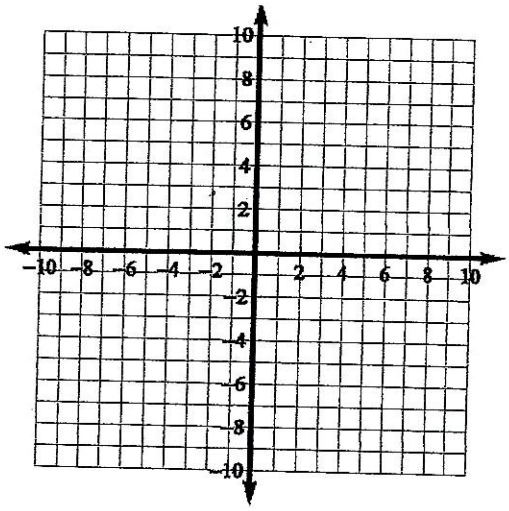
Translations of Linear Functions

1. a. Graph $y = 2x$. Plot at least 5 points on the line.

   b. Translate the graph 4 units to the right by moving each point 4 units to the right.

   c. Write the equation of the translated line in slope-intercept form.



   d. Factor out the common factor in the translated equation.

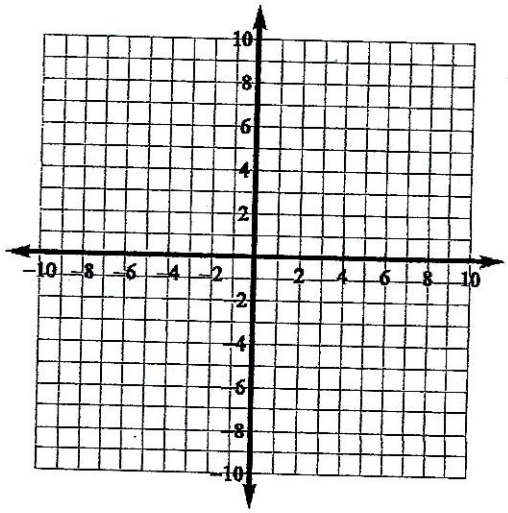
   e. What are the coordinates of the point to which the point (0, 0) is translated?

   f. Where does the amount of the translation appear in the factored form of the equation from part (d)?

2. a. Graph $y = 2x$. Plot at least 5 points on the line.

   b. Translate the graph 4 units to the left by moving each point 4 units to the left.

   c. Write the equation for the translated graph in slope-intercept form.



   d. Factor out the common factor in the translated equation.

   e. What are the coordinates of the point to which the point (0, 0) is translated?

   f. Where does the amount of the translation appear in the factored form of the equation from part (d)?

3. Examine the equations in part (d) of questions 1 and 2.

   a. How do the equations differ?

   b. How does this difference indicate the direction of the horizontal translation?

   c. Explain why $y = 2(x + 4)$ and $y = 2(x - (-4))$ represent the same line.

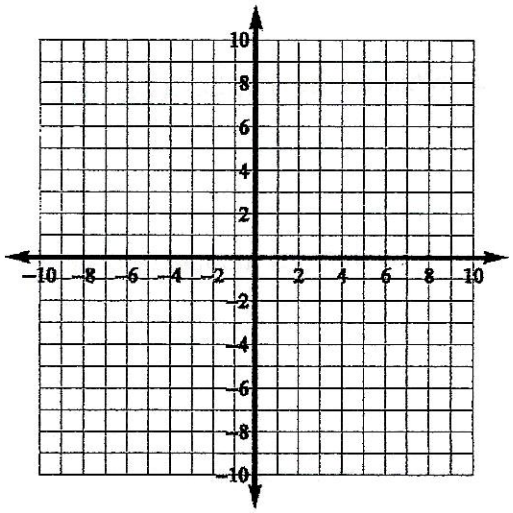
   d. What is the significance of the common factor?

4. a. By how much does $y = 3(x - 2)$ translate the line $y = 3x$ horizontally?

   b. In which direction, left or right, is $y = 3x$ translated?

   c. Graph $y = 3(x - 2)$ using a horizontal translation.

   d. What is the x-coordinate of the point on the line $y = 3(x - 2)$ when the y-coordinate is 0?

