In-class assignment EML3041 Chapter 2

Numerical Methods Problems

1..You are given the time-position data for a rocket in the table below.

Time (s)	0	5	10	15	20
Position(m)	4	14	25	43	63

Using the central divided difference scheme, what is the acceleration of the rocket at 15 seconds?

Answer: 0.08 m/s^2

2..Using a step size of $h = 0.4$ and given $f(2) = 42$, the true error in finding $f'(2)$ using central divided difference approximation is 3.5. What is the best estimate of the true error in finding $f'(2)$ for $h = 0.12$? (Note that $f(x)$ is not given as an expression).

Answer: 0.315

3..Velocity vs time data is given below.

t (s)	0	0.5	1.2	1.5	1.8
v (m/s)	0	213	223	275	300

Allowed to use only a second order polynomial to approximate velocity, the data points you would choose to find the velocity at t=1.1s are _____. How did you make that choice?

4..The highest order of polynomial for which the central divided difference gives the exact answer for its first derivative at any point is _____ . How did you arrive at that conclusion?

Programming problems to get your practice for loops and if statements.

5. Roth IRA is an excellent instrument to save money for retirement, but its use goes beyond retirement. Who wants to think about retirement at your age? "You can use a Roth IRA to help pay college expenses for your children, to make a down payment for a home, or to serve as an emergency fund for unexpected expenses" - *Gene Walden, Senior Finance Editor of Thrivent Mutual Funds.* Run these four scenarios of investment.

(A) You graduate on May 8, 2022, and invest $XXXX in an index mutual fund on that day and do not add any more money ever. Every year, the compound interest is Y%. How much money will you have on May 7, 2065?
Use for loops to do this problem. Do not use any formulas from google or from memory other than that the interest gained in a year is CurrentAmount*Y/100.

(B) You graduate on May 8, 2022, and invest $XXXX in an index mutual fund on that day and then $XXXX e*very year* after on May 7 till May 7, 2065 in a Roth IRA. Every year, the compound interest is Y%. How much money will you have on May 7, 2065?
Use for loops to do this problem.
Do not use any formulas from google or from memory other than that the interest gained in a year is CurrentAmount*Y/100.

(C) You graduate on May 8, 2022, and invest $XXXX in an index mutual fund on that day and then $XXXX every year after on May 7 till May 7, 2045 in a Roth IRA. Every year, the compound interest is Y%. How much money will you have on May 7, 2065?
Use for loops to do this problem.
Do not use any formulas from google or from memory other than that the interest gained in a year is CurrentAmount*Y/100.

(D) You graduate on May 8, 2022, and invest $XXXX in an index mutual fund every year on May 7 starting May 7, 2042 in a Roth IRA. Every year, the compound interest is Y%. Answer these *two* questions.

a. How much money will you have on May 7, 2065? 2) By hit and trial find how much yearly deposit would you need to make to approximately match the answer in (C).
b. Do not use any formulas from google or from memory other than that the interest gained in a year is CurrentAmount*Y/100.

Use for loops to do this problem. Do not use any formulas from google or from memory other than the interest gained in a year would be equal to the CurrentAmount*Y/100.

Use XXXX=3000 and Y=8 to test all parts of the program. You can use the starting year and ending year as variables too to make the program more flexible, but you can do that at home. There is no need to use disp and fprintf statements.

Write a single mfile program with sections separated by using the %% command. For example, you would put
%% Part (a) – single investment

What conclusions do you draw from the numbers you get from the four scenarios?