Background

Approximation functions:

A screen shot of a computer program

Description automatically generated

The ‘numeric approximate’ function returns the estimated value of y(xn) using one of the approximation functions listed above and ‘n’ number of steps between x0 andxn.

A screen shot of a computer program

Description automatically generated

Solving part c first provides an exact solution to compare the approximation to; y(1.5) ~= 19.56.

A screen shot of a computer code

Description automatically generated

Solution

Starting at n =1, the error is computed and compared using all approximation methods above. If the error at any step is less than 0.01, the loop breaks and returns the number of steps required to make this approximation (no rounding).

A screen shot of a computer program

Description automatically generated

Next, these minimum values are recorded, output to the console, and finally, a graph is constructed by first plotting y’ as a vector field and then plotting the curve drawn by each approximation function as they approach the target, y(x­n). Lastly, an error bar is drawn to represent the acceptable deviation relative to the known value of y(x­n).