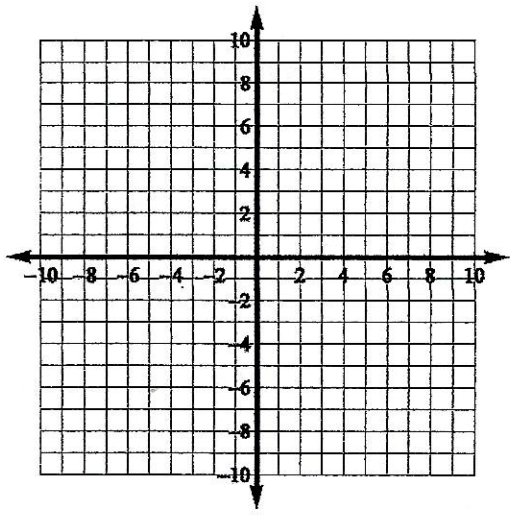


5. a. By how much does $y = 4(x + 2)$ translate the line $y = 4x$ horizontally?

   b. In which horizontal direction is $y = 4x$ translated?

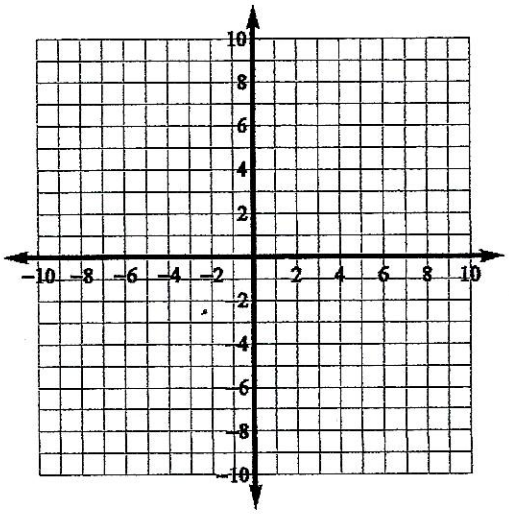
   c. Graph $y = 4(x + 2)$ using a horizontal translation.

   d. What is the x-coordinate of the point on the line $y = 4(x + 2)$ with a y-coordinate of 0?



6. a. Graph $y = 10(x - 3)$ using a horizontal translation.

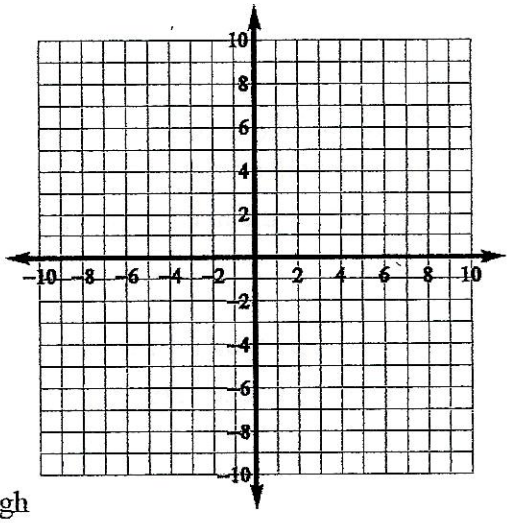
   b. Use your graph to complete the missing values of the coordinates on the line:
   (_____, 0); (4, _____); (_____, −10)



7. a. Graph $y = \frac{1}{2}x$.

   b. Graph $y = \frac{1}{2}(x + 3)$ using a horizontal translation. What is the x-coordinate of the point on this line with a y-coordinate of 0?

   c. Graph $y = \frac{1}{2}(x - 2)$. What is the x-coordinate of the point on this line with a y-coordinate of 0?



   d. Plot the point (5, 0) and draw a line with a slope of $\frac{1}{2}$ through the point. The equation of this line will be $y = \frac{1}{2}(x - 5)$.

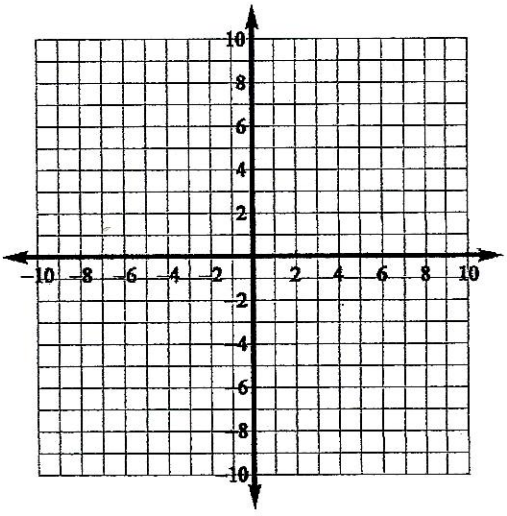
   Explain how this is a horizontal translation of $y = \frac{1}{2}x$.

8. a. Graph $y = -3(x - 4)$ using a horizontal translation. Plot at least 5 points.

   b. Translate the graph in part (a) up 5 units.

   c. What is the y-coordinate of the point on the translated line when the x-coordinate is 4?

   d. The equation of the line can be written as $y = -3(x - 4) + 5$ Show that if $x = 4$ then $y = 5$.

