# 2.4 Exercises

**Problem 1** Consider the initial value problem: $y' = e^{-y}, \quad y(0) = 0,$ with exact solution: $y(x) = \ln(x+1)$.

Apply Euler's method to approximate this soln on the interval $\left[0, \frac{1}{2}\right]$; first w/step size $h_1 = 0.25$, then w/step size $h_2 = 0.1$. Compare the values of the approximations at $x = \frac{1}{2}$ w/the value $y\left(\frac{1}{2}\right)$ of the actual soln $(y(\frac{1}{2}) = \ln\left(\frac{1}{2}+1\right) \approx 0.405)$.

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**Problem 2** Consider the initial value problem: $y' = 2xy^2, \; y(0) = 1;$ Exact solution: $y(x) = \frac{1}{1-x^2}$.

Apply Euler's method to approximate to this solution on the interval $\left[0, \frac{1}{2}\right]$;

First with step size $h_1 = 0.25$, then with step size $h_2 = 0.1$. Compare with the exact solution above.