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

Content Domain: **Expressions and Equations**

Target C [m]: Understand the connections between proportional relationships, lines, and linear equations. (DOK Levels 1, 2)

Tasks for this target will ask students to graph one or more proportional relationships and connect the unit rate(s) to the context of the problem.

Other tasks will ask students to apply understanding of the relationship between similar triangles and slope.

Standards: 8.EE.B, 8.EE.5, 8.EE.6	**8.EE.B Understand the connections between proportional relationships, lines, and linear equations.** **8.EE.5** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* **8.EE.6** Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling: 7.EE.B, 7.EE.3, 7.RP.A,7.RP.2 F-IF.C, F-IF.7, F-IF.8, F-IF.9	**Related Grade 7 Standards** **7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** **7.EE.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.* **7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems.** **7.RP.2** Recognize and represent proportional relationships between quantities. a. 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. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions. c. 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. d. 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. **Related High School Standards** **F-IF.C Analyze functions using different representations.** **F-IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F-IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.* **F-IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
DOK Level:	1, 2
Achievement Level Descriptors:	
RANGE Achievement Level Descriptor (Range ALD) Target C: Understand the connections between proportional relationships, lines,	**Level 1** Students should be able to graph a proportional relationship on a coordinate plane.
	Level 2 Students should be able to compare two different proportional relationships represented in different ways. They should also be able to calculate the slope of a line and identify the *y*-intercept of a line.
	Level 3 Students should understand that slope is a unit rate of change in a proportional relationship, and convert proportional relationships to linear equations in slope-intercept form while also

and linear equations.	understanding when and why the y-intercept is zero. They should also be able to use repeated reasoning to observe that they can use any right triangle to find the slope of a line.
	Level 4 Students should be able to use similar triangles to explain why the slope is the same between any two distinct points on a non-vertical line in a coordinate plane.
Evidence Required:	1. The student graphs proportional relationships. 2. The student interprets the unit rate as the slope of the graph of a proportional relationship. 3. The student compares two different proportional relationships represented in different formats. 4. The student uses similar triangles to determine that the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. 5. The student finds the equation $y = mx$ or $y = mx + b$ for a line.
Allowable Response Types:	Multiple Choice, single correct response; Equation/Numeric; Graphing
Allowable Stimulus Materials:	graphs, tables, equations, verbal descriptions
Construct-Relevant Vocabulary:	proportional relationship, unit rate, slope, y-intercept, similar triangles, origin, coordinate plane, ordered pairs
Allowable Tools:	None
Accessibility Concerns:	Visual graphics may be difficult or not accessible for students who are blind or visually impaired. Reviewing tactile graphs and tables may be time consuming but not prohibitive. The simplest graphics should be used to minimize this issue. Students with dyscalculia may have difficulty with the calculations. Students with visual perceptual disabilities may struggle with answer choices that contain complex number sentences. Students who are visually impaired or blind may need enlarged or brailled text. Students with reading disabilities may struggle with the reading load of word problems. All vocabulary should be at or below grade level to minimize this issue. Students with reading disabilities may need to read the text aloud, or have access to trackers or maskers to follow along. Students with visual processing impairments may benefit from using a tracker or masker when reading. Drag and Drop response types may not be accessible for students who are visually impaired. Consider replacing these response types with multiple choice items for Braille versions. The accommodations listed here are suggestions and could be altered depending on what accommodations will be allowable.
Development Notes:	Tasks for this target will ask students to compare two different proportional relationships presented in different formats. Many of these tasks will contribute evidence to Claims 2 and 4.

Task Model 1

Response Type: Graphing

DOK Level 1

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

Evidence Required:

1. The student graphs proportional relationships.

2. The student interprets the unit rate as the slope of the graph of a proportional relationship.

Tools: None

Prompt Features: The student is prompted to create a graph of a proportional relationship.

