1. Find the following limits.

   (a) $\lim_{x \to 1} 3e^x$

   (b) $\lim_{x \to -3} \frac{x^2 + 4x + 3}{x + 3}$

   (c) $\lim_{x \to 0} \frac{1 - \sqrt{1 + x^2}}{x^2}$

   (d) $\lim_{x \to 1} \frac{1 - \sqrt{3 - x}}{x + 2}$

   (e) $\lim_{x \to -\infty} \frac{\sqrt{x^2 + 3}}{7 - 2x}$

   (f) $\lim_{x \to 1^-} \frac{1}{(x - 1)^2}$

2. Complete the formal definition of continuity.

   The function $f(x)$ is *continuous at* $x = a$ if

3. On which intervals are the following functions continuous?

   (a) $\dfrac{1}{x-1} + 1$

   (b) $\sqrt{1-x^2} - 2$

   (c) $\dfrac{(x-1)(x-2)}{(x-3)(x-4)}$

   (d) $\dfrac{\sin(x)}{\cos(x)}$

4. For which value(s) of k is the function $f(x) = \begin{cases} 4 - kx & \text{if } x > 1, \\ x^2 + k & \text{if } x \leq 1 \end{cases}$ continuous?

5. (a) Write the formal definition of the derivative.

$f'(a) =$

(b) Use the formal definition of the derivative to prove that $\dfrac{d}{dx}\sqrt{x} = \dfrac{1}{2\sqrt{x}}$.

6. (a) Write the quotient rule for derivatives:

$\dfrac{d}{dx}\left(\dfrac{f(x)}{g(x)}\right) =$

(b) Use to quotient rule to prove that $\dfrac{d}{dx}\cot(x) = -\csc^2(x)$.

7. Find the following derivatives.

(a) $\dfrac{d}{dx}\sqrt{\cos(x)}$

(b) $\dfrac{d}{dt}\dfrac{1}{1+e^{-t}}$

(c) $\dfrac{d}{dx}\dfrac{x^2-3e^x}{(x-2)^2}$

(d) $\dfrac{d}{dx}\dfrac{4x-3}{\sqrt{x^2-1}}$

(e) $\dfrac{d}{dx}\left(e^{\sin(x)}-x\cos(x)\right)$

8. Find the equation of the tangent line at $x = -\pi$ to the graph of

$$f(x) = \frac{\sin(x) + 1}{x}$$

9. Find $\lim_{x \to 0} x^2 \sin\left(\frac{1}{x}\right)$ and prove that your answer is correct using the squeeze theorem.