

3 Graphing Linear Functions

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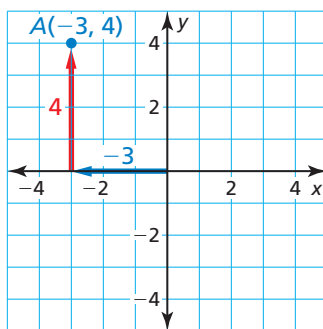
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Maintaining Mathematical Proficiency

Plotting Points

Example 1 Plot the point $A(-3, 4)$ in a coordinate plane. Describe the location of the point.

Start at the origin. Move 3 units **left** and 4 units **up**. Then plot the point. The point is in Quadrant II.



Plot the point in a coordinate plane. Describe the location of the point.

1. $A(3, 2)$
2. $B(-5, 1)$
3. $C(0, 3)$
4. $D(-1, -4)$
5. $E(-3, 0)$
6. $F(2, -1)$

Evaluating Expressions

Example 2 Evaluate $4x - 5$ when $x = 3$.

$$\begin{aligned} 4x - 5 &= 4(3) - 5 && \text{Substitute 3 for } x. \\ &= 12 - 5 && \text{Multiply.} \\ &= 7 && \text{Subtract.} \end{aligned}$$

Example 3 Evaluate $-2x + 9$ when $x = -8$.

$$\begin{aligned} -2x + 9 &= -2(-8) + 9 && \text{Substitute } -8 \text{ for } x. \\ &= 16 + 9 && \text{Multiply.} \\ &= 25 && \text{Add.} \end{aligned}$$

Evaluate the expression for the given value of x .

7. $3x - 4; x = 7$
8. $-5x + 8; x = 3$
9. $10x + 18; x = 5$
10. $-9x - 2; x = -4$
11. $24 - 8x; x = -2$
12. $15x + 9; x = -1$
13. **ABSTRACT REASONING** Let a and b be positive real numbers. Describe how to plot (a, b) , $(-a, b)$, $(a, -b)$, and $(-a, -b)$.

Mathematical Practices

Mathematically proficient students use technological tools to explore concepts.

Using a Graphing Calculator

Core Concept

Standard and Square Viewing Windows

A typical graphing calculator screen has a height to width ratio of 2 to 3. This means that when you use the *standard viewing window* of -10 to 10 (on each axis), the graph will not be in its true perspective.

To see a graph in its true perspective, you need to use a *square viewing window*, in which the tick marks on the x -axis are spaced the same as the tick marks on the y -axis.

```
WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-10
Ymax=10
Yscl=1
```

This is the standard viewing window.

```
WINDOW
Xmin=-9
Xmax=9
Xscl=1
Ymin=-6
Ymax=6
Yscl=1
```

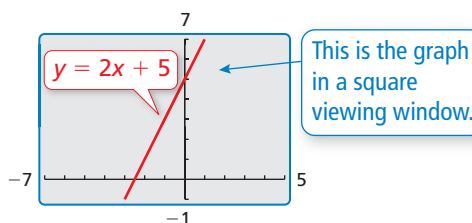
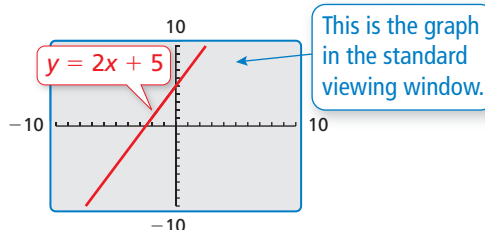
This is a square viewing window.

EXAMPLE 1 Using a Graphing Calculator

Use a graphing calculator to graph $y = 2x + 5$.

SOLUTION

Enter the equation $y = 2x + 5$ into your calculator. Then graph the equation. The standard viewing window does not show the graph in its true perspective. Notice that the tick marks on the y -axis are closer together than the tick marks on the x -axis. To see the graph in its true perspective, use a square viewing window.



Monitoring Progress

Determine whether the viewing window is square. Explain.

- $-8 \leq x \leq 7, -3 \leq y \leq 7$
- $-6 \leq x \leq 6, -9 \leq y \leq 9$
- $-18 \leq x \leq 18, -12 \leq y \leq 12$

Use a graphing calculator to graph the equation. Use a square viewing window.

- $y = x + 3$
- $y = -x - 2$
- $y = 2x - 1$
- $y = -2x + 1$
- $y = -\frac{1}{3}x - 4$
- $y = \frac{1}{2}x + 2$

- How does the appearance of the slope of a line change between a standard viewing window and a square viewing window?