

4. Find the arc length of the graph $y = \ln(\sin x)$ on the interval $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$. (8 points)
5. On the interval $[4,9]$, find the average value of the function $f(x) = \frac{1}{\sqrt{x}}$. (8 points)
6. Find the surface area of the surface of revolution generated by revolving the curve $y = 1 - \frac{x^2}{4}$ over the interval $[0,2]$ around the x -axis. (10 points)
7. Find the centroid of a laminar sheet on constant density bounded by the graphs $y = \sqrt{x} + 1, y = \frac{1}{3}x + 1$. (16 points)

8. An open tank has the shape of a right circular cone (point at the bottom). The top of the tank is 8 feet across and 6 feet deep. How much work is done emptying the tank by pumping the water out over the top edge? Assume that the fluid in the tank is water and it has a weight-density of 62.4 lbs./ft³. (10 points)

9. For the following integrals, state which method you would use, and which basic integration rule. Do not actually perform the integration. Methods may include: substitution, change of variables, complete the square, add/subtract, trig identities, long division, partial fractions, by parts, trig substitution, etc. Basic integration rules may include: power rule, log rule, exponential rule, trig functions, inverse trig functions, etc. Some problems may require more than one method or rule. (5 points each)

a. $\int \frac{1}{x(\ln^3 x)} dx$

b. $\int x^3 \sin x dx$

c. $\int \arccos x dx$

d. $\int \frac{\sqrt{16-x^2}}{x} dx$

e. $\int \frac{1}{(x^2+2x+11)^{\frac{3}{2}}} dx$

f. $\int \frac{x}{16x^4-1} dx$

10. Use Trapezoidal Rule to approximate the area under the curve of $\int_1^2 \frac{\sin x}{x} dx$ for $n=6$. (10 points)

14. Set up (but do not solve) this rational expression $\frac{x^5-7x^3+9x-15}{(x^2+3)(x-1)^3(x^2+1)^2(x+4)}$ for decomposition by partial fractions. (16 points)

15. Integrate by an appropriate method. (10 points each)

a. $\int e^{-3x} \sin 5x \, dx$

b. $\int \frac{4x}{e^x} \, dx$

c. $\int \sin^4 6\theta \, d\theta$

d. $\int \cosh^4 2x \, dx$

e. $\int \frac{9x^3}{\sqrt{1+x^2}} \, dx$

f. $\int \frac{x^2-x}{x^2+x+1} \, dx$

16. Determine whether or not the integral converges or diverges. If the integral converges, state its value. (16 points)

$$\int_0^{\infty} \frac{1}{e^x + e^{-x}} \, dx$$