Show work and write clearly.
Make sure graphs show approximating rectangle, \( R(x) \), \( r(x) \), \( p(x) \) and \( h(x) \).

1. (30 pts.) Use the disk method to find the volume of the solid obtained by rotating the region bounded by \( x = y - y^2 \) and \( x = y^2 - 3 \) about \( x = -4 \).

2. (30 pts.) Find the following integrals:
   
   a. \( \int (\tan^{-1} x) \, dx \)
   
   b. \( \int (x^4 \ln x) \, dx \)
   
   c. \( \int_{0}^{1} (x^3 e^{x^2}) \, dx \)

3. (30 pts.) Use the shell method to find the volume of the solid obtained by rotating the region bounded by \( y = x^2 \), \( y = 1 \) and \( x = 2 \) about \( y = -3 \).

4. (10 pts.) Solve: \( y' = \frac{xy}{3 \ln y} \).