

1. Compute $\int_0^{\pi/2} \sin x \cos x \, dx$.

2. Evaluate:

$$\lim_{x \rightarrow 0} \frac{10x^2 - \frac{1}{2}x^3}{e^{\frac{1}{3}x^2} - 1}$$

3. Find the area enclosed by the graph given by the parametric equations

$$\begin{aligned}y &= \sin(2t) \\x &= \sin(t)\end{aligned}$$

4. Find the value of the n th derivative of $f(x) = \sin^n(x)$ at $x = 0$.

5. Water flows into a tank at 3 gallons per minute. The tank initially contains 100 gallons of water, with 50 pounds of salt. The tank is well-mixed, and drains at a rate of 2 gallons per minute. How many pounds of salt are left after one hour?

6. Evaluate $\int e^{3x} \sin(x) dx$.

7. Compute $\sum_{n=0}^{\infty} \frac{2^{n-1}}{n!}$.

8. Find $f(x)$ such that $\lim_{h \rightarrow 0} \frac{h^2}{f(x+2x) - 2f(x+h) + f(x)} = -\frac{x^3}{2} - x - \frac{1}{2x}$.

9. Suppose $x''(t) + x'(t) = t^5 x(t)$. Let the power series representation of x be $x(t) = \sum a_n t^n$. Find a_n in terms of a_{n-1} and a_{n-7} , where $n > 7$.

10. Evaluate:

$$\int_{-\infty}^x t 2^t e^t dt$$