1. Derive a general formula for the optimal step size ($h_{opt}$) using $O(h^4)$ central differencing and $O(h)$ forward differencing approximations to the derivative.

2. Demonstrate that the above formulas are valid by plotting the $\log(h)$ -vs- $\log(\text{error})$ for the first derivative approximations of $f(x) = e^x$ evaluated at $x_i = 1$. Set $\varepsilon$ (the maximum round-off error) to be $10^{-15}$.

3. What is the slope of these curves before round-off error starts adversely effecting the approximation and why is this appropriate?

4. Compare your results to those from the example using order $h^2$ central differencing. What are the practical benefits and drawbacks of the different schemes.