EXAMPLE 2 **Verify that functions are inverses**

Verify that $f(x) = 3x - 5$ and $f^{-1}(x) = \frac{1}{3}x + \frac{5}{3}$ are inverse functions.

Solution

STEP 1 Show that $f(f^{-1}(x)) = x$.

$$f(\mathbf{f^{-1}(x)}) = f\left(\frac{1}{3}x + \frac{5}{3}\right)$$

$$= 3\left(\frac{1}{3}x + \frac{5}{3}\right) - 5$$
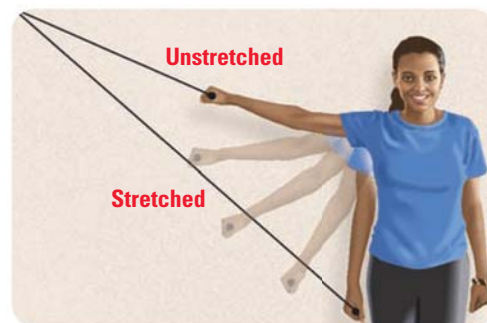
$$= x + 5 - 5$$

$$= x \checkmark$$

STEP 2 Show that $f^{-1}(f(x)) = x$.

$$f^{-1}(\mathbf{f(x)}) = f^{-1}(\mathbf{3x - 5})$$

$$= \frac{1}{3}(\mathbf{3x - 5}) + \frac{5}{3}$$

$$= x - \frac{5}{3} + \frac{5}{3}$$

$$= x \checkmark$$

TAKS

EXAMPLE 3 **TAKS REASONING: Multi-Step Problem**

FITNESS Elastic bands can be used in exercising to provide a range of resistance. A band's resistance R (in pounds) can be modeled by $R = \frac{3}{8}L - 5$ where L is the total length of the stretched band (in inches).

- Find the inverse of the model.

- Use the inverse function to find the length at which the band provides 19 pounds of resistance.

Unstretched

Stretched

Solution

FIND INVERSES
Notice that you do not switch the variables when you are finding inverses of models. This would be confusing because the letters are chosen to remind you of the real-life quantities they represent.

STEP 1 Find the inverse function.

$$R = \frac{3}{8}L - 5 \qquad \text{Write original model.}$$

$$R + 5 = \frac{3}{8}L \qquad \text{Add 5 to each side.}$$

$$\frac{8}{3}R + \frac{40}{3} = L \qquad \text{Multiply each side by } \frac{8}{3}.$$

STEP 2 Evaluate the inverse function when $R = 19$.

$$L = \frac{8}{3}R + \frac{40}{3} = \frac{8}{3}(19) + \frac{40}{3} = \frac{152}{3} + \frac{40}{3} = \frac{192}{3} = 64$$

▶ The band provides 19 pounds of resistance when it is stretched to 64 inches.

✓ **GUIDED PRACTICE** for Examples 1, 2, and 3

Find the inverse of the given function. Then verify that your result and the original function are inverses.

1. $f(x) = x + 4$ **2.** $f(x) = 2x - 1$ **3.** $f(x) = -3x + 1$

4. FITNESS Use the inverse function in Example 3 to find the length at which the band provides 13 pounds of resistance.