Name: Richard

QUIZ 14 ♡

MATH 200
October 25, 2021

1. Use logarithmic differentiation to find the derivative of the function $y = (x^4 + x)^{5x}$.

$$y = (x^4+x)^{5x}$$

$$\ln|y| = \ln\left|(x^4+x)^{5x}\right|$$

$$\ln|y| = 5x \ln|x^4+x|$$

$$D_x\left[\ln|y|\right] = D_x\left[5x \cdot \ln|x^4+x|\right]$$

$$\frac{y'}{y} = 5\ln|x^4+x| + 5x\,\frac{4x^3+1}{x^4+x}$$

$$y' = y\left(5\ln|x^4+x| + \frac{20x^4+5x}{x^4+x}\right)$$

$$\boxed{y' = (x^4+x)^{5x}\left(5\ln|x^4+x| + \frac{20x^4+5x}{x^4+x}\right)}$$

Name: Richard

QUIZ 14 ♣

MATH 200
October 25, 2021

1. Use logarithmic differentiation to find the derivative of the function $y = x^{x^2+5}$.

$$y = x^{x^2+5}$$

$$\ln|y| = \ln\left|x^{x^2+5}\right|$$

$$\ln|y| = (x^2+5)\ln|x|$$

$$D_x\left[\ln|y|\right] = D_x\left[(x^2+5)\ln|x|\right]$$

$$\frac{y'}{y} = (2x)\ln|x| + (x^2+5)\frac{1}{x}$$

$$y' = y\left(2x\ln|x| + \frac{x^2+5}{x}\right)$$

$$\boxed{y' = x^{x^2+5}\left(2x\ln|x| + \frac{x^2+5}{x}\right)}$$

Name: Richard

QUIZ 14 ◊

MATH 200
October 25, 2021

1. Use logarithmic differentiation to find the derivative of the function $y = (x^2+1)^x$.

$$y = (x^2+1)^x$$

$$\ln(y) = \ln\left((x^2+1)^x\right)$$

$$\ln(y) = x \cdot \ln(x^2+1)$$

$$D_x\left[\ln(y)\right] = D_x\left[x \ln(x^2+1)\right]$$

$$\frac{y'}{y} = 1 \cdot \ln(x^2+1) + x \frac{2x+0}{x^2+1}$$

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

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

Name: Richard

QUIZ 14 ♠

MATH 200
October 25, 2021

1. Use logarithmic differentiation to find the derivative of the function $y = (x^2+1)^{x+1}$.

$$y = (x^2+1)^{x+1}$$

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

$$\ln|y| = (x+1)\cdot \ln|x^2+1|$$

$$D_x\left[\ln|y|\right] = D_x\left[(x+1)\cdot \ln|x^2+1|\right]$$

$$\frac{y'}{y} = 1\cdot \ln|x^2+1| + (x+1)\cdot \frac{2x}{x^2+1}$$

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

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