Name_____ Date_____ Period_____

Worksheet 8.1—Derivatives

Show all work on a separate sheet of paper. **No Calculator** unless otherwise specified. USE CORRECT NOTATION **ALWAYS**!

For 1 – 9, find $\frac{dy}{dx}$. Simplify and/or rewrite first as necessary. Simplify your answers (no negative exponents, rational exponents, or complex fractions!!). REMEMBER TO SIMPLIFY EARLY AND OFTEN (ESPECIALLY IN THE PRESENCE OF LOGS).

1. $y = e^{6x^2-5x+1}$ 2. $y = (2x+\sin x)^4$ 3. $y = \frac{6x^3}{2\sqrt{x}}$ 4. $y = e^{-8x}\ln 2x$

5. $y = \cos 3x + 3x + e^{-3} + \ln 3$ 6. $y = \ln\left(9 - \frac{7}{x^3}\right)$ 7. $y = x^5 e^{\sin 3x}$ 8. $y = \frac{4x}{2x^2-1}$

9. $y = \sqrt{3x^2 - \cos x + 1}$

10. Given that $\tan(4x) = \frac{\sin(4x)}{\cos(4x)}$, find y' if $y = \ln(\tan(4x))$.

11. Given that the derivative of $\cot x$ is $-\csc^2 x$, find y' if $y = \cot\left(e^{\sin(4x^2)}\right)$.

12. Determine the *x*-coordinate of the vertex of each parabola using calculus. Determine whether this *x*-coordinate give the location of a maximum value or minimum value.
    (a) $f(x) = 2x^2 + 5x - 7$ (b) $g(x) = 4 - 6x^2 - \frac{2}{3}x$

13. Find the coordinate(s) of each horizontal tangent line (if any exist), then find the equation of the tangent line at each point. If none exist, explain why in terms of calculus.
    (a) $y = \frac{2}{3}x^3 - 2x^2 - 4$ (b) $y = 3x - 2 + 5x^3$

14. For $f(x) = x^3 + 2x^2 + e^x - 3$
    (a) Find $f'(x)$
    (b) Find $f'(0)$
    (c) Find $f(0)$
    (d) Find the equation of the tangent line to $f(x)$ at $x = 0$
    (e) Find the *x*-intercept of the tangent line found in part (d)
    (f) Find $\lim_{x\to\infty} f(x)$ and $\lim_{x\to\infty} f'(x)$. In terms of the graph of $f(x)$, explain what each of these mean.