Intro to Math for Political Scientists

Day 2 Homework

Fall 2017

1. Find the following:
    1. $\lim_{x \to 1} 2x^2 + 1$
    2. $\lim_{x \to 0} \left(\frac{2x^3 - 8}{x - 1} \right)$
    3. $\lim_{x \to 2} \left(\frac{x^2 + 4x + 4}{x^2 - 4} \right)$
    4. $\lim_{x \to -1} (x + 1)^{-4}$
    5. $\lim_{x \to \infty} (x + 1)^{-4}$
2. Find the first and second derivatives with respect to x of the following functions:
    1. $f(x) = -89$
    2. $f(x) = 3x - 2$
    3. $f(x) = 5x^3 - 2x^2 + 6$
3. Find the derivative (with respect to x) of the following functions:
    1. $f(x) = (4x^2 + 7)^{-2}$
    2. $f(x) = \frac{x^4 + 3x^{-3} + 6x - 1}{x^{-2} + 2x}$
    3. $f(x) = (8x^2 + 3x)(x^4 + 2)$
4. A scholar argues that Texas's feelings for Donald Trump in the upcoming election can be modeled with this function:
$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2^2 + \beta_3 x_3$$
where y represents how warmly an individual feels towards Trump, x_1 represents a voter's frequency of church attendance, x_2 represents a voter's age, and x_3 represents their party identification. What is the derivative of y with respect to party identification? What is the derivative of y with respect to age?
5. Find all the extrema of these functions, and determine whether they are maxima or minima:
    1. $f(x) = \frac{x^3}{3} - x$
    2. $f(x) = (x - 2)^2 + 2$
6. Consider the following function:
$$f(x) = \begin{cases} x^2 & \text{if } x < 1 \\ x + 3 & \text{if } x \geq 1 \end{cases}$$
Find:
    1. $\int_{x=1}^{4} f(x)\, dx$
    2. $\int_{x=0}^{1} f(x)\, dx$
    3. $\int_{x=-1}^{3} f(x)\, dx$