Stimulus Guidelines:

- Unit rates can be whole numbers, fractions, or decimals.
- Tables should have four to six rows of data.
- If used, context must be realistic and familiar to students 13 to 15 years old.
- Coordinate graphs for real-world contexts will be limited to Quadrant I.
- x- and y-axes of graphs should be labeled with an appropriate scale and units.
- Equations should be in the form $y = mx$.
- Item difficulty can be adjusted via these example methods:
  - Students graph a proportional relationship from values in a table or an equation.
  - Students graph a proportional relationship from a verbal statement.
  - Unit rate is a whole number, fraction, or decimal.

TM1

Stimulus: The student is presented with a proportional relationship that may be represented as a verbal statement, table, or equation.

Example Stem 1: The cost (c) for p pounds of meat is shown in the table.

p	*c*
3	15
5	25
7	35
9	45
10	50

Use the Add Arrow tool to graph the proportional relationship between the number of pounds of meat and the total cost.

Example Stem 2: Meat costs $5.00 per pound at a store.

Use the Add Arrow tool to graph the proportional relationship between the number of pounds of meat and the total cost.

Example Stem 3: The cost (c) for p pounds of meat can be represented by the equation $c = 5p$.

Use the Add Arrow tool to graph the proportional relationship between the number of pounds of meat and the total cost.

Interaction: Student is given a coordinate plane with axes labeled. The Add Point, Add Arrow, and Delete tools are provided to draw the line.

Rubric: (1 point) Student creates a line with the correct slope.

Response Type: Graphing

Task Model 2

Response Type: Multiple Choice, single correct response

DOK Level 2

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

Evidence Required:
2. The student interprets the unit rate as the slope of the graph of a proportional relationship.

Tools: None

Prompt Features: The student is prompted to identify and interpret the unit rate of a graph.

Stimulus Guidelines:

- Context must be realistic and familiar to students 13 to 15 years old.
- Graphs should contain a line through the origin.
- Item difficulty can be adjusted via these example methods:
  - Unit rates can be whole numbers, fractions, or decimals.
  - Scale on graph can be in different increments.

TM2

Stimulus: The student is presented with a graph of a proportional relationship.

Example Stem: This graph shows a proportional relationship between the amount of money in Jack's savings account and the number of weeks Jack has been saving money.

Which statement identifies the correct slope, and the correct interpretation of the slope for this situation?

A. The slope of the line is $\frac{6}{1}$, so Jack's savings rate is \$6 dollars every week.
B. The slope of the line is $\frac{6}{1}$, so Jack's savings rate is \$1 dollar every 6 weeks.
C. The slope of the line is $\frac{1}{6}$, so Jack's savings rate is \$6 dollars every week.
D. The slope of the line is $\frac{1}{6}$, so Jack's savings rate is \$1 dollars every 6 weeks.

Rubric: (1 point) Student identifies the correct statement of the slope of the graph (e.g., A).

Response Type: Multiple Choice, single correct response

Task Model 3

Response Type: Multiple Choice, single correct response

DOK Level 2

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

Evidence Required:
3. The student will compare two different proportional relationships presented in different formats.

Tools: None

Prompt Features: The student is prompted to compare two proportional relationships given in different formats.

Stimulus Guidelines:

- Equations should be in the form $y = mx$.
- Tables should have three to five rows of data.
- If used, context must be realistic and familiar to students 13 to 15 years old.
- Graphs in preamble should contain a line through the origin.
- Item difficulty can be adjusted via these example methods:
  - Unit rates can be whole numbers, fractions, or decimals
  - Students make a comparison between proportional relationships presented in a table and a graph (unit rate is a whole number).
  - Students make a comparison between proportional relationships presented in an equation and a table (unit rate is a fraction/decimal).
  - Students make a comparison between proportional relationships presented in a graph and an equation (unit rate is a fraction/decimal).

TM3a
Stimulus: The student is presented with a proportional relationship that may be represented as a graph, equation, or table.

Example Stem: The table shows the proportional relationship between the cost (c) of meat and the weight in pounds (p) at Lane Grocery Store.

