

Inspect

CCR Performance Tasks

**Math Grade 7: Represent Relationships to
Solve Problems**

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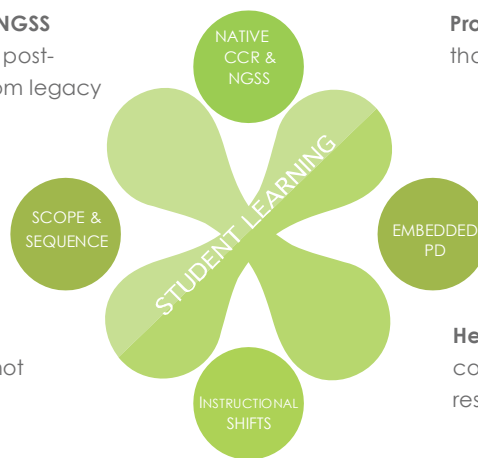
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Inspect Assessment Content is available through a variety of assessment administration and data analysis platforms.

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.

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



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

Help for teachers addressing the instructional shifts with content that elicits evidence of learning from each response

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CCR Performance Tasks

Math Grade 7: Represent Relationships to Solve Problems

Student Test Booklet

Name: _____

Math Grade 7: Represent Relationships to Solve Problems

Student Rubric

This problem is meant to test if you can:

- Recognize if a table of values does or does not represent a proportion, and explain why or why not;
- Use tables, graphs, or equations to solve problems, and justify that your work is correct.

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:

- An accurate graph, with all points from the table represented on the graph;
- At least one correct and complete explanation of why a relationship is proportional or not;
- A correct solution to the problem, with correct and complete work shown.

Level 3:

Your answer is correct, but one or two of your explanations are incomplete.

Your answer includes:

- An accurate graph that contains no more than two minor errors;
- A correct but perhaps incomplete explanation of why a relationship is proportional or not;
- A correct solution to the problem with correct but possibly incomplete work shown.

Level 2:

You have answered only one part, or you have some errors in both parts.

Your answer may include:

- A graph that contains several minor errors or major errors;
- An incomplete or partially incorrect explanation of why a relationship is proportional or not;
- An incomplete or partially incorrect solution to the problem.

Level 1:

Your answers are incorrect.

Your answer may include:

- A graph that contains several major errors;
- An incorrect explanation of why a relationship is proportional or not;
- An incorrect solution to the problem.

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 7: Represent Relationships to Solve Problems

Complete all the tasks in the test booklet.

- 1

Jonathan and his family took a road trip. The table below shows the family’s distance from home at various times.