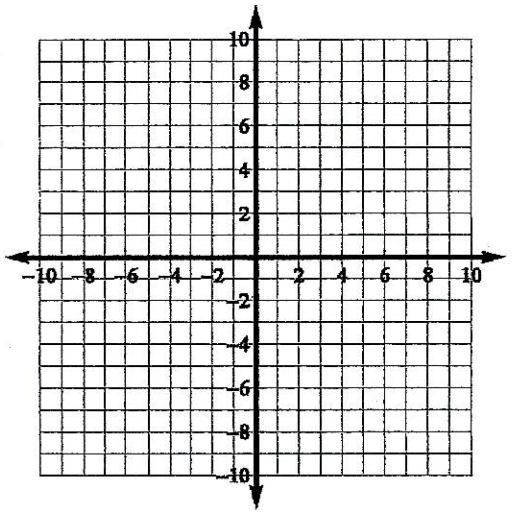


9. a. Graph $y = \frac{1}{4}x$.

   b. Translate the line in part (a) to the right 2 units and up 3 units.

   c. Write the equation for the translated line in part (b) in the form, $y = m(x - h) + k$, where h is the amount that the graph of $y = \frac{1}{4}x$ is translated to the right and k is the amount that the line is translated up.

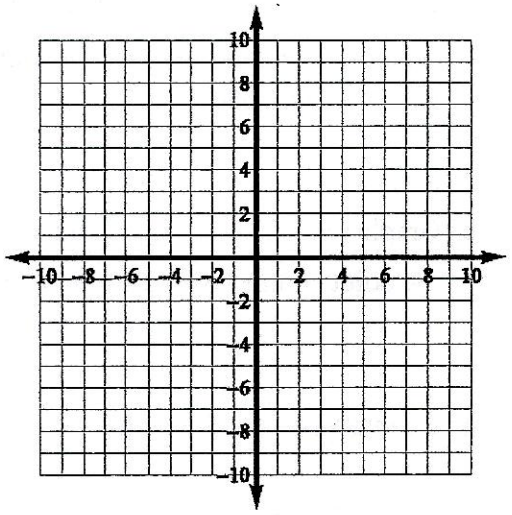
   d. What is the y-coordinate of the point on the translated line when the x-coordinate is 2?



10. a. Plot the point (–1, 3) and graph a line through the point with a slope of 2.

    b. Explain how the line transforms $y = 2x$.

    c. The point (0, 0) on $y = 2x$ is translated to what point on the line $y = 2(x - (-1)) + 3$?



11. Write an equation in the form $y = m(x - h) + k$ for the line that translates the line $y = 4x$.

    a. 2 units to the right and up 1 unit.

    b. 2 units to the left and down 1 unit.

12. Using translations, write the equation of the line in the form $y = m(x - h) + k$ that has a slope of 4 and:

    a. passes through the point (2, 1).

    b. passes through the point (–2, –1).

13. a. The form for the equation of a line $y = m(x - h) + k$ is called the point-slope form. Justify this name.

b. The equation of a line written in the form $y = mx + b$ is called the slope-intercept form of a line because both the slope and the y-intercept are visible in the equation. Show that the slope-intercept form for a line is the same as the point-slope form for a line with a slope of m that passes through the point $(0, b)$.

14. Without graphing the following lines, list the slope of the line and name a point on the line.

a. $y = 3(x - 2) + 4$

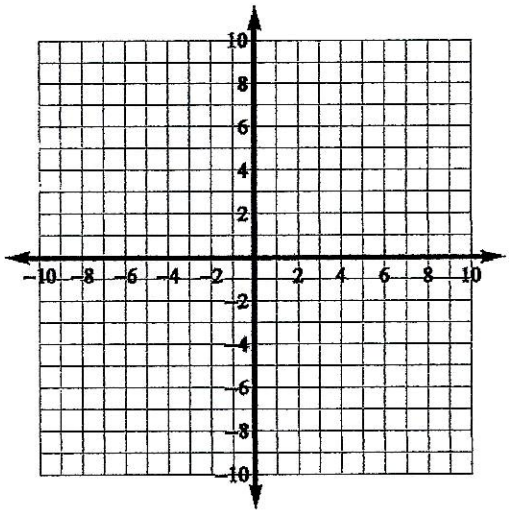
b. $y = \frac{1}{2}(x - (-3)) + 5$

c. $y = 2(x + 1) + 6$

15. a. Graph $y = 2(x + 8) - 3$.

b. Graph $y = 2x + 13$.

c. Explain why graphing this line on the provided grid is easier when the equation is given in point-slope form than in slope-intercept form.



16. Describe two ways in which the equation, $y = m(x - h) + k$ where $h > 0$, can be graphed without converting it to slope-intercept form.