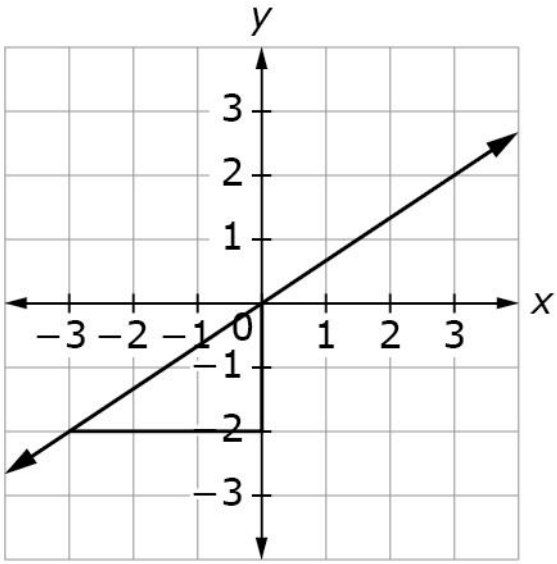
p	***c***
3	15
5	25
7	35
9	45
10	50

Select the equation which shows a cost of meat per pound that is twice the cost of meat per pound than at Lane Grocery Store.

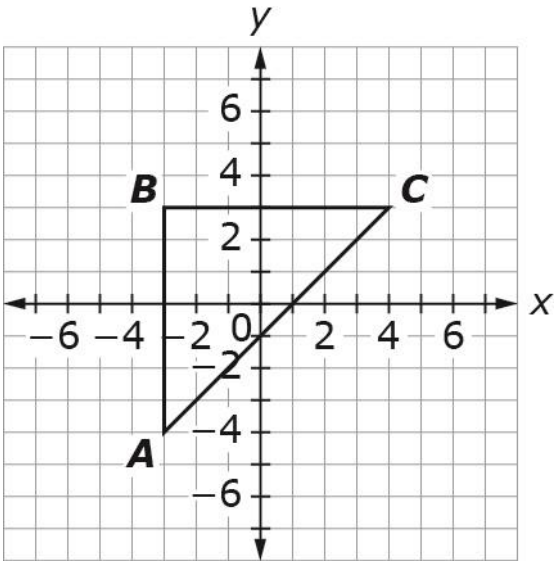
A. $c = 5p$
B. $c = 6p$
C. $c = 10p$
D. $c = 30p$

Rubric: (1 point) Student correctly identifies the equation (e.g., A).

Response Type: Multiple Choice, single correct response

Task Model 4
 	
Response Type: Equation/Numeric
 	
DOK Level 2
 	
8.EE.6
Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*.
 	
Evidence Required:
4. The student uses similar triangles to determine that the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane.
 	
Tools: None
	Prompt Features: The student uses similar triangles and slope to solve a ratio problem.
	
	Stimulus Guidelines:
	• x– and y–axes should be labeled with an appropriate scale and units
	• Item difficulty can be adjusted via these example methods:
	  ○ Slope should be an integer or fraction.
	  ○ Students prompted to move in whole number or integer increments to determine slopes.
	  ○ Students prompted to move in positive or negative rational number increments to determine slopes.
	
	TM4
	Stimulus: The student is presented with a slope triangle on a linear graph or a triangle on a coordinate plane.
	
	Example Stem 1: Line t has slope $\frac{2}{3}$ and passes through (0, 0). Follow these steps:
	
	• Step 1: Start at (0, 0)
	• Step 2: Move right 6 units
	
	 
	
	From the location defined by completing Step 2, how many units up is line *t*?
	
	Rubric: (1 point) Student gives the correct units to show the similarity between any two distinct points (e.g., 4).
	
