Find the derivative.

1. $y=\sin x$ $\cos x$
   $y=\tan x$ $\sec^2 x$
   $y=\sin^{-1}x$ $\frac{1}{\sqrt{1-x^2}}$

2. $y=e^x$ e^x
   $y=2^x$ $2^x \cdot \ln 2$
   $y=\cos x$ $-\sin x$

3. $y=\ln x$ $\frac{1}{x}$
   $y=x^3-8x^2+5x$ $3x^2-16x+5$
   $y=3e^{4x}$ $3e^{4x}\cdot 4$ $12e^{4x}$

4. $y=\tan^{-1}x$ $\frac{1}{1+x^2}$
   $y=\cos^{-1}x$ $\frac{-1}{\sqrt{1-x^2}}$
   $f(x)=x^2\sin(\pi x)$ $2x\sin(\pi x)+x^2\pi\cos(\pi x)$

Oct 30-8:44 AM

Opener

Let f and g be functions that are differentiable everywhere. If g is the inverse function of f and if $g(-2)=5$ and $f'(5)=-\frac{1}{2}$, then $g'(-2)=$

$(-2,5)$

(A) 2 (B) $\frac{1}{2}$ (C) $\frac{1}{5}$ (D) $-\frac{1}{5}$ (E) -2

g $(-2,5)$ -2

f $(5,-2)$ $-\frac{1}{2}$

Oct 1-8:23 AM

If $y=\frac{\ln x}{x}$, then $\frac{dy}{dx}=$

(A) $\frac{1}{x}$ (B) $\frac{1}{x^2}$ (C) $\frac{\ln x-1}{x^2}$ (D) $\frac{1-\ln x}{x^2}$ (E) $\frac{1+\ln x}{x^2}$

$\frac{f'\cdot g-f\cdot g'}{g^2}$

Oct 24-8:18 AM

Simplify the expression using properties of exponents.

1) $\ln(e^{\tan x})$ $\tan x$

2) $\log_2(8^{x-5})=x$

$2^x=8^{x-5}$

$2^x=2^{3(x-5)}$

$x=3x-15$

$-2x=-15$

$x=7.5$

3) $3\ln x^3-\ln 3x+\ln(12x^2)$

$\ln\left(\frac{x^3}{3x}\cdot 12x^2\right)=\ln(4x^4)$

4) $\ln(x^2-4)-\ln(x+2)$

$\ln\left(\frac{x^2-4}{x+2}\right)=\ln(x-2)$

Oct 19-10:08 AM

3-7 Implicit Differentiation

Learning Objectives:

I can calculate the derivatives of implicitly defined function.

I can calculate the second and higher order derivatives of implicitly defined functions.

I can write the tangent and normal lines to implicitly defined functions.

Oct 1-8:23 AM

Implicit differentiation is used whenever you need to find a rate of change (derivative) and the relation cannot be solved for y like with the equation:

$$x^3y^2-\cos y\cdot\ln x+e^x\sec^{-1}y=\sqrt{y^5x^3}$$

Oct 1-8:23 AM

Ex1. Find the derivative of

$$x^2+3x+2y+y^2=0$$

$$2x+3+2\cdot\frac{dy}{dx}+2y\frac{dy}{dx}=0$$

$$2x+3+2\cdot y'+2y\cdot y'=0$$

$$2y'+2y\cdot y'=-2x-3$$

$$y'(2+2y)=-2x-3$$

$$y'=\frac{-2x-3}{2+2y}$$

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Ex2. Find the derivative of

$$\frac{(x-3)^2}{25}+\frac{(y+1)^2}{9}=1$$

$$\frac{1}{25}(x-3)^2+\frac{1}{9}(y+1)^2=1$$

$$\frac{1}{25}\cdot 2(x-3)\cdot 1+\frac{1}{9}\cdot 2(y+1)\cdot 1y'=0$$

$$\frac{2}{25}(x-3)+\frac{2}{9}(y+1)\cdot y'=0$$

$$\frac{\cancel{\frac{2}{9}(y+1)}\cdot y'}{\cancel{\frac{2}{9}(y+1)}}=\frac{-\frac{2}{25}(x-3)}{\frac{2}{9}(y+1)}$$

Oct 1-8:23 AM

Ex3. Write the equation of the tangent line to the curve at the point (1,2)

$$x^2+3xy+y^2=11$$

$f=3x$ $g=y$

$f'=3$ $g'=1\cdot y'$

$$2x+3xy'+3y+2y\cdot y'=0$$

$$2+3y'+6+4y'=0$$

$$8+7y'=0$$

$$7y'=-8$$

$$y'=-\frac{8}{7}$$

$$(y-2)=-\frac{8}{7}(x-1)$$

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Ex4. Write the equation of the normal line to the curve at the point (1,2) (same curve that was in Ex3)

$$y-2=\frac{7}{8}(x-1)$$

$$x^2+3xy+y^2=11$$

$$2x+3xy'+3y+2y\cdot y'=0$$

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Ex5. Find the second derivative of

$$x^2+3x+2y+y^2=0$$

$$y'=\frac{-2x-3}{2+2y}$$

$$\frac{d^2y}{dx^2}=y''=\frac{-2(2+2y)-(-2x-3)2\cdot y'}{(2+2y)^2}$$

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

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Homework

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