1. Find the derivative of each. Look at the answers and state whether or not they are what you would expect. If not, speculate on why.
   Note: These functions are used again in the next problem, so you may want to define them so that you can just refer to them later rather than retyping them.

   (a) $f(x) = \left(4x^3 + 3x - 5\right)\sin(x)$

   (b) $p(t) = \dfrac{5 - 3t^2}{t^3 + 4t - 1}\cos^2(t)$

   (c) $g(\theta) = \theta\cot\left(\theta^2 + 3\theta - 1\right)$

2. Use the functions from problem 1 to find the instantaneous rate of change for the function at the given value. (Express solutions in a *reasonable* form.)

   (a) $f(x)$ when $x = 1$

   (b) $p(t)$ when $t = \pi/6$

   (c) $g(\theta)$ when $\theta = 0.41$

3. Given $f(x) = \dfrac{x^4}{4} - 3x^2 - 2x + 1$.

   (a) Graph f and its first, second, third, and fourth derivatives on the same coordinate plane. Show an appropriately labeled legend.

   (b) What is true about the function f when the first derivative is negative?

   (c) What is true about the first derivative when the second derivative is negative?

   (d) How does the relationships between the graphs of each succeeding derivative illustrate the expected result from the Power Rule?

4. Given $g(x) = \left(x^2 - x - 6\right)\sin\left(\dfrac{x^2}{10}\right)$ on $[-\pi, \pi]$.

   (a) Determine the x-coordinates of all points where g has horizontal tangents in the given interval.

   (b) Determine the x-coordinates of all points in the given interval where the slope of a tangent line to the graph of g is -4.

5. Given $R(t) = \dfrac{5 - 3t + 4t^3 - t^4}{t^2 - t + 2}$.

   (a) Determine the slope of the tangent line to the graph of R when $t = 1, 2.1,$ and 4.31.

   (b) Determine the interval(s) when the second derivative is positive.