Why

Linear Equations in One and Two Variables

Why do students learn the properties of equality?

Students transition from using if–then moves in grade 7 to using the addition property of equality and the multiplication property of equality to support their work in Algebra 1. Rather than defining subtraction and division as separate properties of equality, they are classified as addition and multiplication.

Why do we say *the value* of the ratio?

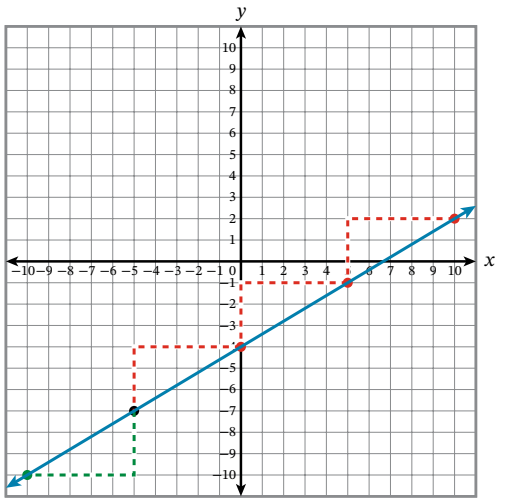
In grade 6, students learn that a ratio is an ordered pair of numbers that are not both zero. For a ratio $A : B$, the value of the ratio is the quotient $\frac{A}{B}$ as long as B is not zero. Therefore, when students determine the slope of a line, they find the value of the height-to-base ratio of a slope triangle for the line.

Why do students use a slope triangle to find the slope of a line?

In grade 7, students learn to draw unit rate triangles for proportional relationships. Then in grade 8, students use the relationship between similar triangles to discover that the unit rate triangle is similar to a slope triangle for proportional relationships. Students are then able to show that the slope between any two points on a line is the same. Students also apply this knowledge to graphs of linear equations that are not proportional relationships.

We can continue to draw slope triangles to locate more points on the line. We can then connect these points to draw the line.

We can also start at the given point and draw a slope triangle in the other direction.



We can also draw other slope triangles for which the value of the height-to-base ratio is equivalent to $\frac{3}{5}$. What is the height and base of another slope triangle for this line?

Another slope triangle for this line has a height of 6 units and a base of 10 units.

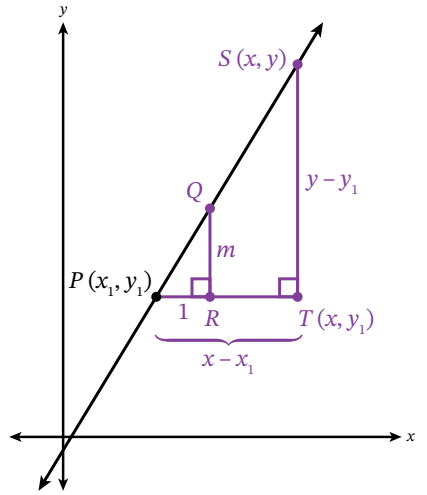
Why does the formal definition of the term *slope of a line* build over four lessons?

The formal definition of the term *slope of a line* begins in lesson 16 and concludes in lesson 19. Students first focus on lines that represent proportional relationships and relate unit rate triangles to slope triangles. They learn that the value of the height-to-base ratio of a slope triangle represents the slope of the line. Next, students work with rising lines that do not go through the origin and learn that the slope of a line describes the steepness of the line. Then, students investigate falling lines and represent their slope by using the opposite of the value of the height-to-base ratio of a slope triangle. Finally, students end their study of the slope of a line by developing a slope formula when two points on the line are given.

Why do students learn the point-slope form of a linear equation?

In topic D, students apply their understanding of the slope to graph a line by using a point on the line and the slope of the line. Through a natural progression, they apply the relationship of similar triangles to develop the point-slope form of a linear equation.

Write an equation for the line that passes through points P and Q with slope m.



$$\frac{y-y_1}{x-x_1}=\frac{m}{1}$$

$$(x-x_1)\left(\frac{y-y_1}{x-x_1}\right)=(x-x_1)\left(\frac{m}{1}\right)$$

$$y-y_1=m(x-x_1)$$