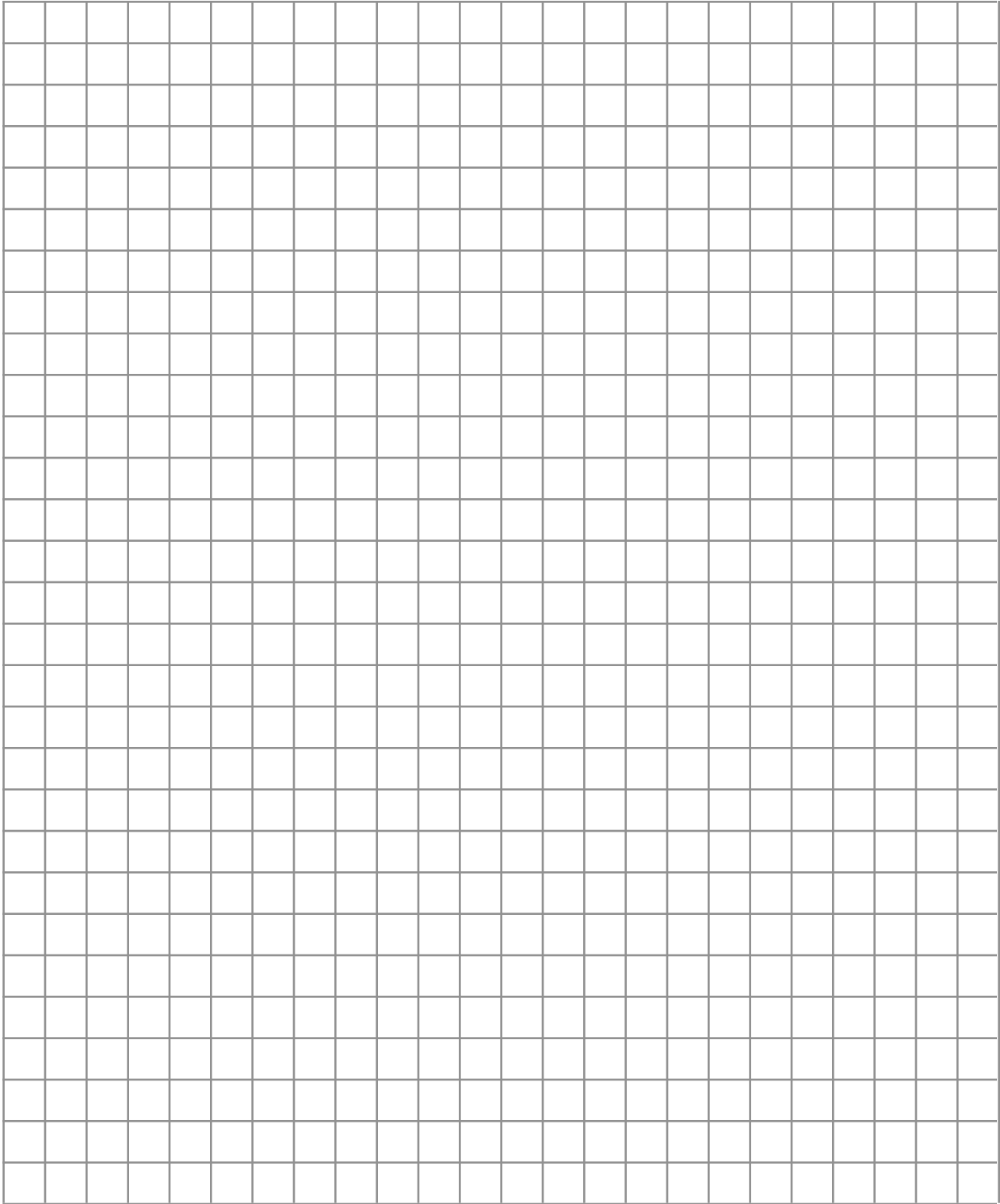
Time (minutes)	Distance (miles)
0	0
15	12
45	36
65	52
90	72
100	80
120	96

- A. Create a graph of this data. Use the graph paper on the next page.

Go On

Name: _____

Math Grade 7: Represent Relationships to Solve Problems



Go On

Math Grade 7: Represent Relationships to Solve Problems

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is a vertical margin line on the left side, creating a narrow left margin. The paper appears to be from a notebook or a standard ruled sheet of paper.

Date	Time	Location	Weather	Temperature	Humidity	Wind Speed	Wind Direction	Notes



CCR Performance Tasks

Math Grade 7: Represent Relationships to Solve Problems

Teacher Guide

About the Teacher Guide

This document contains support materials for “Grade 7: Represent Relationships to Solve Problems.” 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 reteach strategies.

Test Definition File

Item #	Correct Answer	Practice Standard	Content Standards
1	See Scoring Rubric	Mathematical Practice 1	7.RP.2, 7.RP.3

SBAC Claims	PARCC Sub-Claims
1 and 2	A and D

Performance Task

Jonathan and his family took a road trip. The table below shows the family's distance from home at various times.

Time (minutes)	Distance (miles)
0	0
15	12
45	36
65	52
90	72
100	80
120	96

- A. Create a graph of this data.
- B. Is the relationship between time and distance proportional? Explain how you know. Use information from the table and from the graph you drew to support your answer.
- C. Calculate how many miles from home Jonathan and his family were after 1 hour. Show all of your work.

