Name: Key **Date** _____

Instructions: For each question, neatly write a solution and circle your answer.

1. For the implicit function $x\sin(y) = e^y + 2x^2 - \ln(y)$, what is the derivative y'?

$$x\cos(y)\frac{dy}{dx} + \sin(y) = e^y\frac{dy}{dx} + 4x - \frac{1}{y}\frac{dy}{dx}$$

$$x\cos(y)\frac{dy}{dx} - e^y\frac{dy}{dx} + \frac{1}{y}\frac{dy}{dx} = 4x - \sin(y)$$

$$\frac{dy}{dx}\left(x\cos(y) - e^y + \frac{1}{y}\right) = 4x - \sin(y)$$

$$\frac{dy}{dx} = \frac{4x - \sin(y)}{x\cos(y) - e^y + \frac{1}{y}}$$

2. Use logarithmic differentiation to find $\dfrac{\mathrm{d}}{\mathrm{d}x}\dfrac{(x^2-3)\sqrt{x-4}}{(x+5)^3}$.

$$y = \frac{(x^2-3)(x-4)^{\frac{1}{2}}}{(x+5)^3}$$

$$\ln y = \ln\frac{(x^2-3)(x-4)^{\frac{1}{2}}}{(x+5)^3}$$

$$\ln y = \ln(x^2-3) + \ln(x-4)^{\frac{1}{2}} - \ln(x+5)^3$$

$$\ln y = \ln(x^2-3) + \frac{1}{2}\ln(x-4) - 3\ln(x+5)$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{2x}{x^2-3} + \frac{1}{2(x-4)} - \frac{3}{x+5}$$

$$\frac{dy}{dx} = \frac{(x^2-3)(x-4)^{\frac{1}{2}}}{(x+5)^3}\left[\frac{2x}{x^2-3} + \frac{1}{2(x-4)} - \frac{3}{x+5}\right]$$