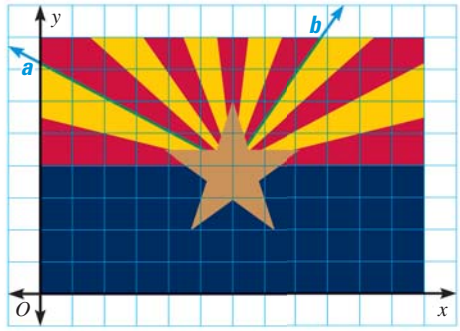
EXAMPLE 3 Determine whether lines are perpendicular

STATE FLAG The Arizona state flag is shown in a coordinate plane. Lines a and b appear to be perpendicular. Are they?



Line *a*: $12y = -7x + 42$

Line *b*: $11y = 16x - 52$

Solution

Find the slopes of the lines. Write the equations in slope-intercept form.

Line *a*: $12y = -7x + 42$ **Line *b*:** $11y = 16x - 52$

$$y = -\frac{7}{12}x + \frac{42}{12} \qquad y = \frac{16}{11}x - \frac{52}{11}$$

▶ The slope of line a is $-\frac{7}{12}$. The slope of line b is $\frac{16}{11}$. The two slopes are not negative reciprocals, so lines a and b are not perpendicular.

EXAMPLE 4 Write an equation of a perpendicular line

Write an equation of the line that passes through (4, −5) and is perpendicular to the line $y = 2x + 3$.

Solution

STEP 1 **Identify** the slope. The graph of the given equation has a slope of 2. Because the slopes of perpendicular lines are negative reciprocals, the slope of the perpendicular line through (4, −5) is $-\frac{1}{2}$.

STEP 2 **Find** the y-intercept. Use the slope and the given point.

$y = mx + b$ Write slope-intercept form.

$-5 = -\frac{1}{2}(4) + b$ Substitute $-\frac{1}{2}$ for m, 4 for x, and −5 for y.

$-3 = b$ Solve for b.

STEP 3 **Write** an equation.

$y = mx + b$ Write slope-intercept form.

$y = -\frac{1}{2}x - 3$ Substitute $-\frac{1}{2}$ for m and −3 for b.

GUIDED PRACTICE for Examples 3 and 4

3. Is line a perpendicular to line b? *Justify* your answer using slopes.

Line *a*: $2y + x = -12$ **Line *b***: $2y = 3x - 8$

4. Write an equation of the line that passes through (4, 3) and is perpendicular to the line $y = 4x - 7$.