

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.
 - (a) $f(x) = (4x^3 + 3x - 5) \sin(x)$
 - (b) $p(t) = \frac{5 - 3t^2}{t^3 + 4t - 1} \cos^2(t)$
 - (c) $g(\theta) = \theta \cot(\theta^2 + 3\theta - 1)$
2. Use the functions from problem 1 to find the instantaneous rate of change for the function at the given value. (Express your answers 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 $f(x) = \frac{x^4}{4} - 3x^2 - 2x + 1$.
 - (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 $g(x) = (x^2 - x - 6) \sin\left(\frac{x^2}{10}\right)$ 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 $R(t) = \frac{5 - 3t + 4t^3 - t^4}{t^2 - t + 2}$.
 - (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.