Sample Questions for Exam #2

1. Find the equation of the tangent line $y^3 + 2xy - y = 2x^2$ at the point (3, 2).

2. Find coordinates of all the points on the ellipse $x^2 + 2y^2 = 16$ where the tangent line has a slope of 2.

3. Use a linear approximation of the function $f(x) = \sqrt{5 + x^2}$ at the point where $x = 2$ to estimate the value of $f(2.1)$.

4. Find all the critical points of the function $f(x) = (\cos x)(\sin x)$.

5. Use logarithmic differentiation to prove the power rule: $\frac{d}{dx}[x^a] = ax^{a-1}$ for all constant exponents $a$.

6. Find a value of $b$ such that the cubic function $f(x) = x^3 + bx^2 - 8x + 3$ has a horizontal tangent line at $x = 4$.

7. Calculate $\frac{d}{dx}[\cot x]$ using the derivatives of sine and cosine.

8. Let $y = e^{\frac{x}{6}}$. Find the differential $dy$ at the point $x = 20$.

9. A weight is hanging from a spring and bouncing so that it’s height above the ground at time $t$ seconds is

$$h(t) = 20 + 3 \sin \left( \frac{2\pi}{5}(t + 1) \right)$$

inches.

Find the acceleration of the weight at the instants during the first 5 seconds when the velocity of the spring is zero. Give exact answers, not decimal approximations, and include units in your answers.