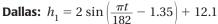**EXAMPLE 5** **TAKS REASONING: Multi-Step Problem**

DAYLIGHT HOURS The number h of hours of daylight for Dallas, Texas, and Anchorage, Alaska, can be approximated by the equations below, where t is the time in days and $t = 0$ represents January 1. On which days of the year will the two cities have the same amount of daylight?

Dallas: $h_1 = 2 \sin\left(\dfrac{\pi t}{182} - 1.35\right) + 12.1$ **Anchorage:** $h_2 = -6 \cos\left(\dfrac{\pi t}{182}\right) + 12.1$

Solution

STEP 1 **Solve** the equation $h_1 = h_2$ for t.

$$2 \sin\left(\frac{\pi t}{182} - 1.35\right) + 12.1 = -6 \cos\left(\frac{\pi t}{182}\right) + 12.1$$

$$\sin\left(\frac{\pi t}{182} - 1.35\right) = -3 \cos\left(\frac{\pi t}{182}\right)$$

$$\sin\left(\frac{\pi t}{182}\right)\textbf{cos 1.35} - \cos\left(\frac{\pi t}{182}\right)\textbf{sin 1.35} = -3 \cos\left(\frac{\pi t}{182}\right)$$

$$\sin\left(\frac{\pi t}{182}\right)(\textbf{0.219}) - \cos\left(\frac{\pi t}{182}\right)(\textbf{0.976}) = -3 \cos\left(\frac{\pi t}{182}\right)$$

$$0.219 \sin\left(\frac{\pi t}{182}\right) = -2.024 \cos\left(\frac{\pi t}{182}\right)$$

$$\tan\left(\frac{\pi t}{182}\right) = -9.242$$

$$\frac{\pi t}{182} = \textbf{tan}^{-1}(\textbf{-9.242}) + n\pi$$

$$\frac{\pi t}{182} \approx \textbf{-1.463} + n\pi$$

$$t \approx -84.76 + 182n$$

STEP 2 **Find** the days within one year (365 days) for which Dallas and Anchorage will have the same amount of daylight.

$t \approx -84.76 + 182(\textbf{1}) \approx 97$, or on April 8

$t \approx -84.76 + 182(\textbf{2}) \approx 279$, or on October 7

✓ **GUIDED PRACTICE** for Examples 3, 4, and 5

Simplify the expression.

6. $\sin(x + 2\pi)$ **7.** $\cos(x - 2\pi)$ **8.** $\tan(x - \pi)$

9. Solve $6 \cos\left(\dfrac{\pi t}{75}\right) + 5 = -24 \sin\left(\dfrac{\pi t}{75} + 22\right) + 5$ for $0 \le t < 2\pi$.