$+10$

1. Find $\frac{dy}{dx}$ if $2x^2 - xy + y^3 = 10$.

$$\frac{d}{dx}(2x^2) - \frac{d}{dx}(xy) + \frac{d}{dx}y^3 = \frac{d}{dx}10$$

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

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

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

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

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

$+8$

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

$2y = 2$

$y = 1$

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

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

$y = \frac{1}{2}x - \frac{1}{2} + 1$

$y = \frac{1}{2}x + \frac{1}{2}$

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

+6

(a) $\lim_{x\to\infty} x^2e^{-3x}$ $= \lim_{x\to\infty} \frac{x^2}{e^{3x}} \overset{LR}{=} \lim_{x\to\infty} \frac{2x}{3e^{3x}}$

$\overset{LR}{=} \lim_{x\to\infty} \frac{2}{9e^{3x}} = 0$

(b) $\lim_{x\to-\infty} x^2e^{-3x}$

+6

x^2 goes to $+\infty$

e^{-3x} goes to $+\infty$

DNE$(+\infty)$

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

+6

DNE$(-\infty)$

(d) $\lim_{x\to 0^+} x^3\ln(x)$ $= \lim_{x\to 0^+} \frac{\ln(x)}{x^{-3}} \overset{LR}{=} \lim_{x\to 0^+} \frac{\frac{1}{x}}{-3x^{-4}}$

+6

$= \lim_{x\to 0^+} \frac{1}{x}\cdot\frac{x^4}{-3} = \lim_{x\to 0^+} \frac{x^3}{-3} = 0$