Standards Alignment

Practice Standards

MP1 > DOK 3

Make sense of problems and persevere in solving them. -- Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Content Standards

7.RP.2

Recognize and represent proportional relationships between quantities.

- Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
- Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p , the relationship between the total cost and the number of items can be expressed as $t = pn$.*
- Explain what a point (x,y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0,0)$ and $(1, r)$, where r is the unit rate.

7.RP.3

Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

Math Grade 7: Represent Relationships to Solve Problems

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 #2:

Problem Solving. Students can solve a range of complex, well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies.

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 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 student response demonstrates:

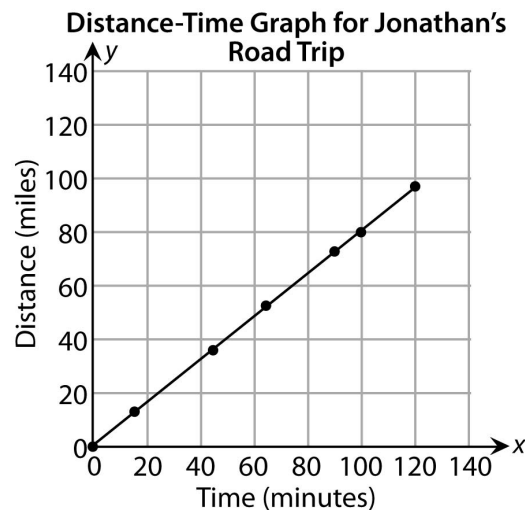
- The ability to recognize a proportional relationship and explain why the situation represents a proportion;
- A strong understanding of multiple representations for proportional situations;
- The ability to solve a proportional problem using a table of values, a graph, or an equation.

A level 4 response should include:

- An accurate graph, with all points from the table represented on the graph, and accurate axis titles. (The student may connect the points with a straight line or add a graph title, but these elements are not required);
- At least one correct and complete explanation as to why the relationships are proportional;
- A correct answer to the problem of how far Jonathan and his family are from home after 1 hour, with correct and complete work shown.

A sample level 4 response follows.

Part A: "I turned each row of the table into an ordered pair to get (0,0), (15,12), (45,36), and so on, up to (120,96). I then plotted those points, with the first coordinate on the x-axis and the second coordinate on the y-axis. I then connected the points, because they were also driving during times that weren't listed in the table."



Part B: "From the table, the first row shows that the situation starts at (0,0), which is a requirement for a proportion. In addition, the ratio of time to distance for each row is constant. For instance, $15/12 = 45/36 = 65/52$. In every case, the ratio is equal to $5/4$. In the graph, all the points occur along a straight line. Because the line passes through the origin and there is a constant slope, that also indicates that it's a proportion."

Part C, sample 1: "From the graph, it can be seen that the distance at 60 minutes was 48 miles."

Part C, sample 2: "This can be solved with a proportion. Since the ratio of time to distance is constant, any row of values from the table can be used. I used (15,12), and then the proportion is $15/12 = 60/x$. Solving this equation gives $x = 48$, so Jonathan and his family were 48 miles from home when they were 1 hour into the trip."

Part C, sample 3: "The points on the graph form a straight line. Because the ratio of distance to time is $4/5$ in every row of the table, the slope of the line is $\frac{4}{5}$. This means that $d = \frac{4}{5}t$. So when $t = 60$, $d = \frac{4}{5}(60) = 48$. Therefore, Jonathan and his family were 48 miles from home when they were 1 hour into the trip."

