1. In an experiment to determine riboflavin by fluorescence spectrometry, a series of riboflavin standards was analyzed and gave a calibration line with a slope of 2000 ppm^{-1} and an intercept 50. If a sample gave a fluorescence reading of 750, what is the riboflavin concentration (in ppm) of the sample? (10 points)

2.
   A. One diprotic acid H_2A solution of which the first and second acid dissociation constants are k_1 and k_2, respectively. Please derive the α-function of the first conjugate base HA^-, $\alpha_{HA^-} = [HA^-]/C_{H2A}$ where C_{H2A} is the original molar concentration of H_2A. (20 points)

   B. Please prove that the pH of HA^- solution is $(pk_1 + pk_2)/2$. (10 points)

3. If the constant of solution product (Ksp) of a salt MX_2 is 3.2×10^{-11} M^3, what is the solubility of this salt in water? (10 points)

4. If the measurement uncertainty of A, B, and C are $\triangle A$, $\triangle B$, and $\triangle C$, respectively, please derive the uncertainty of D, $\triangle D = [\triangle A^2 + \triangle B^2 + \triangle C^2]^{1/2}$, when $D = A + B - C$. (10 points)
   *Hint: When $Z = X \pm Y$, $\triangle Z^2 = \triangle X^2 + \triangle Y^2$

5. What is the major advantage of using dropping mercury electrode (DME) to perform polarograph? (10 points)

6. One chromatogram contains three signal peaks A, B, and C with the same baseline width 2 min, of which the retention times are t_A, t_B, and t_C, respectively. When $t_A < t_B < t_C$, please answer the following questions.
   A. If the retention factor of peak A is 2, and $t_A = 3$ min and the resolution between peak A and peak B is two, please estimate the retention time of peak B, when the retention time of solvent peak is 1 min. (20 points)

   B. If the resolution between peak B and peak C is one, are these two peaks baseline-resolved? (10 points)