DO NOW

Find the second derivative of: $y^2 = x^2 + 2x$

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3.5 Implicit Differentiation- Day 3

Logarithmic Differentiation:

** Take ln of both sides

** Use to differentiate sums and differences instead of products and quotients.

** Put in terms of x only by substituting the original y = value into the derivative if possible.

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Use logarithmic differentiation to find the derivative.

1. $y = x^{x-1}$

$\ln y = \ln x^{x-1}$

$\ln y = (x-1)\ln x$

$\frac{1}{y}\cdot y' = (x-1)\cdot\frac{1}{x} + \ln x\,(1)$

$y' = y\left[\frac{x-1}{x} + \ln x\right]$

$y' = x^{x-1}\left[\frac{x-1}{x} + \ln x\right]$

$y' = x^{x-1}\left(\frac{1}{x}\right)\left[x-1+x\ln x\right]$

$y' = \frac{x^{x-1}}{x}\left(x-1+x\ln x\right]$

$y' = x^{x-2}\left(x-1+x\ln x\right)$

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2. $y = \sqrt[3]{\frac{x^2+1}{x^2-1}}$

$\ln y = \ln\sqrt[3]{\frac{x^2+1}{x^2-1}}$

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

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

$\frac{y'}{y} = \frac{1}{3}\left[\frac{2x}{x^2+1} - \frac{2x}{x^2-1}\right]$

$\frac{y'}{y} = \frac{1}{3}\left(\frac{2x(x^2-1) - 2x(x^2+1)}{(x^2+1)(x^2-1)}\right)$

$\frac{y'}{y} = \frac{1}{3}\left(\frac{2x^3-2x-2x^3-2x}{x^4-1}\right)$

$y' = \frac{1}{3}(y)\left(\frac{-4x}{x^4-1}\right)$

$y' = \frac{-4x}{3(x^4-1)}\left(\sqrt[3]{\frac{x^2+1}{x^2-1}}\right)$

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HOMEWORK

pg 173; 56, 63, 65 - 67, 71, 73

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