

4. Find the length of the arc of the curve $f(x) = \cosh x$ on the interval $[0, 2]$. Round to 4 decimal places. (9 points)

5. Find the surface area of the shape formed by revolving the graph $y = x^3$ around the y -axis, on the interval $[0, 2]$. Sketch the region. (10 points)

6. Find the center of mass of the lamina with constant density of the region bounded by $y = x^2 - x, y = 0$. (16 points)

7. A force of 5 pounds compresses a 15-inch spring a total of 4 inches. How much work is done in compressing the spring 7 inches? (10 points)

8. 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. (6 points each)

a. $\int \frac{3}{2-e^x} dx$

b. $\int \cot x dx$

c. $\int x^2 e^{-x^2} dx$

d. $\int \frac{1}{\sqrt{x^2-7}} dx$

e. $\int \frac{1}{\sqrt{x}\sqrt{7-x}} dx$

f. $\int \cos^2 x dx$

9. Use Simpson's Rule to approximate the area under the curve of $\int_1^2 e^x \ln x dx$ for $n=6$. (10 points)

Part 2: In this section you will record your answers on paper along with your work. After scanning, submit them to a Canvas dropbox as directed. These questions will be graded by hand.

10. Use the definition of the hyperbolic trig functions to prove that the derivative of $\tanh(x) = \operatorname{sech}^2(x)$. (15 points)

11. Find the volume of the solid generated by revolving the region bounded by the graphs of the equations $f(y) = y^2$ and $g(y) = 4$ about the line $x = 6$. Sketch the graph of the region. (15 points)

12. Consider a conical tank with diameter 14 feet and a height of 12 feet. Find the amount of work needed to drain the tank if it is only half full. Assume that the fluid in the tank is water and it has a weight-density of 62.4 lbs./ft³. (20 points)

13. Set up (but do not solve) this rational expression $\frac{x^3 + 5x^2 - 8x - 24}{(x^2 + 1)^2(x - 3)^3(x + 4)(x - 1)}$ for decomposition by partial fractions. (15 points)

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

a. $\int \sin 2\theta \cos 2\theta d\theta$

b. $\int x\sqrt{2x+3}dx$

c. $\int \sec^3 x \tan x dx$

d. $\int \frac{3x-4}{(x-5)(x+1)} dx$

e. $\int \frac{dt}{\sqrt{3-4t^2}}$

15. Determine whether or not the integral converges or diverges. If the integral converges, state its value. (12 points)

$$\int_1^{\infty} \frac{1}{x \ln x} dx$$