

Always show work to defend your answer in a logical and organized fashion unless told otherwise.

1. (15 points) Find the center of mass for the one-dimensional metal rod with linear density

$$\delta(x) = \frac{2}{(x+1)(x+3)} \text{ for } 0 \leq x \leq 2.$$

2. (10 points) Evaluate $I = \int \cosh^2(x) \sinh(x) + x \ln(x) dx$.

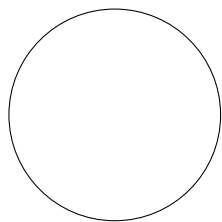
3. (10 points) Is $I = \int_0^{\infty} e^{-x} \sin(x) dx$ convergent or divergent? Evaluate if convergent, explain why if divergent.

4. (10 points) Is $I = \int_1^{\infty} \frac{2 + \cos(x)}{\sqrt{x}} dx$ convergent or divergent? Evaluate if convergent, explain why if divergent.

5. (5 points) Is $I = \int_{-1}^1 x^{-0.2} dx$ an improper integral or not? Defend your answer.

6. (15 points) Use an integral to find the arc length of the graph of $y = \frac{x^2}{4} - \frac{\ln(x)}{2}$ for $1 \leq x \leq e$.
7. (10 points) Use an integral to find the surface area of the solid formed by rotating the graph of $y = \sqrt{1 + 2x}$ for $0 \leq x \leq 2$ about the x-axis.

8. (15 points) Use an integral to calculate the force on one side of a circular plate of radius 5 meters submerged vertically two meters below the surface of the water. Use 1000 kg/m^3 for density of water and 10 m/sec^2 for standard gravity.



9. (10 points) Use integrals and symmetry to find the centroid of the lamina with constant density bounded by $y = x$, $x + y = 2$, and the y -axis.