

**SHOW ALL WORK!**

Problem 1 (35 pts)

Consider the definite integral

$$I = \int_a^b f(x) dx \quad \text{where } a = 1.0, b = 2.0 \text{ and } f(x) = \frac{1}{x^2},$$

- A) Fill in the table below with  $f(x_i)$  rounded to 4 places after the decimal point. Find  $I_{10}$  using Trapezoidal Integration with 10 intervals to approximate I. Express your answer to 4 places after the decimal point.

| $i$ | $x_i$ | $f(x_i)$ |
|-----|-------|----------|
| 0   | 1.0   |          |
| 1   |       |          |
| 2   |       |          |
| 3   |       |          |
| 4   |       |          |
| 5   |       |          |
| 6   |       |          |
| 7   |       |          |
| 8   |       |          |
| 9   |       |          |
| 10  | 2.0   |          |

- B) Find  $I_5$  using Trapezoidal Integration with 5 intervals to approximate I. Express your answer to 4 places after the decimal point.
- C) Find  $\hat{I}$  using the results of Parts A) and B) to obtain an estimate of I. Express your answer to 4 places after the decimal point.
- D) Find the truncation error in the estimate obtained in Part C). Express your answer to 4 places after the decimal point.

**SHOW ALL WORK!**

Problem 2 (35 pts)

The following data points were obtained experimentally.

| $x_i$ | $y_i = f(x_i)$ |
|-------|----------------|
| 0.0   | 0.000          |
| 0.5   | -0.375         |
| 1.0   | 0.000          |
| 1.5   | 1.875          |
| 2.0   | 6.000          |
| 2.5   | 13.125         |
| 3.0   | 24.000         |
| 3.5   | 39.275         |
| 4.0   | 60.000         |
| 4.5   | 86.625         |
| 5.0   | 120.00         |

- A) Find the Normal Equations to solve for the coefficients of the Least Squares Quadratic through the data points.
- B) Solve for the coefficients and express the results to 3 places after the decimal point.
- C) Find SST
- D) Find  $r^2$  if  $SSE = 96.525$
- E-) The unknown function  $f(x) = x^3 - x$ . Find the true relative error when using the Least Squares Quadratic for prediction at  $x = 3.25$

Sp 99  
EGN 3420

FINAL

Name \_\_\_\_\_

## SHOW ALL WORK!

Problem 3 (30 pts)

Given the following system of equations

$$\begin{array}{rccccrcr} x_1 & + & x_2 & + & x_3 & - & 3x_4 & = & 2 \\ -x_1 & & & & + & x_3 & - & x_4 & = & K \\ 2x_1 & - & x_2 & + & 3x_3 & - & 8x_4 & = & 2 \\ & & x_2 & + & Kx_3 & - & 2x_4 & = & 2 \end{array}$$

Find the value(s) of  $K$  for which there exist an infinite number of solutions.