計算題需計算過程，無計算過程者不予計分

1. Solve $(x^2 + y^2 + 3)dx + (-2xy)dy = 0$. (Hint: Nonexact ODE) (20%)

2. Solve $(x+1)^2 y'' - 2(x+1)y' + 2y = 0$, $y'(0)=0$, $y(0)=1$ (20%)

3. Please using the series method to find the Legendre polynomial $P_2$

   of $(1-x^2)y'' - 2xy' + 6y = 0$ as $y(1)=1$ (20%)

4. Please solve

   (1). the spring-damping system as m=1 kg, c=6 kg/s, k=9 kg/s$^2$, y(0)=0,

      y'(0)=0 with external force = exp(-3t) (20 %)

   (2). the same configuration but the external force runs as 1<t<2 (20 %)