Find dy/dx for the following curves:

$x^2y + e^x = \cos(y)$ $\quad$ $(x^3+y^3)^5 + x^2 = y\, e^x$ $\quad$ $\sin(x^2y) + y^2 = x^3 - 2e^y$

$$\frac{dy}{dx} = \frac{-e^x - 2xy}{x^2 + \sin(y)} \qquad \frac{dy}{dx} = \frac{ye^x - 2x - 5(x^2+y^3)^4(3x^2)}{5(x^3+y^3)^4 3y^2 - e^x}$$

$$\frac{dy}{dx} = \frac{3x^2 - \cos(x^2y)2xy}{2e^y + 2y + \cos(x^2y)x^2}$$

Find the equation of the tangent line to the given curve at the specified point:

$$x^2 + xy + y^2 = 3 \text{ at } (1,1)$$

$$\left.\frac{dy}{dx}\right|_{x=y=1} = \left.\frac{-2x-y}{x+2y}\right|_{x=y=1} = \frac{-2-1}{1+2} = -1 \qquad y - 1 = -(x-1)$$

$$x^2 + y^2 = (2x + 2y^2 - x^2)^2 \text{ at } (0, 1/2)$$

$$\left.\frac{dy}{dx}\right|_{x=0,y=1/2} = \left.\frac{-2x + 2(2x+2y^2-x^2)(2-2x)}{2y - 2(2x+2y^2-x^2)4y}\right|_{x=0,y=1/2} = \frac{2}{1-2(1/2)2} = -2$$

$$y - \frac{1}{2} = -2(x-0)$$

Use logarithmic differentiation to find the derivatives of the following functions:

$$f(x) = x^{\tan x} \qquad g(x) = \frac{\sqrt{2x^3 + x^{-1/2}}\,(2x^3+5x)^2}{3x^8+17x^2} \qquad h(x) = (3x^2{+}2\sin x)^{x^2+1}$$

$$f'(x) = x^{\tan x}\left(\sec^2(x)\,\ln(x) + \frac{\tan x}{x}\right)$$

$$g'(x) = \frac{\sqrt{2x^3 + x^{-1/2}}\,(2x^3+5x)^2}{3x^8+17x^2}\left(\left(\frac{1}{2}\right)\frac{6x^2 - \frac{1}{2x^{3/2}}}{2x^3+x^{-1/2}} + (2)\frac{6x^2+5}{2x^3+5x} - \frac{24x^7+34x}{3x^8+17x^2}\right)$$

$$h'(x) = (3x^2{+}2\sin x)^{x^2+1}\left(2x\ln(3x^2+2\,\sin x) + \frac{(x^2+1)(6x+2\cos x)}{3x^2+2\sin x}\right)$$

Find a linearization to the following functions at the specified point:

$$f(x) = \sin(2x) \text{ at } x = 0 \qquad L(x) = 2x$$

$$f(x) = \sqrt{1+x} \text{ at } x = 8 \qquad L(x) = 3 + \frac{1}{6}(x-8)$$

- Use a linear approximation to find a good estimate for $\sqrt{15}$.

$$L(x) = 4 + \frac{1}{8}(x-16), \qquad L(15) = 4 - \frac{1}{8} = \frac{31}{8}$$

Evaluate the following limits:

$$\lim_{x\to 9} \frac{\sqrt{x}-3}{x-9} = \frac{1}{6} \qquad \lim_{x\to 1} \frac{x^3+2x-3}{x-1} = 5 \qquad \lim_{x\to 0} \frac{\sin 3x}{2x} = \frac{3}{2}$$

$$\lim_{x\to 0} \frac{1-\cos 2x}{x^2} = 2 \qquad \lim_{x\to\infty} \sqrt{x^2+x}-x = \frac{1}{2} \qquad \lim_{x\to\infty} \left(1+\frac{2}{x^2}\right)^x = 1$$