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. [10pts] Choose two of the three functions below, and find the first derivative.

(a) \( g(t) = \pi \sin^{-1}(x) \) \hspace{1cm} (b) \( y = 4x^x - x \) \hspace{1cm} (c) \( h(x) = \frac{1}{x} + \frac{2}{x^2} \)

5. [10pts] Choose two of the three calculations below.

(a) Find \( \frac{d}{dx} [(e^x + x) \sin(2x)] \) \hspace{1cm} (b) Find \( \frac{d}{dt} \left[ \frac{t^2 - 2t + 1}{t^4 + 1} \right] \) \hspace{1cm} (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.

\[
\begin{align*}
\text{(a) } & \lim_{x \to 0} f(x) \\
\text{(b) } & \lim_{x \to 2^-} f(x) \\
\text{(c) } & \lim_{x \to -2} f(x)
\end{align*}
\]

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

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

10. [10pts] Find the equation for all horizontal and vertical asymptotes of the function \( h(x) = \frac{3}{x^2} - 1 \).
11. [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 $x = \pi$?