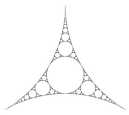

University of Portland
Department of Mathematics

CALCULUS I | EXAM 3 | FALL 2017

NAME:_____

Read This First!

- Show **ALL** work clearly in the space provided. In order to receive full credit on a problem, solution methods must be complete, logical and understandable.
- Answers must be clearly labeled in the spaces provided after each question. Cross out or fully erase any work that you do not want graded. The point value of each question is indicated after its statement. No books or other references are permitted.

I attest that I have neither given nor received help of any kind on this exam.

SIGNATURE:_____

Grading - For Administrative Use Only

Question	Points	Score
1	9	
2	12	
3	10	
4	5	
5	7	
6	10	
Total:	53	

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1. Evaluate the following limits [9]

   (a) $\lim_{x \to 0} \dfrac{\sin 3x}{7x}$

   (b) $\lim_{x \to \infty} \dfrac{e^{x^2}}{x^2}$

   (c) $\lim_{x \to 0} (1+x)^{\frac{1}{x}}$

2. Consider a function $f(x)$ that has the following first and second derivatives: [12]

$$f'(x) = \frac{x^4 - 16}{x^2 + 1} \qquad f''(x) = \frac{2x(x^4 + 2x^2 + 16)}{(x^2 + 1)^2}$$

(a) Find all critical points of $f(x)$ (just the x-values)

(b) Use the first derivative test to classify these critical points as minima, maxima, or neither (create a sign chart)

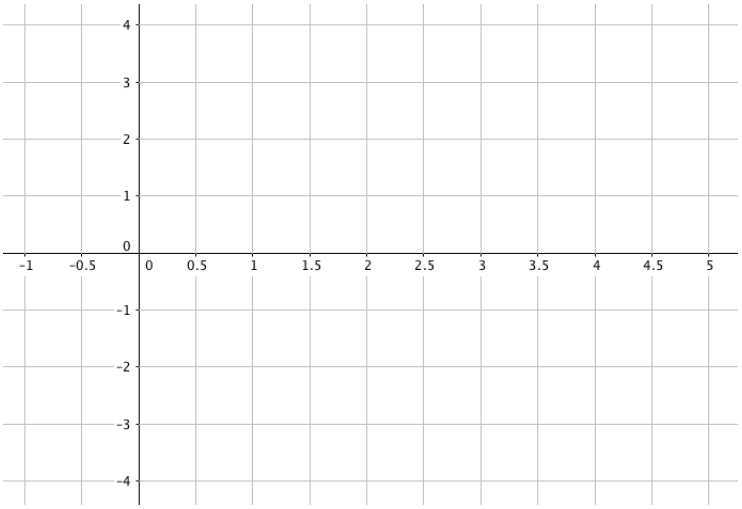
(c) Use the second derivative test to classify these critical points as minima, maxima, or neither

(d) Find all inflection points of $f(x)$ (just the x-values)

3. You are in charge of building a very sturdy box. The base of the box is a rectangle such that the width is twice as long as the length. The box doesn't have a top. The bottom of the box costs 10 cents per square inch and the sides cost 9 cents per square inch. The volume must be 20 cubic inches. Find the dimensions that minimize the cost. What is the cost? [10]

4. Consider the parametric equation: [5]

$$x(t) = 5 - 3t$$
$$y(t) = 3 - 2t$$
$$-\infty < t < \infty$$



(a) Sketch the parametric equation on the graph above

(b) Write a different parametric equation that sketches the same line

5. Consider the parametric equation describing the motion of a particle: [7]

$$x(t) = t^3 - 3t$$
$$y(t) = t^2 - 2t$$
$$-\infty < t < \infty$$

(a) Find the speed of the particle at time $t = 2$

(b) Is the particle ever stopped? When? Where?

6. Recall the in-class example we did where I shined a laser pointer on the chalkboard while rotating in my chair. I am sitting 3 meters from the wall and rotating at 4 radians per minute. How fast is the red dot moving when the angle between the the laser and the wall is $\pi/4$? [10]