

Problem Set #1

1. Calculate the integral $\int e^x \sin(x) dx$.
2. Calculate the integral $\int \frac{1}{(y-1)(y+2)} dy$.
3. Solve the differential equation $\frac{d\Phi}{dz} = \frac{1}{z^4 - z^3}$.
4. Solve the initial value problem where $\frac{dL}{d\theta} = \theta\sqrt{\theta^2 + 9}$ and $L(-4) = 0$.
5. Find the general solution to the differential equation $\frac{dQ}{dt} = te^{-t}$.
6. Solve the initial value problem where $w'(\varphi) = \sin(\sqrt{\varphi})$ and $w(0) = 1$.
7. Solve the differential equation $y' = x^3(1 - y)$.
8. Solve the initial value problem where $\frac{dv}{dt} = 2\sqrt{v+1} \cos(t)$ and $v(\pi) = 0$.
9. Find the general solution to the differential equation $y' = 1 + x + y + xy$.
10. Solve the initial value problem where $\frac{dz}{dy} = \frac{1 + 3y^2}{3z^2 - 6z}$ and $z(0) = 1$. Determine the interval on which the solution is valid.
11. Solve the initial value problem $x' = 2x^2 + tx^2$ and $x(0) = 1$. Determine where the solution attains its minimum value.
12. Solve the equation
$$\frac{dy}{dx} = \frac{Ay + B}{Cy + D}$$
where $A, B, C,$ and D are constants.