EXAMPLE 2 Use a difference formula

Find cos $(a - b)$ given that cos $a = -\frac{4}{5}$ with $\pi < a < \frac{3\pi}{2}$ and sin $b = \frac{5}{13}$ with $0 < b < \frac{\pi}{2}$.

Solution

Using a Pythagorean identity and quadrant signs gives $\sin a = -\frac{3}{5}$ and $\cos b = \frac{12}{13}$.

$\cos(a - b) = \cos a \cos b + \sin a \sin b$ — **Difference formula for cosine**

$= -\frac{4}{5}\left(\frac{12}{13}\right) + \left(-\frac{3}{5}\right)\left(\frac{5}{13}\right)$ — **Substitute.**

$= -\frac{63}{65}$ — **Simplify.**

✓ GUIDED PRACTICE for Examples 1 and 2

Find the exact value of the expression.

1. $\sin 105°$ **2.** $\cos 75°$ **3.** $\tan \frac{5\pi}{12}$ **4.** $\cos \frac{\pi}{12}$

5. Find $\sin(a - b)$ given that $\sin a = \frac{8}{17}$ with $0 < a < \frac{\pi}{2}$ and $\cos b = -\frac{24}{25}$ with $\pi < b < \frac{3\pi}{2}$.

EXAMPLE 3 Simplify an expression

Simplify the expression cos $(x + \pi)$.

$\cos(x + \pi) = \cos x \cos \pi - \sin x \sin \pi$ — **Sum formula for cosine**

$= (\cos x)(-1) - (\sin x)(0)$ — **Evaluate.**

$= -\cos x$ — **Simplify.**

EXAMPLE 4 Solve a trigonometric equation

Solve $\sin\left(x + \frac{\pi}{3}\right) + \sin\left(x - \frac{\pi}{3}\right) = 1$ for $0 \le x < 2\pi$.

ANOTHER WAY

You can also solve by using a graphing calculator. First graph each side of the original equation and then use the *intersect* feature to find the x-value(s) where the expressions are equal.

$\sin\left(x + \frac{\pi}{3}\right) + \sin\left(x - \frac{\pi}{3}\right) = 1$ — **Write equation.**

$\sin x \cos \frac{\pi}{3} + \cos x \sin \frac{\pi}{3} + \sin x \cos \frac{\pi}{3} - \cos x \sin \frac{\pi}{3} = 1$ — **Use formulas.**

$\frac{1}{2} \sin x + \frac{\sqrt{3}}{2} \cos x + \frac{1}{2} \sin x - \frac{\sqrt{3}}{2} \cos x = 1$ — **Evaluate.**

$\sin x = 1$ — **Simplify.**

▶ In the interval $0 \le x < 2\pi$, the only solution is $x = \frac{\pi}{2}$.