Name: _____

Instructions: All solutions should be prepared carefully and neatly. All solution sets shall be completed on this packet and submitted by uploading a scan or picture of your written work to D2L by 11:59 PM on the due date below. **Submit only a single pdf file of your entire packet. Desmos graphs can be submitted separately.** The mobile app called *Genius Scan* works well. Use a PENCIL and if you make a mistake, use an eraser. This assignment is graded on effort, completeness, and neatness for a total of 5 points. Careless presentation (e.g. bad handwriting, pen scribbles, doodles, wasted space, etc) will result in a deduction of points at my discretion. Submitted work that does not demonstrate clearly the process by which one arrived at the answer may result in a loss of points. Any parts to any questions that are not answered will also result in a loss of points. Academic dishonesty will not be tolerated.

Problem Set V

MAT 181 – Calculus I

Due: Friday, March 29, by 11:59 PM on D2L

Read: Sections 3.5–3.7

1. Differentiate the following relations implicitly to find $\frac{dy}{dx}$:

   (a) $3x^4 + 2y^3 = 10834$

   (b) $15x^2 - 4y^6 = 2x^2y^3$

   (c) $\cos(x + y) = y^2e^x + 69$

2. Consider the curve defined by the equation $x^3 + y^2 = \frac{5}{8}xy^3$. Verify that $(1, 2)$ lies on this curve. Find the equation of the tangent line to the curve at the point $(1, 2)$. Submit a Desmos graph of the curve defined by the equation and the tangent line on the same plot.

3. Find the equation of the line tangent to the graph of $f(x) = \dfrac{(4+x)2^{\ln(x)}}{x^3 2^x}$ at the point $(1, f(1))$. **Do not use any decimal approximations.**

4. For each of the following functions, find the derivative function $f'(x)$ using derivative rules developed in class. Simplify as much as humanly possible.

   (a) $f(x) = \arcsin(2\sqrt{x})$

   (b) $f(x) = \ln(x^{.18} + 4x - 6)$

   (c) $f(x) = 2^{\arctan(x+2)}$

   (d) $f(x) = \log_7(\log_5(\log_2(x)))$

5. Application Problem: A boat is towed toward a dock by a cable attached to a winch that stands 10 feet above the water level (see figure below). Let θ be the angle of elevation of the winch and let ℓ be the length of the cable as the boat is towed toward the dock.

   (a) Find $\dfrac{d\theta}{d\ell}$ in terms of ℓ only.

   (b) Compute $\dfrac{d\theta}{d\ell}$ when $\ell = 50$, 20, and 11 ft. Explain what would happen as $\ell \to 10^+$. Notice from the figure that θ is increasing as the boat is getting closer to the dock. Why, then, is $d\theta/d\ell$ negative?