1. Let $f(x) = -\ln(1-x)$.

   (a) Find $f'(x), f''(x), f'''(x), f^{(4)}(x)$, and $f^{(n)}(x)$

   (b) Find $f(0), f'(0), f''(0), f'''(0), f^{(4)}(0)$, and $f^{(n)}(0)$

   (c) Find the $n$th-degree Maclaurin polynomial of $f$

   (d) Find the Maclaurin series for $f(x)$. (Do not verify that $\lim_{n\to\infty} R_n(x) = 0$.)

   (e) Find the interval of convergence for this Maclaurin series.

2. Find the first five terms of the Taylor series for the following functions at a given value $c$:

(a) $f(x) = \cos x$ at $c = \dfrac{\pi}{3}$

(b) $f(x) = \sqrt{x}$ at $c = 4$

(c) $f(x) = \tan x$ at $c = \dfrac{\pi}{4}$

3. Find the Maclaurin series for $f(x) = 6x^4 - 2x^3 + 4x^2 + x + 7$. Show all work!

4. Find the sum of each of the following infinite series. Give exact answers.

(a) $1 - \frac{1}{2!} + \frac{1}{4!} - \frac{1}{6!} + \cdots + (-1)^n \frac{1}{(2n)!} + \cdots$

(b) $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots + (-1)^n \frac{1}{n+1} + \cdots$

(c) $\frac{\pi}{6} - \frac{\pi^3}{6^3 \cdot 3!} + \frac{\pi^5}{6^5 \cdot 5!} - \cdots + (-1)^n \frac{\pi^{2n+1}}{6^{2n+1}(2n+1)!} + \cdots$

5. (a) Use the Maclaurin series for $\arctan x$ with $x = 1$ to represent $\pi$ as the sum of an infinite series.

(b) What accuracy is obtained by using the first five terms of the series to approximate $\pi$?

(c) Approximately how many terms of the series are required to obtain four decimal places of accuracy?