1. If you approximate \( \sin(1/2) \) using a Taylor polynomial centered at \( x=0 \), how many terms will you need to use in order to ensure that the error in your approximation is less than \( \frac{1}{500,000} \)? Justify your answer briefly.

2. If you approximate \( f(x) = e^x \) on the interval \([0,3]\) by a 25th degree Taylor polynomial centered at \( x=0 \), find an upper bound on the error. You may use the fact that \( e < 3 \). You do not need to simplify quantities such as \( 3^{10} \) or \( 10! \) in your final answer.

3. Consider the differential equation \( \frac{d^2 y}{dx^2} = 4y \).
   
   a) Is \( y = 2e^{3x} \) a solution? Explain.

   b) Is \( y = 3e^{2x} \) a solution? Explain.