1. Find $\frac{dy}{dx}$ if $2x^2 + xy - y^3 = 12$.

+10

$$\frac{d}{dx}(2x^2) + \frac{d}{dx}(xy) - \frac{d}{dx}y^3 = \frac{d}{dx}12$$

$$4x + x\frac{dy}{dx} + y - 3y^2\frac{dy}{dx} = 0$$

$$x\frac{dy}{dx} - 3y^2\frac{dy}{dx} = -4x - y$$

$$(x - 3y^2)\frac{dy}{dx} = -4x - y$$

$$\frac{dy}{dx} = \frac{-4x - y}{x - 3y^2}$$

2. Consider the curve defined by $xy = x - 2y$. You are given that $\frac{dy}{dx} = \frac{1-y}{2+x}$. Find an equation of the tangent line when $x = -1$. Write your answer in the form $y = mx + b$.

+8

$x = -1$: $\quad -1 \cdot y = -1 - 2y$

$y = -1$

$\frac{dy}{dx}$ at $(-1,-1)$: $\frac{1-(-1)}{2-1} = 2$

$y - (-1) = 2(x - (-1))$

$y + 1 = 2x + 2$

$y = 2x + 1$

3. Evaluate each of the following limits. When a limit DNE, determine whether it is DNE $(+\infty)$, DNE $(-\infty)$, or just DNE.

+6

(a) $\lim_{x\to\infty} x^2e^{-4x}$ $= \lim_{x\to\infty} \frac{x^2}{e^{4x}} \overset{LR}{=} \lim_{x\to\infty} \frac{2x}{4e^{4x}}$

$\overset{LR}{=} \lim_{x\to\infty} \frac{2}{16e^{4x}} = 0$

+6

(b) $\lim_{x\to-\infty} x^2e^{-4x}$

goes to $+\infty$ goes to $+\infty$ $\Big\}$ DNE $(+\infty)$

+6

(c) $\lim_{x\to 0^-} \frac{\sin(x)}{x^2}$ $\overset{LR}{=} \lim_{x\to 0^-} \frac{\cos(x)}{2x}$ $\leftarrow$ +1 near $x=0$ $\leftarrow$ neg. # close to 0

DNE $(-\infty)$

+6

(d) $\lim_{x\to 0+} x^4\ln(x)$ $= \lim_{x\to 0^+} \frac{\ln(x)}{x^{-4}} = \lim_{x\to 0^+} \frac{\frac{1}{x}}{-4x^{-5}}$

$= \lim_{x\to 0^+} \frac{1}{x}\cdot\frac{x^5}{-4} = \lim_{x\to 0^+} \frac{x^4}{-4} = 0$