

Engr 5011: Homework #0

Introduction to numerical integration

Please submit with this page first, and the problems attached in order.

Due 21 September in class (or by 11PM in canvas)

Name (print): _____

TUID:

I	H	G	F	E	D	C	B	A

USE THE ABOVE VALUES (A,B,C, ETC) WHEN A QUANTIFIED (NUMERICAL) ANSWER IS NEEDED.

"Technical points" possible for each question are shown; excellent documentation will receive a bonus.

Also, if you have not already, **download matlab to your laptop computer from**

https://download.temple.edu

1. Problem 1 score/comments

(a) Problem 1.a [**2 pt**]

(b) Problem 1.b [**5 pt**]

(c) Problem 1.c [**18 pt**]

2. Problem 2 score/comments.

(a) Problem 2.a [**5 pt**]

(b) Problem 2.b [**10 pt**]

3. Problem 3 score/comments

(a) Problem 3.a [**3 pt**]

(b) Problem 3.b [**7 pt**]

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Problem #1: Definite Integrals

Assemble submission for this problem in the following order:

- (1) this page on top, followed by
- (2) your handwritten notes for parts b,c followed by
- (3) listing of your matlab scripts/functions for parts a,b,c,
- (4) printout of matlab plotted results for parts a,b,c

Name (print): _____

Collaborants (print): _____

Documents & resources used _____

1. Definite integrals!

(a) Implement the simpson-rule integrator and demonstrate that it works on a problem you can do another way.

(b) Plot $I(b)$ on $-0 \leq b \leq 5$, computing $I(b)$ to at least three significant digits.

$$I(b) = \int_0^5 e^{-b \cos(\tau)} d\tau \quad \text{on } b = 0 : 1/10 : 5$$

What is $I(4.6)$? Write it here: $I(4.6) =$ _____

(c) Evaluate I to at least three significant digits and write it here:

$$I = \int_0^5 \frac{dx}{2 - \sqrt{x}}; \quad I = \underline{\hspace{2cm}}$$

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Problem #2. Integrals on data

Assemble submission for this problem in the following order:

(1)

this page on top, followed by

(2)

your handwritten notes

(3)

your matlab code(s)

(4)

your computed results

Name (print):

Collaborants (print):

Documents or resources used

2. Predictor-corrector integration scheme

(a) Implement a predictor/corrector integration scheme and test it on a problem you can do another way.

(b) To three significant digits, integrate and plot y_j (where $y_j = y(t_j)$) if

$$y' = \frac{y}{\cos(\frac{t}{3}) + \alpha f(t)} + t; \quad y(0) = -1$$

$$\alpha = (\text{average of your TUID digits})$$

Here $f(t)$ is tabulated data given by:

0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	t
1.00	0.84	0.78	0.73	0.68	0.65	0.61	0.58	0.55	0.53	0.50	0.48	0.45	0.43	0.41	0.39	0.37	0.35	0.33	f

Estimate the minimum value of y on $0 \leq t \leq 1.8$ from your results and write them here:

$t =$

$y =$

Engr-5011: Homework #0 Problem #3. Numerical integration of initial-value problems

Assemble submission for this problem in the following order:

- (1) this page on top, followed by
- (2) your handwritten notes
- (3) your matlab code(s)
- (4) your computed results

Name (print): _____

Collaborants (print): _____

Documents or
resources used _____

3. Numerical integration of initial-value problems

(a) Implement the 4th-order Runge Kutte integration scheme and test it on a problem that you can do another way.

(b) To three significant digits, integrate and plot $y(t)$, $y'(t)$, and $y''(t)$ on $t \subseteq [0, 5]$ if

α	=	$\frac{\text{average(A,B,C)}}{10}$
β	=	$\frac{\text{average(D,E,F)}}{10}$
γ	=	$\frac{\text{average(G,H,I)}}{10}$

and

$$y''' + \alpha y'' + \beta y y' + \gamma y = \cos(3t); \quad y(0) = A; \quad y'(0) = B; \quad y''(0) = C;$$

Here [A,B,C,D,E,F,G,H,I] are taken from your TUID.

At what value of $t \subseteq [0, 5]$ is $y(t)$ maximized? Write them here:

$t =$	_____
$y =$	_____