Exercise 3

Math Bootcamp

Instructions

- Please show your work! You may lose points by simply writing in the answer. If the problem requires you to execute commands in `R`, please include the code you used to get your answers. Please also include the `.R` file that contains your code. If you are not sure if work needs to be shown for a particular problem, please ask.
- You should submit your work electronically on GitHub in `.pdf` form.

Question 1

1. Find the following limits:
   (a) $\lim_{x \to 4} [x^2 - 6x + 4]$
   (b) $\lim_{x \to 0} \left[\frac{x-25}{x+5}\right]$
   (c) $\lim_{x \to 4} \left[\frac{x^2}{3x-2}\right]$
   (d) $\lim_{y \to 0} \left[\frac{y^4}{y-1}\right]$
2. Find the following infinite limits:
   (a) $\lim_{x \to \infty} \left[\frac{9x^2}{x^2+3}\right]$
   (b) $\lim_{x \to \infty} \left[\frac{3x-4}{x+3}\right]$
   (c) $\lim_{x \to \infty} \left[\frac{2^x}{2^x+1}\right]$
3. Calculate the following derivatives:
   (a) $\frac{\partial}{\partial x} 3x^{\frac{1}{3}}$
   (b) $\frac{\partial}{\partial y} (y^3 + 3y^2 - 12)$
   (c) $\frac{\partial}{\partial x} (x^2 + 1)(x^3 - 1)$
   (d) $\frac{\partial}{\partial y} \exp[y^2 - 3y + 2]$
   (e) $\frac{\partial}{\partial x} \log(2\pi x^2)$
   (f) $\frac{\partial}{\partial x} \left(\frac{1}{100} x^{25} - \frac{1}{10} x^{0.25}\right)$

Question 2

Calculate the area of the function $f(x) = 4x2 + 12x - 18$ that lies above the x-axis and over the domain [-10, 10]. Note that before integrating, you must solve for the portion of the domain that is above the x-axis.

Question 3

Obtain the first, second, and third derivatives of the following functions:

1. $f(x) = 5x^4 + 3x^3 - 11x^2 + x - 7$
2. $f(y) = \sqrt{y} + \frac{1}{y^{\frac{7}{2}}}$
3. $h(u) = \log(u) + k$
4. $h(z) = 111z^3 - 121z$