Calculus 1 for Social Science **Name:** ______________________
Summer 2019
Final Exam **Time Limit: 180 min**

- **DO NOT open the exam booklet until you are told to begin. You should write your name and section number at the top and read the instructions.**
- Organize your work, in a reasonably neat and coherent way, in the space provided. If you wish for something to not be graded, please strike it out neatly. I will grade only work on the exam paper, unless you clearly indicate your desire for me to grade work on additional pages.
- You may use any results from class, homework or the text, but you must cite the result you are using. You must prove everything else.
- You needn't spend your time rewriting definitions or axioms on the exam.
- Show all of your work. You may not receive full credit for correct answers if supporting work is not demonstrated.

Question:	1	2	3	4	5	6	7	8	9	10	11	Total
Points:	12	5	5	18	5	15	5	10	5	10	10	100
Score:												

1. Evaluate the following limits. If it doesn't exist, explain why.

   (a) (4 points) $\lim_{x\to 4} \dfrac{x^2-16}{x-4}$

   (b) (4 points) $\lim_{x\to\infty} \dfrac{5x^4-3x+2}{7x^4+3x^2-1}$

   (c) (4 points) $\lim_{x \to 0^+} \dfrac{1}{1+2^{-1/x}}$

2. (5 points) Use the definition of the derivative to determine the derivative of $f(x) = \dfrac{-1}{x}$

3. (5 points) Find the values of x for which the function $f(x)$ is discontinuous.

$$f(x) = \begin{cases} -2x + 1 & \text{if } x < 0 \\ x^2 + 1 & \text{if } 0 \leq x \leq 1 \\ \sqrt{x+1} & \text{if } 1 < x < \infty \end{cases}$$

4. For the function $f(x) = x^3 + 2x^2 + x$

   (a) (3 points) Find the critical numbers.

   (b) (3 points) Find the intervals where $f(x)$ is increasing and decreasing and identify any relative maximum and minimum values.

   (c) (5 points) Find the regions of concavity.

   (d) (2 points) Find the x-coordinate of any inflection points.

(e) (5 points) Plot the function.

5. (5 points) Find the equation of the tangent line to the curve $y^2 = x^3(2-x)$ at the point $(x, y) = (-1, 2)$.

6. Find $\dfrac{dy}{dx}$ for the following equations.

   (a) (5 points) $y = \tan(x^3 + 1)$

   (b) (5 points) $y = \arcsin\left(e^{2x}\right)$

   (c) (5 points) $y = (x^2 + 1)\arctan(\sqrt{x})$

7. (5 points) Use Logorithmic differentiation to find the derivative of $y = \dfrac{(x^3+1)^4 \sin^2(x)}{\sqrt[3]{x}}$.
   DO NOT SIMPLIFY YOUR ANSWER.

8. A company's cost function and demand function are given by

$$C(x) = 3800 + 5x - \frac{x^2}{1000} \quad \text{and} \quad p(x) = 50 - \frac{x}{100} \quad \text{for} \quad 0 \le x \le 1000.$$

   (a) (4 points) Compute $C'(300)$ and give an interpretation of the results.

   (b) (2 points) Find the revenue function $R(x)$.

   (c) (4 points) Find the profit function $P(x)$ and the demand level which maximizes profit.

9. (5 points) Find the horizontal (if any) and vertical (if any) asymptote(s) of the function

$$f(x) = \frac{2x^2 - 6x}{x^2 - 9}$$

10. (10 points) A box with an open top and a square base is to have a volume of 32000 cm^3. Find dimensions of the box which will minimize the surface area of the box.

11. (10 points) A ladder 10ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 2 ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 6ft from the wall?