.*

2. Identify a few instances in real life that can be modeled by a linear function.

Sample responses:

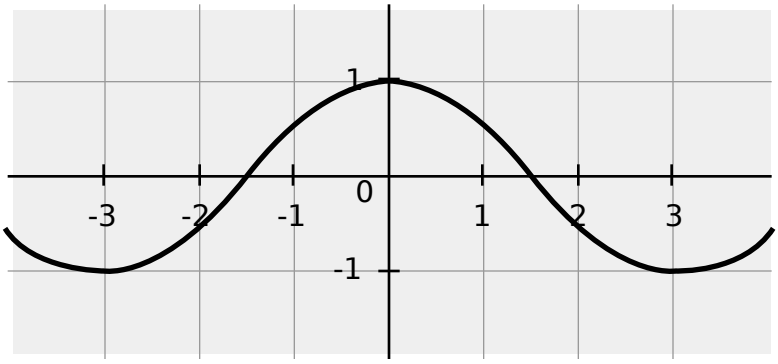
- *Converting hours to minutes can be modeled by a linear function. If we let y represent the number of minutes and x represent the number of hours, then y = 60x can be used to find the hours-to-minute conversion since there are 60 minutes in each hour.*
- *Calculating travel times can also be modeled by a linear function. If we know that it takes 20 minutes for someone to walk a mile, then we can use the linear function t = 20d, where t is the time in minutes and d is the distance walked in miles, to find out how long it takes to walk other distances.*

3. Are the following relationships linear or nonlinear? Explain. If the relationship is linear, identify the unit rate.

A.

x	***y***
1	1
2	4
3	9
4	16
5	25

B.



C. The relationship between the number of identical candies in a jar and their total weight.

D. A video game rental store uses the equation $p = 3.5v + 0.5$ (where p = price and v = the number of video games rented) to calculate the price to rent video games.

E. A DVD rental service charges $7.99 a month for unlimited movie rentals.

Sample responses:

A. *This is not a linear relationship. While the interval between each x-value in the table is constant at 1, the interval between the y-values increases. Therefore, there is not a constant rate of increase.*

B. *This is not a linear relationship. You can see the graph forms a curved rather than a straight line. Therefore, this is not a linear relationship.*

C. *This is a linear relationship. Since the candies are identical, it is reasonable to assume that each has the same weight. As the number of candies increases incrementally, their weight increases at a constant rate. The unit rate in this relationship is the weight of one candy.*

D. *This is a linear equation. If we graph this equation, the result is a straight line that intersects the y-axis at 0.5 and extends up and to the right. The unit rate in this example is 3.5.*

E. *This is a linear relationship. In this example, it does not matter how many DVDs you rent in a month because you are always charged $7.99. If you rent one DVD, your monthly cost is $7.99. If you rent 2 DVDs, your monthly cost is $7.99. If you rent 3 DVDs, your monthly cost is still $7.99, and so on. The graph is a horizontal line that crosses the y-axis at 7.99. The unit rate here is 0.*