New York State Next Generation Mathematics Learning Standards Unpacking Document (DRAFT)

GRADE: 8	DOMAIN: Equations and Expressions (Inequalities)

CLUSTER: Understand the connections between proportional relationships, lines and linear equations.

Students will understand the connections between proportional relationships, lines and linear equations. They will encounter the slope of a line by interpreting the rate of change in its graph (constant of proportionality). They will compare proportional relationships in different ways (i.e., graphs, tables, equations or descriptions). Using their knowledge of similar triangles, students will make a connection between unit rate and the slope of a graph, and explain why any two points on a line have the same slope which allows for the derivation of the equation of a line y=*m*x+b.

Grade Level Standard:

NY-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 of y=*m*x for a line through the origin and the equations y=*mx+b* for a line intercepting the vertical axis at *b*.

PERFORMANCE/KNOWLEDGE TARGETS
(measurable and observable)

- Determine the slope of a line.
- Explain why the slope of a line is the same for any two points on the graph of the same line.
- Explain slope as a constant rate of change (rise over run).
- Given a line passes through the origin, write the equation for the line in the form y=*m*x.
- Given a line that passes through the vertical axis at a point other than the origin, write the equation of the line in the form y=*m*x+*b*, where the slope is *m* and *b* is where the line intercepts the vertical axis.
- Recognize that multiple forms of an equation can represent the same line.
- Write the equation of a line given the slope and a point on the line.
- Write the equation of a line given two points.

ASPECTS OF RIGOR

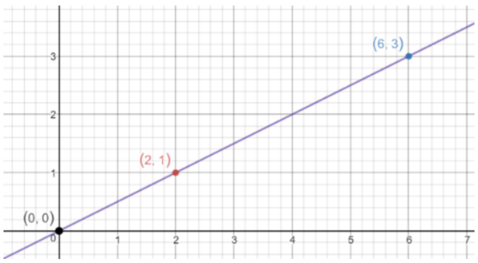
Procedural Conceptual Application

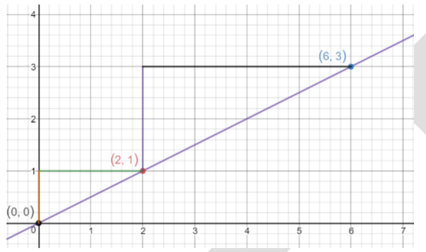
MATHEMATICAL PRACTICES	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
FOUNDATIONAL UNDERSTANDING	**NY-7. G.1** Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. **NY-7.RP.**2 Recognize and represent proportional relationships between quantities. **NY-7.RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. **NY-8. G.3** Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates. **NY-8. G.4** Know that a two-dimensional figure is similar to another if the corresponding angles are congruent and the corresponding sides are in proportion. Equivalently, two two-dimensional figures are similar if one is the image of the other after a sequence of rotations, reflections, translations, and dilations. Given two similar two-dimensional figures, describe a sequence that maps the similarity between them on the coordinate plane.

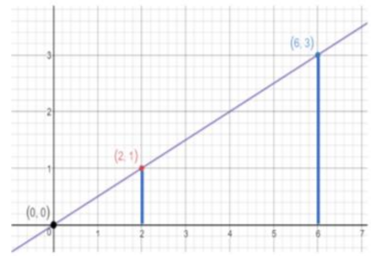
The following pages contain EXAMPLES to support current instruction of the content standard and may be used at the discretion of the teacher and adapted to best serve the needs of the learners in the classroom.

Example 1: Concrete Models

Students use similar triangles to explain that the slope between any two points on a line is a constant.
Have students construct two triangles when they are given a line and three points, sharing why they know the two triangles constructed are similar.



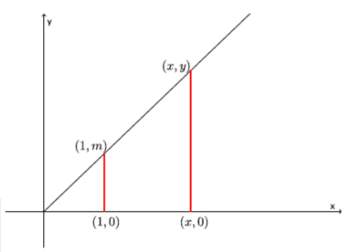




Example 2: Abstract Models

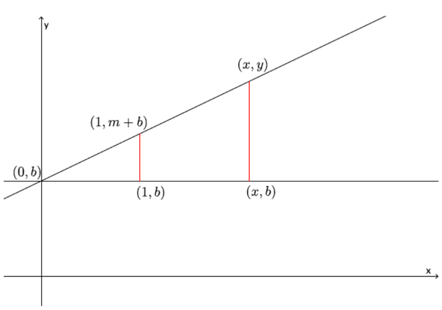
Applying what students saw through concrete examples, abstractly, given a line that passes through the origin, students will derive the equation y=*m*x using similar triangles. The following is taken from lesson 17, [EngageNY Grade 8 Module 4].