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3 Point Response:

The response demonstrates a strong understanding, but some work or explanations are incomplete. A level 3 response is characterized by:

- The ability to recognize a proportional relationship and explain why the relationship is proportional, although the explanation may be incomplete;
- A strong understanding of multiple representations for proportional situations;
- The ability to solve a proportional problem using a table of values, a graph, or an equation, but the work 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 recognize a proportion but a weak ability to explain why a relationship is proportional. The explanation in part B may be vague, missing, or contain errors;
- A basic ability to represent a proportional relationship. The graph is basically correct but may be incomplete.
- A basic ability to solve a proportional problem using a table of values, a graph, or an equation. The work may be incomplete or vague, and the student may have found an incorrect answer due to calculation errors, but the setup indicates a basic understanding of how to solve a proportion.

1 Point Response:

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

- An extremely weak ability to recognize a proportion. The explanation may contain misstatements and incorrect reasoning, and it may demonstrate misconceptions about proportional relationships;
- Little or no understanding of multiple representations for proportional situations. The student may not be able to connect the table of values with a graph or an equation;
- An inability to solve a proportional problem using any method. The student's work may contain incorrect procedures and equations, and steps do not follow logically from one to another.

0 Point Response:

There is no response, or the response is off topic.

Discussion Questions

Use the following questions to stimulate discussion:

1. Tell me about a proportional situation that you've encountered. How do you know that the two variables are in proportion?

Possible Response: *Answers will vary, as every student will have different examples from their lives. But in describing why the situation is proportional, the student should mention that a graph of the situation passes through the origin (that is, when one variable has a value of 0, the other variable has a value of 0, too) and that an increase (or decrease) in one variable corresponds to an increase (or decrease) in the other variable; moreover, the ratio of the variables is constant.*

2. Can you explain why a student might look at this table of values and think that it does NOT represent a proportional relationship?

Possible Response: *The values in the first column of the table do not increase by a constant amount. Consequently, this set of data does not look like a proportional relationship that may have been seen in other contexts. In addition, there are not two pairs of consecutive points from the table that have the same time difference; therefore, a student may have difficulty recognizing that the ratio is constant.*

3. The last question asks for the distance from home after 1 hour, but the times in the table are given in minutes. How do you account for this difference when solving the problem?

Possible Response: *Since 1 hour = 60 minutes, you can use $t = 60$ to solve the problem. Alternatively, you can convert all time values in the table to hours; for instance, 15 minutes = $\frac{1}{4}$ hour. Either method works, since in each case the situation still represents a proportion.*

Extension Activities

1. Developing an intuitive understanding about proportions by considering proportions in other contexts.

A. Develop a list of other situations that represent proportions.

Examples include gasoline has a constant price of \$3.59 per gallon, a car travels at a constant speed of 60 mph, and a person deposits \$50 in his bank account (which receives no interest) every week.

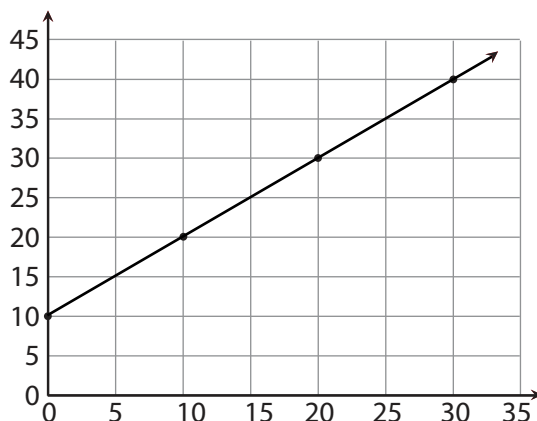
2. Developing a deeper understanding of proportional relationships by examining relationships that are not proportional.

A. Generate a table of values that are not in proportion.

Example values include (0,10), (10,20), (20,30), and (30,40).

B. Generate a graph that shows a line but that does not show a proportion.

For example, using the values from the previous answer gives the following graph. It is not a proportion because it does not pass through the origin.



C. Discuss why the equation $d = 3t$ represents a proportion but $d = 6t + 2$ does not.

For example, the first equation represents a straight line that passes through the origin. Although the second equation also represents a straight line, it does not pass through the origin.