Math 2250, Practice Sheet for exam 1

1. Use the definition of the derivative to compute the following derivatives:
   a. $\dfrac{d}{dx}\left(x^2 - x\right)$

   b. $\dfrac{d}{dx}\left(\sqrt{x-1}\right)$

   c. $\dfrac{d}{dx}\left(1/x + \sqrt{x}\right)$

   d. $\dfrac{d}{dx}\left(\sin x\right)$
   hint: $\sin(A+B) = \sin A \cos B + \cos A \sin B$

2. Use the derivative rules to compute the following derivatives. Show your work!
   a. $\dfrac{d}{dx}\left(\sqrt{x-1}\cos x\right)$

   b. $\dfrac{d}{dx}\left(\dfrac{1}{1-\frac{1}{\sin x}}\right)$

   c. $\dfrac{d}{dx}\left(\sqrt[5]{x^{-3/2}} - \cot(x)\right)$

   d. $\dfrac{d}{dx}\left(\dfrac{x-1}{x+1}\right)$

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

3. Compute the following limits:
   a. $\lim_{x\to 9} \dfrac{(x-3)(\sqrt{x}-3)}{x-9}$

   b. $\lim_{x\to 0} \dfrac{\sin^3(2x)}{x^2\tan(x)}$

4. Explain why $\lim_{x\to 0^+} x\sin(x^3 - \ln x) = 0$.

5. Use the intermediate value theorem to explain why there is a solution to the equation $x^3 + 2x + 7 = 0$.

6. Explain why there is no solution to the equation $x^6 + 2x^2 + 7 = 0$.

7. Suppose that $f(x), g(x)$ are functions with $g(x) = f(2x+1)$. Use the definition of the derivative to show that $2f'(2x+1) = g'(2x+1)$.