(a): Compute the derivative of the following function: \( f(x) = \arctan(2x) + \log_5(\cos(x)) \).

**Solution:** Recall that the derivative of \( \arctan(x) \) is \( 1/(1 + x^2) \) and the derivative of \( \log_5(x) \) is \( 1/(x \ln(5)) \). Using these together with the chain rule gives

\[
f'(x) = \frac{1}{1 + (2x)^2} \cdot \frac{d}{dx}(2x) + \frac{1}{\cos(x) \ln(5)} \cdot \frac{d}{dx}(\cos(x))
\]

\[
= \frac{1}{1 + 4x^2} \cdot 2 + \frac{1}{\cos(x) \ln(5)} \cdot (-\sin(x))
\]

\[
= \frac{2}{1 + 4x^2} - \frac{\tan(x)}{\ln(5)}.
\]

(b): Compute the derivative of the following function: \( y = x^{\tan(x)} \).

**Solution:** The main strategy is to first take the natural logarithm of both sides, and then differentiate. Taking the natural logarithm gives \( \ln(y) = \ln(x^{\tan(x)}) = \tan(x) \ln(x) \). When we differentiate, the left side is \( \frac{1}{y} \cdot y' \) by the chain rule, since the derivative of \( \ln(x) \) is \( 1/x \). For the right side, we use the product rule, and we obtain

\[
\frac{y'}{y} = \frac{d}{dx}(\tan(x)) \cdot \ln(x) + \tan(x) \frac{d}{dx}(\ln(x)) = \sec^2(x) \ln(x) + \tan(x) \cdot \frac{1}{x}.
\]

To obtain the derivative \( y' \), we multiply both sides by \( y = x^{\tan(x)} \), and we obtain

\[
y' = x^{\tan(x)} \left( \sec^2(x) \ln(x) + \frac{\tan(x)}{x} \right).
\]