

## MATH 1620/ Project

### Phase 1

This is a group project which means you must work in a team of at least two people (at most 5).

Here is what you need to do for the phase 1 of the project. Use computer algebra system to investigate the properties of the integrals below and come up with a formula for integration of the family of functions. For that you can use Wolfram Alpha following the link: <https://www.wolframalpha.com>.

1. Calculate one by one the integrals (use Wolfram Alpha).

$$1) \int x e^x dx =$$

$$2) \int x^2 e^x dx =$$

$$3) \int x^3 e^x dx =$$

$$4) \int x^4 e^x dx =$$

$$5) \int x^5 e^x dx =$$

2. Based on the pattern you are getting, guess the general formula for any integer  $n$ :

$$\int x^n e^x dx =$$

I will be giving hints during the class on Thursday, the odd-timed class. Also, the deadline will be declared once we are done with the rest of the phases.

## Phase 2

In this phase, we will evaluate the integral numerically using the definition by Riemann sum. For numerical calculations, we will use MATLAB software.

3. First, use MATLAB to evaluate this time a definite integral.

$$\int_0^2 x e^x dx =$$

For that, type directly into command window in MATLAB: `syms x; int(x*exp(x),0,2)`. Get the answer in a number with at least four decimals.

4. Download an m-file, ***midPointRule.m***, from Canvas and run it on MATLAB. Notice that the approximation is correct only up to two decimals (compare with the previous calculation). Increase the number of intervals up to 1000 and run the code one more time. Paste the figure you obtained as an answer for this question in your report and write the captions explaining what the figure exactly means.
5. Now you must modify the code to calculate the integral:

$$\int_0^3 x^2 e^x dx =$$

You can use the same Midpoint Rule as in my code or, for extra points, modify it to use Trapezoidal Rule. Paste the figure and your code as an answer to the question.

## Rubric

### By questions:

**Question 1:** All answers are given. (1 point, 0.2 for each).

**Question 2:** The formula is given clearly in a comprehensible for the level of the class format, i.e. no Gamma functions. Recursive formula is a legitimate answer. (1 point).

**Question 3:** The integral is equal – the output from your MATLAB, but as a number, at least four decimals. (1 point).

**Question 4:** The figure is uploaded, and the caption is written (1 point).

**Question 5:** The figure and the modified script are uploaded (1 point). If the code/script is modified sufficiently for the use of Trapezoid Rule, you are entitled for extra 0.5 points. Remember, I will check the code.

Submit your work on Canvas as a pdf-file.

If the work is done by one person solely 0.5 points will be taken.