SPECIAL DERIVATIVES REVIEW

$$x^2 e^{4y} + \sin(y^2) = 4 - 2\cos(6x)$$

$$\underbrace{x^2 \cdot e^{4y} \cdot 4}\frac{dy}{dx} + e^{4y} \cdot 2x + \cos(y^2) \cdot 2y\frac{dy}{dx} = 2\sin(6x) \cdot 6$$

$$4x^2 e^{4y}\frac{dy}{dx} + 2xe^{4y} + 2y\cos(y^2)\frac{dy}{dx} = 12\sin(6x)$$

$$\frac{dy}{dx}\left[4x^2 e^{4y} + 2y\cos(y^2)\right] = 12\sin(6x) - 2xe^{4y}$$

$$\frac{dy}{dx} = \frac{12\sin(6x) - 2xe^{4y}}{4x^2 e^{4y} + 2y\cos(y^2)}$$

$$= \frac{6\sin(6x) - xe^{4y}}{2x^2 e^{4y} + y\cos(y^2)}$$

$(0, \pi)$

$\uparrow \ \ \uparrow$

$x \ \ y$

$$m = \frac{0 - 0}{0 \cdot 1 + \pi \cdot 1} = \frac{0}{\pi} = 0$$

$$y - \pi = 0(x - 0)$$

$$\boxed{y = \pi}$$

$$\frac{d}{dx} e^x = e^x \qquad \frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx} \cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} \ln x = \frac{1}{x} \qquad \frac{d}{dx} \tan^{-1} x = \frac{1}{x^2+1} \qquad \frac{d}{dx} \cot^{-1} x = \frac{-1}{x^2+1}$$

$$\frac{d}{dx} a^x = \ln a \cdot a^x \qquad \frac{d}{dx} \sec^{-1} x = \frac{1}{|x|\sqrt{x^2-1}} \qquad \frac{d}{dx} \csc^{-1} x = \frac{-1}{|x|\sqrt{x^2-1}}$$

$$\log_b a = \frac{\ln a}{\ln b}$$

$$\lim_{x\to\infty} e^x = +\infty \qquad \lim_{x\to-\infty} e^x = 0$$

$$\lim_{x\to\infty} \ln x = +\infty \qquad \lim_{x\to 0^+} \ln x = -\infty$$

$$2a^3 - 4b^2 = 9c^5$$

Find $\frac{db}{da}$

$$6a^2 - 8b\frac{db}{da} = 45c^4\frac{dc}{da}$$

$$\frac{6a^2 - 45c^4\frac{dc}{da}}{8b} = \frac{\cancel{8b}\frac{db}{da}}{\cancel{8b}}$$

$$\log_8\left(\frac{\sin^{-1}(x^2)}{4^{x^3}}\right)$$

$$=\frac{\ln\left(\frac{\sin^{-1}x^2}{4^{x^3}}\right)}{\ln 8}$$

$$=\frac{1}{\ln 8}\left[\left(\frac{4^{x^3}}{\sin^{-1}x^2}\cdot\left[\frac{\overbrace{4^{x^3}\cdot\frac{1}{\sqrt{1-(x^2)^2}}\cdot 2x}-\overbrace{\sin^{-1}(x^2)\ln 4\cdot 4^{x^3}\cdot 3x^2}}{\left(4^{x^3}\right)^2}\right.\right.\right.$$