EML3041 Computational Methods
Fall 2022
Week Three: September 5 – September 9

Week 03 - Session 02 Question

Answer the free-response question starting on a fresh sheet of paper. Solve the problem as if you were submitting them for a test. Identify each part separately. Put your last name, first name, and your first letter of last name in bold.

1) The table below shows the calculated values of the first derivative of a function $f(x)$ at $x = 3$ using three divided difference methods.

	$f'(3)$		
h	**Forward divided difference method**	**Central divided difference method**	**Backward divided difference method**
0.100000	291.3571	271.0652	250.7734
0.050000	280.4363	270.3046	260.1730
0.025000	275.1787	270.1147	265.0506
0.012500	272.5990	270.0672	267.5354
0.006250	271.3212	270.0553	268.7895
0.003125	270.6853	270.0524	269.4194

a) Based on what you know about numerical differentiation, which one is the best estimate of $f'(3)$ in the table above. Write this best estimate and justify your answer.
b) What is the absolute relative approximate error in the value of $f'(3)$ for $h = 0.00625$ as found using the forward divided difference method?
c) How many significant digits can one trust in the value of $f'(3)$ for $h = 0.00625$ found using the forward divided difference method? Show your reasoning.
d) Can you find a better approximation of $f'(3)$ based on the values given in the table. Hint: Richardson's extrapolation formula.

Answers

a) Answer not given intentionally.
b) 0.47095%
c) Answer not given intentionally.
d) 270.0514