Find y' in terms of x and y.

4. $x^3 + y^3 - 6xy = 0$

$$\frac{d}{dx}\left[x^3+y^3-6xy\right] = \frac{d}{dx}[0]$$

$$3x^2 + 3y^2 \cdot y' - 6(xy' + 1 \cdot y) = 0$$

$$3x^2 + 3y^2 y' - 6xy' - 6y = 0$$

$$3y^2 y' - 6xy' = 6y - 3x^2$$

$$y' = \frac{6y - 3x^2}{3y^2 - 6x} = \boxed{\frac{2y - x^2}{y^2 - 2x}}$$

Find y' in terms of x and y.

5. $y = \sin(xy)$

$$\frac{d}{dx}[y] = \frac{d}{dx}[\sin(xy)]$$

$$y' = \cos(xy) \cdot [xy' + 1 \cdot y]$$

$$y' = xy' \cos xy + y \cos xy$$

$$y' - xy' \cos xy = y \cos xy$$

$$y'(1 - x\cos xy) = y \cos xy$$

$$\boxed{y' = \frac{y \cos xy}{1 - x \cos xy}}$$

Review

Find the limit (if it exists).

$$\lim_{x\to 1}\frac{\sqrt{x+3}-2}{x^2-1}\cdot\frac{\sqrt{x+3}+2}{\sqrt{x+3}+2}=\lim_{x\to 1}\frac{x+3-4}{(x^2-1)(\sqrt{x+3}+2)}$$

$$=\lim_{x\to 1}\frac{x-1}{(x-1)(x+1)(\sqrt{x+3}+2)}=\frac{1}{(1+1)(\sqrt{1+3}+2)}=$$

$$=\frac{1}{2(2+2)}=\boxed{\frac{1}{8}}$$

$$\lim_{x\to 2}f(x)=8 \qquad f(x)=\begin{cases}10-x, & x\le 2\\ x^2+2x, & x>2\end{cases}$$

$10-2=8$

$2^2+2(2)=8$

Review

Find k such that the line $y=2x$ is tangent to the graph of the function $f(x)=x^2+kx$.

slope of tangent line = derivative of function

$2=2x+k$

equations are equal at point of tangency (intersection)

$2x=x^2+kx$

$2-k=2x$

$1-\frac{k}{2}=x$

$2\left(1-\frac{k}{2}\right)=\left(1-\frac{k}{2}\right)^2+k\left(1-\frac{k}{2}\right)$

$2-k=1-k+\frac{k^2}{4}+k-\frac{k^2}{2}$

$\frac{k^2}{2}-\frac{k^2}{4}-k+2-1=0$

$\frac{k^2}{4}-k+1=0$

$k^2-4k+4=0$

$(k-2)^2=0$

$\boxed{k=2}$

Find the derivative of f with respect to x. Review

$$f(x) = 5\sin^2\left(\sqrt{3\csc(7x^2 - 2x)}\right)$$

$$= 5\left[\sin\left(3\csc\left[7x^2-2x\right]\right)^{1/2}\right]^2$$

$$f'(x) = 10\sin\sqrt{3\csc(7x^2-2x}\cdot\cos\sqrt{3\csc(7x^2-2x}\cdot$$
$$\frac{1}{2}\left(3\csc(7x^2-2x)\right)^{-1/2}\cdot\left(-3\csc(7x^2-2x)\cot(7x^2-2x)\right)\cdot$$
$$(14x-2)$$

Homework #6 (submitted Wed. 9/17)
2.5 # 1-39 odd; 43, 47 - Implicit Differentiation

Homework #7 (due Fri. 9/26)
2.6 # 15-23 odd - Related Rates
2.6 # 25, 27, 35 - Related Rates (more challenging problems)
3.1 # 17-31 odd - Absolute Extrema on an Interval

Homework #8 (due Fri. 10/3)
3.2 # 7-19 odd - Rolle's Theorem
3.2 # 31-37 odd - Mean Value Theorem
3.3 # 11-31 odd - Increasing, Decreasing, and Relative Extrema
3.4 #11-25 odd - Inflection Points and Concavity

Quiz #4 - Mon, 9/29
Test #3 - Fri, 10/3