1. a) Show by substitution that the exponential function $y = 10e^{2.5t}$ is a solution of the differential equation $y'(t) = 2.5y$.
   
   b) Show by substitution that the exponential function $y = Ce^{2.5t}$ is a solution of the same differential equation, for any constant $C$.

2. a) Find the **general solution** of the differential equation $y'(t) = 10e^{-\frac{t}{2}}$.
   
   b) Solve the initial value problem $y'(t) = 10e^{-\frac{t}{2}}, y(0) = 4$.

3. a) **A first-order linear equation**: Find the **general solution** of the differential equation $\frac{du}{dx} = 2u + 6$.
   
   b) Solve the initial value problem $\frac{du}{dx} = 2u + 6, u(1) = 6$. 
4. (Midterm 2, 2015) A Separable equation A function $y = f(x)$ has the property

$$y'(x) = e^{2x}e^{-y}, \quad y(0) = \ln(5).$$

Find the function $f(x)$.

5. (Midterm 2, Sample 5) Solve the initial value problem:

$$\frac{dy}{dt} = \frac{ty^3}{\sqrt{1+t^2}}, \quad y(0) = -1.$$

Express the answer in its explicit form.