+6

1. Given $f(x) = \log_3(2x + x^2)$, find $f'(x)$.

$f(x) = \log_3(x) \quad f'(x) = \frac{1}{x \ln 3}$

$g(x) = 2x + x^2 \quad g'(x) = 2 + 2x$

$f'(g(x))g'(x) = \frac{1}{g(x)\ln 3}(2+2x) = \frac{2+2x}{(2x+x^2)\ln 3}$

+10

2. Consider the curve defined implicitly by $3x^2 - 2xy + 4y^2 = 5$. Show that $\frac{dy}{dx} = \frac{y - 3x}{4y - x}$.

$\frac{d}{dx}3x^2 - \frac{d}{dx}2xy + \frac{d}{dx}4y^2 = \frac{d}{dx}5$

$6x - 2(x\frac{dy}{dx} + y) + 8y\frac{dy}{dx} = 0$

$6x - 2x\frac{dy}{dx} - 2y + 8y\frac{dy}{dx} = 0$

$(8y - 2x)\frac{dy}{dx} = 2y - 6x$

$\frac{dy}{dx} = \frac{2y - 6x}{8y - 2x} = \frac{2(y-3x)}{2(4y-x)} = \frac{y-3x}{4y-x}$

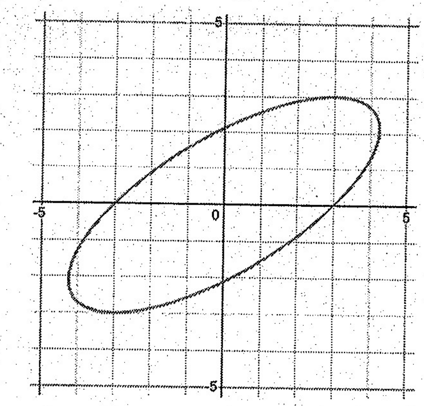
+4

3. Find $\lim_{x\to\infty} \frac{4 - x - x^3}{6x^3 + x^2}$.

$\lim_{x\to\infty} \frac{4 - x - x^3}{6x^3 + x^2} = -\frac{1}{6}$

tangents

+6 4. Given the ellipse $x^2 - 2xy + 2y^2 = 9$ and $\dfrac{dy}{dx} = \dfrac{y-x}{2y-x}$, find the equations of the horizontal ~~asymptotes~~. The picture is a guide only, you cannot just guess by looking at the picture.



Set the numerator to 0.

$y - x = 0$

$y = x$

Substitute back in.

$y^2 - 2y \cdot y + 2y^2 = 9$

$y^2 = 9$

$y = \pm 3$

Tangents are $y = -3$ and $y = 3$.

+5 5. Find $\displaystyle\lim_{x \to 0+} \frac{x+1}{\cos(x) - 1}$.

Form: $\dfrac{1}{0}$, so DNE

Near 0, $\cos(x) < 1$, so $\cos(x) - 1 < 0$.

Thus, the limit is DNE $(-\infty)$.