# Homework 1

Due 1/17/2019

1. Let $f(t) = \frac{1}{1-t}$.
   (a) Derive a formula for the $n$'th Taylor polynomial about $t_0 = 0$, called $p_n(t)$, of $f$.
   (b) How large should $n$ be so that $f$ can be approximated by its $n$'th Taylor polynomial with error not exceeding $\epsilon = 10^{-4}$ for all $-1/3 < t < 1/3$ ?
2. Let $g(x) = \frac{1}{2+3x}$.
   (a) Derive a formula for the $n$'th Taylor polynomial about $x_0 = 0$, called $q_n(x)$, of $g$. Hint: use Problem 1.
   (b) How large should $n$ be so that $g$ can be approximated by its $n$'th Taylor polynomial with error not exceeding $\epsilon = 10^{-5}$ for all $0 < x < 1/5$ ?
3. Let $h(x) = \frac{1}{1+x^2}$.
   (a) Derive a formula for the $n$'th Taylor polynomial about $x_0 = 0$, called $r_n(x)$, of $h$. Hint: use Problem 1.
   (b) How large should $n$ be so that $h$ can be approximated by its $n$'th Taylor polynomial with error not exceeding $\epsilon = 10^{-5}$ for all $-0.4 \leq x \leq 0.5$ ?

*Use Matlab Practice 1 posted on Canvas and course website as a practice (but don't turn in the problems in there). Then do the following problem.*

4. Write Matlab code using either a "for" loop or a "while" loop to compute the following sum:

$$\sum_{k=1}^{10} \pi^k \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{6} \cdots \frac{2k-1}{2k}$$

   Make sure to write a few comments in your paper on how you do it. The code should be turned in on Canvas as an .m file.