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Complete the following problems. Show all work to receive full credit.

1. Find the derivatives of the following functions:

(a)  $f(x) = \sec^{-1}(\sin x)$

$$\begin{aligned} f'(x) &= \frac{1}{|\sin x| \sqrt{\sin^2 x - 1}} \cdot \cos x \\ &= \frac{\cos x}{|\sin x| \sqrt{\sin^2 x - 1}} \end{aligned}$$

(b)  $f(x) = \log_3(1 + x \ln 3)$

$$\begin{aligned} f'(x) &= \frac{1}{(1 + x \ln 3) \ln 3} \cdot \ln 3 \\ &= \frac{1}{1 + x \ln 3} \end{aligned}$$

(c)  $f(x) = \tan^{-1}(\cos x)$

$$\begin{aligned} f'(x) &= \frac{1}{1 + \cos^2 x} \cdot (-\sin x) \\ &= \frac{-\sin x}{1 + \cos^2 x} \end{aligned}$$

2. Find the linearization of the function  $f(x) = \ln(1 + x)$  near  $x = 0$

$$f(0) = \ln 1 = 0$$

$$f'(x) = \frac{1}{1 + x}$$

$$f'(0) = \frac{1}{1 + 0} = 1$$

$$y - 0 = 1(x - 0) \Rightarrow y = x$$