1. [10pts] On the fourth of July, a rocket is shot straight up into the air and allowed to fall to the ground. After $t$ seconds, the rocket’s height above the ground, in feet, is given by the expression $s(t) = 80t - 16t^2$

(a) How many seconds does the rocket spend in the air?

(b) What is the velocity of the rocket at the time when it lands on the ground?

2. (a) [5pts] Find the limit: $\lim_{h \to 0} \frac{\frac{1}{5+h} - \frac{1}{5}}{h}$

(b) [5pts] Find the limit: $\lim_{x \to 2} \frac{2x^2 - 8}{2 - x}$

3. [10pts] Find the equation for the tangent line to the function $f(x)$ at the point $(0, 1)$.

$f(x) = e^{2x} + 2x + 1$

4. (a) $g(t) = \pi \sin^{-1}(x)$

(b) $y = 4x^2 - x$

(c) $h(x) = \frac{1}{x} + \frac{2}{x^2}$

5. (a) Find $\frac{d}{dx} [(e^x + x) \sin(2x)]$

(b) Find $\frac{d}{dt} \left( \frac{t^2 - 2t + 1}{t^2 + t^4 + 1} \right)$

(c) Find $\frac{d^2}{dx^2} [\sin(x) \cos(x)]$

6. [10pts] Find $\frac{dy}{dx}$, for the relation below.

$ye^y - x = 1 - x^2$

7. [10pts] Consider the functions $f(x) = x^2 - 4$, and $g(x) = \sqrt{x + 8}$.

(a) What are the domain and range of $f(x)$ and $g(x)$?

(b) What is the domain and range of $(g \circ f)(x)$?

8. [6pts] Consider the function $f(x)$ pictured below, and find the indicated limits. If a limit does not exist, write DNE.

9. (a) [5pts] Find $\frac{d}{dx} [\cos(x^4 - e^x)]$

(b) [5pts] Find $\frac{d}{dt} \left[ \ln \left( \cos^2 (t) \right) \right]$

10. [4pts] Draw a continuous function $f(x)$ whose derivative, $f'(x)$, has the following properties:

- $f'(x) = 0$ when $x = 1$
- $f'(x) < 0$ when $x < 1$
- $f'(x) > 0$ when $x > 1$

BONUS [5pts] Suppose that the graphs of both $f(x)$ and $f'(x)$ pass through the point $(\pi, 2)$. What is the equation of the tangent line for $f(x)$ where $x = \pi$?