Exam 3 **Name**_____

Math 131-01 **Calculus I** **April 6, 2018**

Guidelines

- **Calculators are not allowed.**
- Read the questions carefully. You have 50 minutes; use your time wisely.
- You may leave your answers in symbolic form, like $\sqrt{3}$ or $\ln(2)$, unless they simplify further like $\sqrt{9} = 3$ or $\cos(3\pi/4) = -\sqrt{2}/2$.
- Put a box around your final answers when relevant.
- Show all steps in your solutions and make your reasoning clear. Answers with no explanation will not receive full credit, even when correct.
- Use the space provided. If necessary, write "see other side" and continue working on the back of the same page.
- Remember $\dfrac{d}{dx}(a^x)$

OSL Tutors,
Thank you very much for the thought and care you use when checking solutions for test corrections.

Please sign here: _____

Date: _____

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

1. (10 points) Complete test corrections if score is 84 or below. Test corrections should be completed on a separate sheet of paper. Neatly written, with all work shown. Take the test corrections to the OSL and have them checked by a tutor. The tutor will sign and date the corrections; you will turn these into your instructor. Please DO NOT WAIT till the last minute to have your corrections checked, this may result in your corrections not being done by the due date. Get them done right after the test is returned to you and have them checked early.

2. (10 points) Evaluate $\lim_{x \to e} \frac{\ln x - 1}{x - e}$.

3. (10 points) Evaluate $\lim_{x \to 0} \frac{\sin^2(3x)}{3x^2}$.

4. (10 points) Evaluate $\lim_{x \to \infty} \left(1 + \frac{10}{x^2}\right)^{x^2}$.

5. (10 points) Find the absolute maximum and absolute minimum values of $f(x) = x^3 e^{-x}$ on $[-1, 5]$.

6. (10 points) Given $f(x) = x^2 - 2\ln x$, find intervals of increase and decrease for the function. Label each critical point as local maximum, local minimum or neither.

7. (10 points) Approximate the change in the volume of a sphere when its radius changes from $r = 5$ ft to $r = 5.1$ ft $\left(V(r) = \frac{4}{3}\pi r^3\right)$.

8. (10 points) Suppose $f''(x) = \dfrac{12x^4 - 12x}{(2 + x^3)^3}$ for a function with domain $(-\infty, -\sqrt[3]{2}\,) \cup (-\sqrt[3]{2}, \infty)$. Determine intervals where the function is concave up and concave down. Also identify any points of inflection.

9. (10 points) Sketch a graph of a function that satisfies the following conditions:

   a. $f(0) = 0$, $\lim_{x \to \pm\infty} f(x) = 4$, and $\lim_{x \to 2^+} f(x) = \infty$, $\lim_{x \to 2^-} f(x) = -\infty$

   b. $f'(x) < 0$ for $\infty < x < 0$, $0 < x < 2$, $2 < x < \infty$

   c. $f''(x) < 0$ for $-\infty < x < -2$ and $0 < x < 2$; $f''(x) > 0$ for $-2 < x < 0$ and $2 < x < \infty$

10. (10 points) A square based box-shaped shipping crate is designed to have a volume of 16 cubic feet. The material used to make the base costs \$8 per square foot, the material to make the sides cost \$4 per square foot and \$2 per square foot for the top. What are the dimensions of the crate that minimizes the cost of the materials?