Full Name:_____ **Instructor & Section:**_____

Instructions: Answer each question completely. Show all work. No credit is allowed for mere answers with no work shown. Show the steps of calculations. State the reasons that justify conclusions. Give exact values in results. Each problem is worth 10 points

1. Evaluate the given definite integral using the limit definition. Use $2i/n$ as $\overline{x_i}$.

$$\int_0^2 (x+1)dx$$

2. Find the tangent line to the graph of $f(x) = e^x$ at the point $(1, e)$

3. Find the intervals where the function $f(x) = x^2e^{-x}$ is increasing or decreasing. Find any local extreme values of the given function $f(x) = x^2e^{-x}$ on $[-5, 5]$.

4. First show that $f(x) = 3x^5 + x - 2$ has an inverse function $f^{-1}(x)$, and find $(f^{-1})'(2)$. (No explicit form of f^{-1} needed.)

5. Find the average value of the function defined by $f(x) = \cos(x/4)$ on the interval $[0, \pi]$.

6. A bacterial population grows at a rate proportional to its size. Initially, it is 10,000 and after 10 days it is 20,000. What is the population after 30 days?

7. A cone with circular base of radius a and height h has volume $\frac{1}{3}(\pi a^2)h$. If $a + h = 20$, then what is the maximum possible volume?