Find y' implicitly in terms of x and y. Review

$x^2y + 3xy^3 = 5x^3y^2$

$2xy + x^2y' + 3y^3 + 3x(3y^2y') = 15x^2y^2 + 5x^3(2yy')$

$x^2y' + 9xy^2y' - 10x^3yy' = 15x^2y^2 - 2xy - 3y^3$

$y'(x^2 + 9xy^2 - 10x^3y) = \sim\sim$

$$\boxed{y' = \frac{15x^2y^2 - 2xy - 3y^3}{x^2 + 9xy^2 - 10x^3y}}$$

$\cos x + \sin y = \tan(xy)$

$-\sin x + y'\cos y = \sec^2(xy) \cdot (xy' + y)$

$-\sin x + y'\cos y = xy'\sec^2 xy + y\sec^2 xy$

$y'(\cos y - x\sec^2 xy) = y\sec^2 xy + \sin x$

$$\boxed{y' = \frac{y\sec^2 xy + \sin x}{\cos y - x\sec^2 xy}}$$

Find the limit (if it exists). Review

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

$$= \lim_{x \to 1} \frac{\cancel{x-1}\ 1}{\cancel{(x-1)}(x+1)(\sqrt{x+3} + 2)} = \boxed{\frac{1}{8}}$$

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

$= \boxed{8}$

Review

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

$x^2 + kx = 2x$

$2 = 2x + k$

$2 - 2x = k$

$x^2 + (2-2x)x - 2x = 0$

$x^2 + 2x - 2x^2 - 2x = 0$

$-x^2 = 0$

$x = 0$

$\boxed{k = 2}$

Find the derivative of f with respect to x.

Review

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

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

$f'(x) =$

$10\sin\sqrt{3\csc(7x^2-2x)} \cdot$

$\cdot \cos\sqrt{3\csc(7x^2-2x)} \cdot$

$\cdot \frac{1}{2}\left(3\csc(7x^2-2x)\right)^{-1/2} \cdot$

$\cdot \left(-3\csc(7x^2-2x)\cot(7x^2-2x)\right)$

$\cdot (14x-2)$

Review

$f(x) = -3x \tan x$

a. Find $f'(x)$.

b. Find $f''(x)$.

$$f'(x) = (-3\tan x) + (-3x\sec^2 x)$$

$$f''(x) = -3\sec^2 x - 3\sec^2 x - 3x(2\sec x \cdot \sec x \tan x)$$

$$= -6\sec^2 x - 6x\sec^2 x \tan x$$

- Find all critical numbers and state the open intervals on which f is increasing and/or decreasing.
- Find all inlection points and state the open intervals on which f is concave up and/or concave down.
- Use these results to determine all relative and absolute extrema.

3.3

30. $f(x) = \dfrac{x+3}{x^2}$

3.4 #20

$$f(x) = \frac{x+1}{\sqrt{x}}$$

Homework since Test #2 (Material for Test #3)

2.5 # 1-39 odd; 43, 47 - Implicit Differentiation
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
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 - Inlection Points and Concavity