MAT 2384-Practice Problems on Numerical Integration Methods

1. Use the rectangular rule to estimate the value of $\int_0^{0.5} \cos(x^2)dx$ within 0.01
2. Use the rectangular rule to estimate the value of $\int_0^2 xe^{-x^2}dx$ within 0.01. Compute the exact value of the integral and compare with your estimate by the Rectangular Rule.
3. Using the Trapezoidal Rule, compute the value of $\int_0^1 \frac{4}{1+x^2}$ accurate within 0.001. Use your answer to give an estimation of the value of π accurate to three decimal places.
4. Repeat Problem (3) using the Simpson's Rule with an accuracy of 0.0001
5. Use Simpson's rule with $n = 8$ subdivisions to estimate the value of $\int_1^2 e^x \ln(x)dx$. Give an upper bound for the Error
6. Use the two-points Gauss Quadrature Rule to compute the value of $\int_0^4 xe^{2x}dx$. Calculate the exact value of the integral to deduce the Error.
7. Use the Gaussian Quadrature Rule of order 4 (Four-Points Gauss Quadrature Rule) to compute the value of $\int_1^2 \frac{\sqrt{1+x^2}}{x}dx$.
8. Use the Gaussian Quadrature Rule of order 5 (Five-Points Gauss Quadrature Rule) to compute the value of $\int_1^{1.5} x^2 \ln(x)dx$. Compute the exact value of the integral and give the error.
9. Use Simpson's rule with $n = 8$ subdivisions to estimate the value of $\int_1^2 x^2e^{x^2} \ln(x)dx$. Give bounds for the error on your estimation.