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 IV

MAT 181-050 – Calculus I

Due: Monday, March 4 by 11:59 PM on D2L

Read: Sections 3.2, 3.3, and 3.4

1. Using the appropriate rules of differentiation, find the derivative of the following functions: [(7)]

   (a) $f(x) = 1$

   (b) $u(x) = \pi^3 + 12$

   (c) $g(t) = t^{42070}$

   (d) $p(t) = 42070^t$

   (e) $y(w) = 4w^6 + 14\sqrt{w} - 2^w$, where $w \geq 0$.

   (f) $q(s) = \dfrac{s^5 - 2s^2}{s^2}$, where $s \neq 0$.

   (g) $F(x) = \dfrac{e^x}{3} - 11x^3$

   (h) $h(t) = (t - t^3)(t^2 - 1)$

2. (This problem spans two pages.) Differentiate the following functions and simplify the expression as much as possible:

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

(b) $g(x) = \dfrac{100x}{x-1}$

(c) $h(x) = \dfrac{\sqrt{x}+x}{\sqrt{x}-x}$

(d) $k(x) = \dfrac{2x+1}{x^3 e^x}$

[ ]

(e) $k(x) = \dfrac{1 - \sin(x)}{1 - \cos(x)}$

(f) $f(x) = e^{5x+2} \tan(\sqrt{x})$

(g) $g(x) = (2x^{40} + 13x^3 + \sqrt[3]{x} - 5)^{20}$

(h) $h(x) = \cos\big(5\sin(x)\big)$

(i) $k(x) = \sqrt[5]{x^3 + \sin(2x^5 - 3)}$

3. In each problem below, find the equation of the tangent line to the curve at the given point. **For each problem, submit a Desmos graph that shows the function and the tangent line on the same plot.**

   (a) Consider $f(x) = \dfrac{2x^2}{3x - 1}$ at the point $\left(1, f(1)\right)$.

   (b) Consider $f(x) = 2\csc(x) - \sin(x)$ at the point $\left(\frac{\pi}{2}, f\left(\frac{\pi}{2}\right)\right)$.

4. Consider the function $f(x) = \dfrac{x}{2x-1}$ and the point $(-7, 1)$. This point *does not* lie on the graph of $y = f(x)$. Suppose $(c, f(c))$ is a point on the graph of $y = f(x)$ such that the tangent line to f at c goes through the point $(-7, 1)$. Show that two possible values for c exist and find them.

5. <u>Application Problem:</u> The position function for damped harmonic motion of an object of mass m is

$$y(t) = Ae^{-\frac{k}{2m}t}\cos(\omega t)$$

where A is the amplitude, and k and ω are constants specific to the motion. Find the velocity and acceleration functions for this motion.