1. (10%) Solve $e^x \sin(y) - 2x + (e^x \cos(y) + 1)y' = 0$

2. (10%) Solve $(x^2 - 2x)y' + (x^2 - 5x + 4)y = (x^4 - 2x^3)e^{-x}$; $y(3) = 18e^{-3}$

3. (10%) Solve $y'' - 2y' + y = 3x + 25\sin(3x)$

4. (10%) Solve $y'' + 4y = f(t)$; $y(0) = y'(0) = 0$
   
   in which $f(t) = \begin{cases} 
   0 & \text{for } t < 3 \\
   t & \text{for } t \geq 3 
   \end{cases}$

5. (20%) Consider heat conduction in a bar with insulated ends, hence no energy loss across the ends. Find the temperature distribution if the LEFT HALF of the bar is INITIALLY at temperature $A$ and the RIGHT HALF is kept at temperature zero.

6. (20%) Find a series solution for the Dirichlet problem (Steady state problem) for a disk of the given radius 9 and given boundary data $f(\theta) = 16\cos(6\theta)$

7. (20%) Solve the problem
   $$\frac{\partial^2 y}{\partial t^2} = 16 \frac{\partial^2 y}{\partial x^2} + 2x \quad 0 < x < 2, \ t > 0$$
   $$y(0,t) = y(2,t) = 0 \quad \text{for } t > 0$$
   $$y(x,0) = 0, \ \frac{\partial y}{\partial t}(x,0) = 0 \quad \text{for } x > 0$$