Show all work. Part A. Problems 1-5, 6 points each.

1. Use integration by parts to evaluate \( \int \ln(x) \, dx \)

2. What is the average value of the function \( f(x) = x^2 \) on the interval \([-2, 2]\)?

3. Does \( \int_1^{\infty} \frac{x}{x + 1} \, dx \) converge or diverge and why? Hint: you don’t have to perform the integration to find the answer.

4. If \( f(x, y) = xe^{xy} \) find \( f_x(1, 1) \).

5. True or False.

1) The equation \( z = x^2 \) is the equation for a parabola in 3 dimensions.

2) \( y = 3x + 2 \) represents a line when graphed in the \( x, y, z \) coordinate system.

3) The graph of \( ax + by + cz = 0 \) is a plane if \( a, b \) and \( c \) are all not 0 and the plane goes through the origin.
6. Use integration by parts to evaluate $\int_0^1 x^2e^{-x} \, dx$. You may leave your answer at the evaluation bar.

7. Show the volume of a sphere of radius $r$ is $\frac{4}{3}\pi r^3$ by finding the volume of the function $y = \sqrt{r^2 - x^2}$ from $-r$ to $r$ rotated around the $x$-axis.

8. For an interest rate of 4% over 3 years what **constant** money flow has a present value of $10,000?

9. If $p > 1$ find the value of $\int_1^\infty \frac{1}{x^p} \, dx$ in terms of the variable $p$. 
10. A car dealership estimates that the total weekly sales of a car is a function of the car’s price, \( p \), and the interest rate in percent, \( i \), (here 8% implies \( i = 8 \)) offered by the manufacturer. The approximate weekly sales are given by \( S(p, i) = 132p - 2pi - .01p^2 \).

a) Find an interpret \( S_i(p, i) \).

b) What would be the effect on weekly sales if the price is $9400 and the interest rate rises from 8% to 9%?

11/12. Show that the point \((-1, -\frac{1}{2})\) is a critical point for the function \( f(x, y) = x^2 - 2xy + 2y^2 + x - 5 \) and determine if it is Relative Max or Relative Min. Be sure to include all the first and second order partial derivatives needed to compute \( D \).