1. Compute $\int_0^{\pi/2} \sin x \cos x \; dx$.
2. Evaluate:
$$\lim_{x \to 0} \frac{10x^2 - \frac{1}{2}x^3}{e^{\frac{1}{3}x^2} - 1}$$
3. Find the area enclosed by the graph given by the parametric equations
$$y = \sin(2t)$$
$$x = \sin(t)$$
4. Find the value of the nth 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 $\lim_{h \to 0} \frac{h^2}{f(x+2x) - 2f(x+h) + f(x)} = -\frac{x^3}{2} - x - \frac{1}{2x}$.
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:
$$\int_{-\infty}^{x} t 2^t e^t dt$$