AP Calc AB 4.4 Practice Name _____

Find the derivative.

1. $y = \ln(x^2 - x)$

$\frac{dy}{dx} = \frac{1}{x^2-x} \cdot (2x-1)$

$= \boxed{\frac{2x-1}{x^2-x}}$

2. $y = \log(3x)$ base is 10

$\frac{dy}{dx} = \frac{1}{3x} \cdot \frac{1}{\ln 10} \cdot 3$

$= \frac{3}{3x \ln 10} = \boxed{\frac{1}{x \ln 10}}$

3. $y = \log_4(x^3 - x\ln 3)$

$\frac{dy}{dx} = \frac{1}{(x^3 - x\ln 3)} \cdot \frac{1}{\ln 4} \cdot (3x^2 - \ln 3)$

$= \boxed{\frac{3x^2 - \ln 3}{\ln 4 (x^3 - x \ln 3)}}$

4. $y = 5e^{2x}$

$\frac{dy}{dx} = 5e^{2x} \cdot 2$

$= \boxed{10e^{2x}}$

5. $y = 8^x$

$\frac{dy}{dx} = 8^x \cdot \ln 8 \cdot 1$

$= \boxed{8^x \ln 8}$

6. $y = x^{1-e}$ ← this is NOT exponential! Power Rule!

$\frac{dy}{dx} = (1-e)x^{1-e-1}$

$= (1-e)x^{-e}$

$= \boxed{\frac{1-e}{x^e}}$

Use logarithmic differentiation to find the derivative.

7. $y = x^{\cos x}$

$\ln y = \ln x^{\cos x}$

$\frac{d}{dx}[\ln y = \cos x \cdot \ln x]$ product rule

$y \cdot \frac{1}{y}\frac{dy}{dx} = \left[-\sin x \cdot \ln x + \cos x \cdot \frac{1}{x}\right] \cdot y$

$\frac{dy}{dx} = x^{\cos x}\left[-\sin x \ln x + \frac{\cos x}{x}\right]$

8. $y = (\sin x)^x$

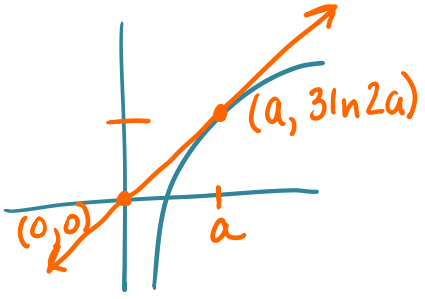
$\frac{d}{dx}[\ln y = x \cdot \ln(\sin x)]$

$\frac{1}{y}\frac{dy}{dx} = 1 \cdot \ln(\sin x) + x \cdot \frac{1}{\sin x} \cdot \cos x$

$y \cdot \frac{1}{y}\frac{dy}{dx} = \left[\ln(\sin x) + \frac{x\cos x}{\sin x}\right] \cdot y$

$= (\sin x)^x [\ln(\sin x) + x \cot x]$

9. Find the slope of the line tangent to $y = 3\ln 2x$ that also goes through the origin.



$\frac{dy}{dx} = 3 \cdot \frac{1}{2x} \cdot 2 = \frac{6}{2x} = \frac{3}{x}$ at $x=a$, $\frac{dy}{dx} = \frac{3}{a}$

slope: $\frac{3\ln 2a - 0}{a - 0} = \frac{3}{a}$

$\frac{a\,3\ln 2a}{3a} = \frac{3a}{3a}$ $a \neq 0$

$\ln 2a = 1$

$e^1 = 2a$ $a = \frac{e^1}{2}$

$m = \frac{3}{\frac{e}{2}} = \boxed{\frac{6}{e}}$