

Tools for Instruction

The Equation of a Line

Objective Describe the relationship between the slope and y-intercept of the graph of a non-vertical line and the equation $y = mx + b$.

Materials Graph paper

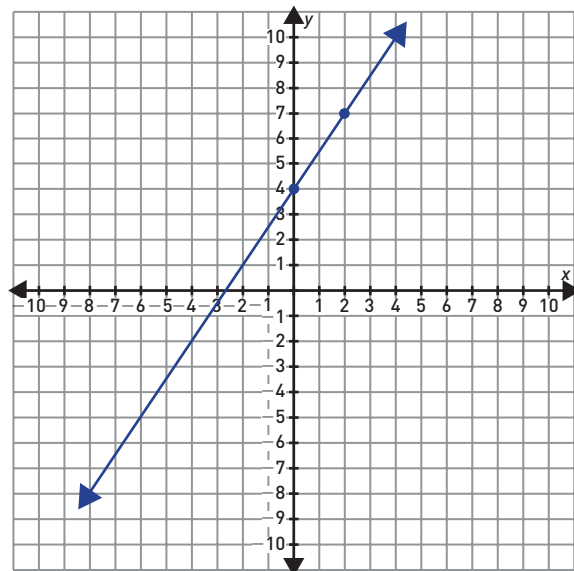
Students have been working with tables, graphs, and equations of proportional relationships between two quantities, x and y . They have seen that the unit rate of change is represented by the slope m of the straight line through the origin in a graph, and by the constant m in the equation $y = mx$.

Now students make the jump to linear relationships between quantities x and y . The graph of this relationship is still a straight line, but it may intersect the y -axis at any point $(0, b)$. The equation representing the linear relationship is $y = mx + b$, where m is the slope of the line and b is the y -coordinate of the point where the line crosses the y -axis, called the y -intercept. A thorough understanding of this equation is necessary for future work in algebra.

Step by Step 30–45 minutes

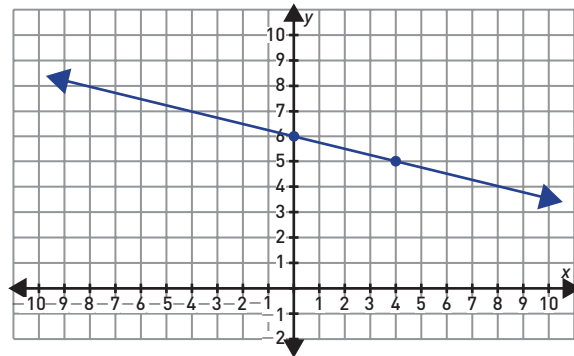
1 Present a linear relationship.

- Review the concept that the graph of a proportional relationship between x and y is a straight line that intersects the y -axis at $(0, 0)$.
- Display a graph of a linear relationship between x and y . Explain that it is a straight line, but it intersects the y -axis at a different point. The y -coordinate of this point is called the y -intercept.
- Ask: *What is the y -intercept for this line?* (4)
What is the slope? ($\frac{3}{2}$)
- Tell the student that the equation of the line is $y = \frac{3}{2}x + 4$, and the student will soon find out why. Have the student test two points to confirm.



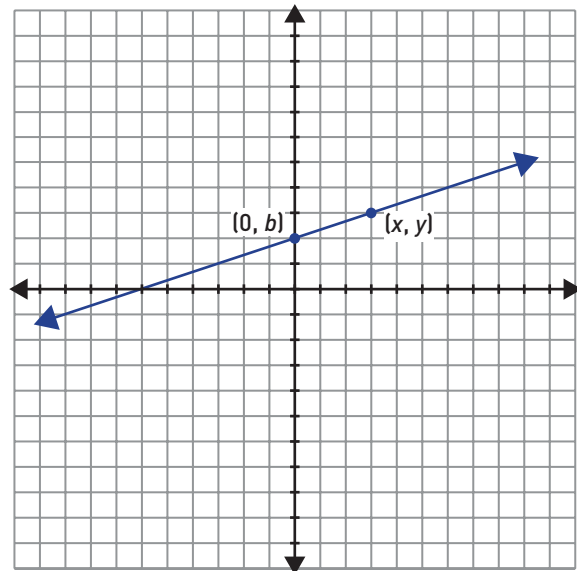
2 Identify patterns and relationships.

- Display a graph of a linear relationship between x and y .
- Ask: *What is the y -intercept?* (6) *What is the slope?* ($-\frac{1}{4}$)
- Tell the student that the equation that represents this relationship is $y = -\frac{1}{4}x + 6$, and the student will soon find out why. Have the student test two points to confirm.
- Ask the student to identify any patterns he notices in the two equations and their graphs. (pattern seems to be y equals a constant times x , plus another constant; x is multiplied by slope; y -intercept is added to end of equation)



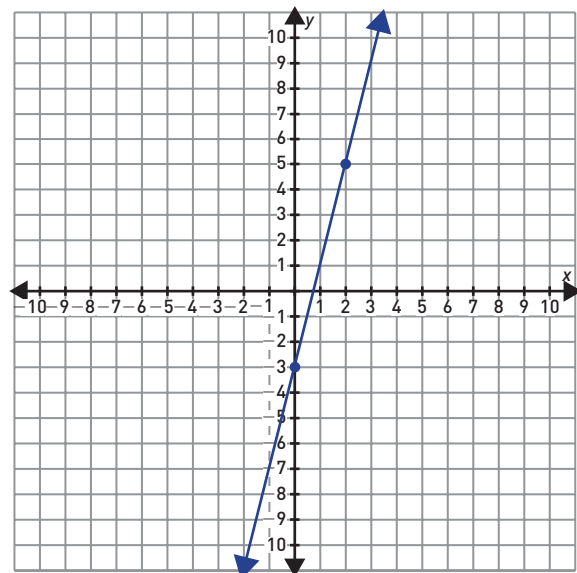
3 Develop the general linear equation.

- Display a graph of a linear relationship between x and y , with points $(0, b)$ and (x, y) labeled. Ask: *What is the y-intercept?* (b) *What is the slope?* ($\frac{y-b}{x}$)
- Use the equation for slope to write the general equation of a line. Help students to develop the rule: Any equation in the form $y = mx + b$ represents the graph of a line with slope m and y-intercept b .
- Ask the student to describe the general equation of a line in words. (The value of y is equal to the product of the slope m times the value of x , plus the y-intercept.) Have the student identify examples and non-examples of equations of lines.



Check for Understanding

Present the following problem to the student: Write an equation to represent the relationship between x and y shown in the graph. ($y = 4x - 3$)



For the student who struggles, use the chart below to help pinpoint where extra help may be needed.

If you observe...	the student may...	Then try...
the student answers $y = -3x + 4$	have switched the slope and y-intercept.	making a table of values and plotting points to show that $y = -3x + 4$ represents a different graph. Have the student write the equation with m and b in the correct positions.
the student answers $y = 4x$	have left out the y-intercept.	testing $(0, -3)$ and $(2, 5)$ in $y = 4x$. Help the student recognize that the slope is correct but the points on the line are shifted. Have the student rewrite the equation, this time with the y-intercept.