1. (a) Sketch the graph of \( \sin \left( \frac{1}{x} \right) \). Is this function continuous? (You may assume that trigonometric functions are continuous on their domain; see Spiderwire for a proof.)

(b) Is the function

\[
f(x) = \begin{cases} 
\sin \left( \frac{1}{x} \right) & \text{if } x \neq 0 \\
0 & \text{if } x = 0
\end{cases}
\]

continuous?

2. In class, we claimed that the function \( g(x) = ax^3 + bx^2 + 1 \), where \( a = \frac{1}{\pi} \left( 1 - \frac{2}{\pi} \right) \) and \( b = \frac{1}{\pi} \left( \frac{3}{\pi} - 2 \right) \), makes the function

\[
f(x) = \begin{cases} 
\tan(x) & \text{if } x < 0 \\
g(x) & \text{if } 0 \leq x \leq \pi \\
\cos(\sin(x)) & \text{if } x > \pi
\end{cases}
\]

differentiable for all \( x > -\frac{\pi}{4} \). Prove that this is true.

3. Sketch and find the equation of the line tangent to \( y = \sin x \) at \( x = \pi \).

4. Find the equation of the line tangent to \( y = \cos^2(x) \) at \( x = \frac{\pi}{3} \).

5. Explain why \( \sin \left( \frac{\pi}{6} \right) = \sin \left( -\frac{11\pi}{6} \right) \).

6. Sketch the graphs of \( \csc(\theta) = \frac{1}{\sin(\theta)} \), \( \sec(\theta) = \frac{1}{\cos(\theta)} \) and \( \cot(\theta) = \frac{1}{\tan(\theta)} \).