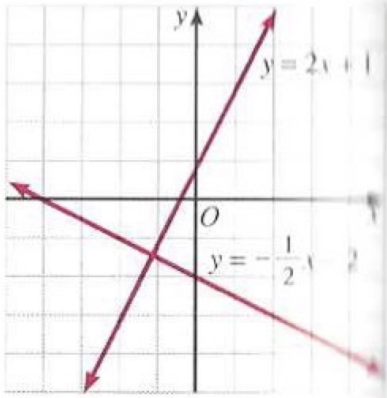
Extra / Perpendicular Lines

In a coordinate plane, the x-axis and the y-axis intersect to form right angles. Any two lines that intersect to form right angles are **perpendicular.** The graphs of $y = 2x + 1$ and $y = -\frac{1}{2}x - 2$ shown are perpendicular. The following relationships exist between perpendicular lines and their slopes.



1. If the product of the slopes of two lines is -1, the lines are perpendicular.
2. Perpendicular lines that are not horizontal and vertical have slopes whose product is -1.

Example Show that the graphs of $y = \frac{3}{4}x - 1$ and $6y + 8x = 7$ are perpendicular.

Solution

1. Write $6y + 8x = 7$ in slope-intercept form: $y = -\frac{4}{3}x + \frac{7}{6}$
2. The slope of $y = \frac{3}{4}x - 1$ is $\frac{3}{4}$. The slope of $y = -\frac{4}{3}x + \frac{7}{6}$ is $-\frac{4}{3}$.
3. $\frac{3}{4}\left(-\frac{4}{3}\right) = -1$ $\therefore$ the lines are perpendicular. ***Answer***

Exercises

Find the slope of the line perpendicular to the graph of each line.

1. $y = \frac{3}{2}x + 7$ **2.** $y = \frac{4}{5}x - 2$ **3.** $y = -\frac{3}{8}x + 5$

4. $2x + y = 3$ **5.** $3x - 5y = 110$ **6.** $y = -x$

7. $y = 1$ **8.** $x = 3$ **9.** $x - 3y - 8 = 0$

Tell whether the graphs of each pair of equations are parallel, perpendicular, or neither.

10. $3x + 6y = 8$
$y = 2x - 8$

11. $3x + y = 7$
$y = -3x + 2$

12. $2x + 5y = 7$
$2x + 5y = 9$

13. $2x - 8y = 9$
$12x + 3y = 7$

14. $y = x + 5$
$y = 8 - x$

15. $4x + 6y = 9$
$2x + 3y = 5$

16. Show that the graphs of $y = 4 - 3x$ and $3y - x = 12$ have the same y-intercept and are perpendicular.

17. The graph of $y = \frac{2}{3}x - 12$ intersects the y-axis at $Q(0, -12)$ and is perpendicular to a line joining Q to the point $P(x, 0)$. Find x.