	Response Type: Equation/Numeric

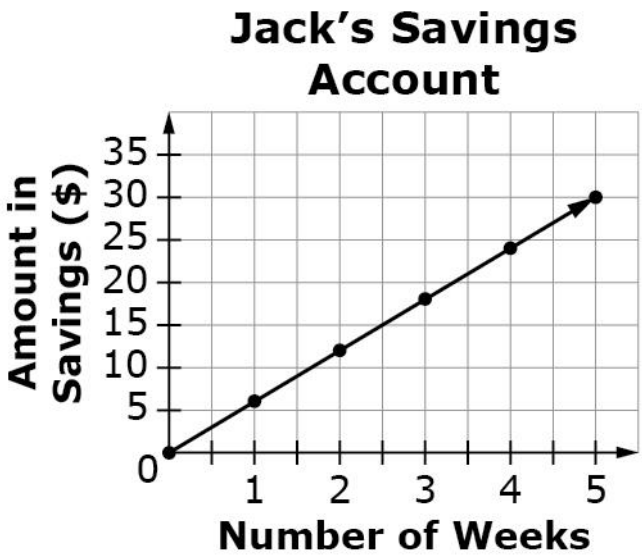
Example Stem 2: Given ΔABC with coordinates $A(-3, -4)$, $B(-3, 3)$ and $C(4, 3)$.

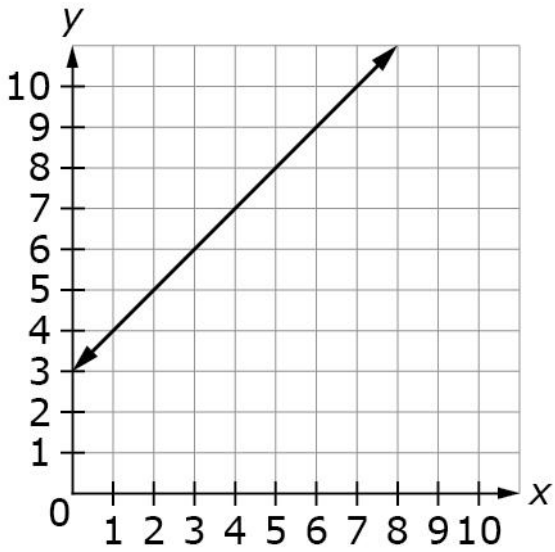


The ordered pair $(7, y)$ is on line AC. Enter the value of y for this ordered pair.

Rubric: (1 point) Student gives the correct value for y (e.g., 6).

Response Type: Equation/Numeric

Task Model 5
 	
Response Type: Equation/Numeric
 	
DOK Level 2
 	
8.EE.6
Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*.
 	
Evidence Required:
5. The student finds the equation $y = mx$ or $y = mx + b$ for a line.
 	
Tools: None
	Prompt Features: The student is prompted to give the equation of a line.
	
	Stimulus Guidelines:
	• Line must be non-vertical and non-horizontal.
	• Coordinate graphs for real-world contexts will be limited to Quadrant I.
	• x- and y-axes should be labeled with an appropriate scale and units.
	• Lines should be in the form $y = mx$ or $y = mx + b$ (where $b \neq 0$).
	• Context must be realistic and familiar to students 13 to 15 years old.
	• Item difficulty can be adjusted via these example methods:
	  ○ y-intercept is zero.
	  ○ y-intercept is not zero.
	  ○ Slope should be an integer, fraction, or decimal.
	  ○ Students select the equation for a given line.
	  ○ Students enter the equation for a given line.
	
	TM5
	Stimulus: The student is presented with a graph of a line.
	
	Example Stem 1: This graph shows the amount of money (s) in Jack's account after *w* weeks.
	
	 
	
	Enter an equation to represent the amount of money (s) in Jack's account after *w* weeks.
	
	Example Stem 2:
	
	Consider the line shown on the graph.



Enter the equation of the line in the form $y = mx + b$ where m is the slope and b is the y-intercept.

Rubric: (1 point) The student gives the correct equation (e.g., $s = 6w$; $y = x + 3$). Slope may be written as an integer, fraction, or decimal.

Response Type: Equation/Numeric