1. (3 pts) Suppose \( f \) is an invertible function. Use the data below to evaluate \( \frac{d}{dx}(f^{-1}) \) at \( x = -3 \).

\[
\begin{align*}
f(-3) &= 0 & f'(-3) &= -7 & f(-7) &= -3 & f'(-7) &= 3
\end{align*}
\]

Since \( f \) is invertible and \( f(-7) = -3 \), we have \( f^{-1}(-3) = -7 \). We use the formula \( (f^{-1})'(a) = \frac{1}{f'(f^{-1}(a))} \). We get \( (f^{-1})'(-3) = 1/f'(-7) = 1/3 \).

2. (2 pts) Use the formula \( \frac{d}{du}(\cot^{-1}u) = \frac{-1}{1 + u^2} \), to compute \( f'(x) \) if \( f(x) = \cot^{-1}(x + \ln x) \).

It’s a chain rule question! So we get \( -1/(1 + [x + \ln x]^2) \cdot (1 + 1/x) \).

3. (5 pts) A 13-ft ladder is leaning against the side of a house when its base starts to slide away along the ground. By the time the base is 12-ft from the house, the base is moving at the rate of 5 ft/sec away from the wall.

(a) How fast is the top of the ladder sliding down the wall at that moment?

(b) At what rate is the area of the triangle formed by the ladder, the wall, and the ground changing at that moment?

Let \( x \) denote the horizontal distance to the wall. (a) The height \( h = h(x) \) is given by \( \sqrt{13^2 - x^2} \). So \( \frac{dh}{dt} = (1/2)(13^2 - x^2)^{-1/2} \cdot (-2x) \cdot \frac{dx}{dt} \). Plugging in what we know, we get \( \frac{dh}{dt} = (-24/10) \cdot (5) = -12 \).

(b) The area \( A = A(t) \) is given by \( (1/2) \cdot h \cdot x \), so just use the same idea as above to get \( \frac{dA}{dt} = (1/2)(h' \cdot x + h \cdot x') = (1/2)(-12 \cdot 12 + 5 \cdot 5) \).