We know from our previous work with slope that when the horizontal distance between two points is fixed at one, then the slope of the line is the difference in the y-coordinates. We also know that when the horizontal distance is not fixed at one, we can find the slope of the line using any two points because the ratio of corresponding sides of similar triangles will be equal. We can put these two facts together to prove that the graph of the line $y = mx$ has slope m. Consider the diagram below



Examine the diagram and think of how we could prove that $\frac{y}{m} = \frac{x}{1}$.

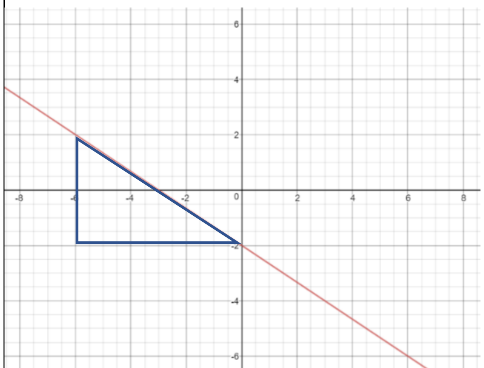
The proportion formed by the ratios of the corresponding sides yields y=*m*x. The slope of the line is *m* because when the horizontal distance between two points is fixed at 1, the vertical change is *m*. Applying similar reasoning to the diagram below, students can derive the equation y=*m*x+*b*. A detailed explanation is provided in [EngageNY Grade 8 Module 4], lesson 17.



The following pages contain EXAMPLES to support current instruction of the content standard and may be used at the discretion of the teacher and adapted to best serve the needs of the learners in the classroom.

Example 3: Illustrative Mathematics task , Slopes Between Points on a Line, content licensed under CC BY-NC-SA 4.0.

Example 4: Given the points (-6,2) and (0, -2), generate the equation of the line that passes through both points.



Find the slope of the line defined by (-6,2) and (0, -2).

Identify the slope as $m = \frac{-4}{+6} = \frac{-2}{3}$

Identify the y-intercept, *b*, at the point (0, -2), so *b*= -2

y= ($\frac{-2}{3}$) x - 2

Have students identify another point that is on the line. How did they determine the point?

Example 5: A line goes through the point (5, -7) and has slope *m* = -3. Write the equation that represents the line.

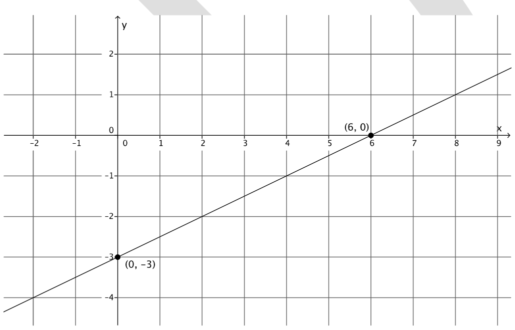
Using the slope-intercept equation of a line y=*m*x+*b*
-7= -3(5) +*b*
-7= -15 + *b*
8= *b*
y= -3x +8

Using the point-slope form of a line $m(x_2 - x_1) = (y_2 - y_1)$
-3 (x – 5) = y + 7
-3x + 15 = y + 7
-3x +8 = y

Example 6: Determine the equation of a line parallel to a given line and passing through a point not on the given line.

Write the equation of a line parallel to 2x - 4y = 12 that passes through the point (1,2).

y= $\frac{1}{2}x - 3$



y=*m*x+*b*

y=$\frac{1}{2}$x+*b*

2=$\frac{1}{2}$ (1) + *b*

2=$\frac{1}{2}$ + *b*

$\frac{3}{2}$=*b*

y= $\frac{1}{2}$ x + $\frac{3}{2}$