

1. Determine all values of r for which $y''' - 3y'' + 2y' = 0$ has solutions of the form $y(t) = e^{rt}$.
2. Solve the initial value problem $y' + 2ty = 2te^{-t^2}$, $y(2) = 0$.
3. A tank has ten gallons of water in which two pounds of salt has been dissolved. Brine with 1.5 pound of salt per gallon enters at three gallons per minute, and the well-stirred mixture is drained out at a rate of four gallons per minute. Find the amount of salt in the tank at any time.
4. Determine an integrating factor for $xy^2 + y - xy' = 0$ and use it to solve the equation.