Math 241
Fall 2018
Exam 2 - Practice
10/26/18
Time Limit: 50 Minutes

Name (Print): _____
Section:

Problem	Points	Score
1	20	
2	30	
3	30	
4	15	
5	20	
6	10	
7	30	
8	40	
Total:	195	

1. (20 points) Use linearization to approximate $\sqrt{143}$ and $\sqrt[3]{124}$.

2. (a) (10 points) State Rolle's Theorem and the Mean Value Theorem.

(b) (10 points) Use the IVT and Rolle's Theorem (or the Mean Value Theorem) to show that $2x - \sqrt{2} = \cos^2(x)$ has one, and only one solution.

(c) (10 points) Show that if f is differentiable at $x = c$, then f is continuous at $x = c$.

3. (30 points) True of false: If $f''(c) = 0$ for some c, then f has an inflection point at $(c, f(c))$.

True of false: If f is differentiable on (a, b) and continuous of $[a, b]$ then $f'(c) = \dfrac{f(b) - f(a)}{b - a}$ for any c in (a, b).

True of false: If $f'(x) = 0$ then f is a constant function.

True of false: If $f'(c) = 0$ for some c, then $x = c$ is a critical number for f at $x = c$.

True of false: If $f'(c) = 0$ for some c, then f has a local min or max at $x = c$.

4. (15 points) a) Find the absolute extrema of $f(x) = x^{2/3}(x-6)$ on the interval $[-1, 5]$.

b) Find the absolute extrema of $f(x) = (x-3)^{2/3}$ on the interval $[2, 11]$.

c) Find the absolute extrema of $f(x) = \frac{x^3}{3} - 2x^2 + 3x$ on the interval $[0, 4]$.

5. (20 points) Consider the function $f(x) = \dfrac{x^2 - 1}{x^2 + 1}$.

a) Determine the interval(s) where $f(x)$ is positive/negative.

b) Find $\lim_{x \to \infty} f(x)$ and $\lim_{x \to -\infty} f(x)$. Give the equations of any asymptotes (horizontal, vertical or slant).

c) Give the intervals of increase and decrease and give the coordinates of any local min/max (meaning the x and y values).

d) Find the intervals of concavity and the coordinates of any inflection points.

6. (10 points) Sketch a graph of the function from the previous page. Label the asymptotes, extrema and inflection points.

7. (30 points) Repeat the process of problems 5 and 6 for the functions $f(x) = \dfrac{x^2}{\sqrt{x+1}}$, $g(x) = \dfrac{2x^2}{x^2-1}$ and $h(x) = \dfrac{x^2+3}{x-1}$.

8. (40 points) a) Find the radius and height of the largest right circular cylinder that can fit inside a sphere of radius 2.

b) What point on the graph of $f(x) = \frac{1}{\sqrt{x}}$ is closest to the origin?

c) You are to design a, quite large, square bottom box with total volume of 1500 $ft.^3$. The mysterious material you are to use costs 2 dollars per $ft.^2$ and you need to use two sheets of mysterious material on the bottom (this makes the box stronger). Find the dimensions and cost of the cheapest box you can make.