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

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

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

   (c) Find the nth-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 $c = 4$

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. Find the Indicated Taylor polynomial and remainder given f, c and n:

   (a) $f(x) = \cos x$, $c = \frac{\pi}{4}$, $n = 4$

   (b) $f(x) = \frac{1}{(x-3)^2}$, $c = 4$, $n = 5$

6. If we used problem 6(a) to approximate $\cos 47°$, what decimal place accuracy could we achieve?

7. (a) Use problem 6(b) to approximate $\frac{1}{(.9)^2}$

(b) Use the Taylor remainder in problem 6(b) to estimate the error in this approximation.

8. Determine the number of decimal places of accuracy that the given approximation formula yields for $|x| \leq 0.1$.

   (a) $e^x \approx 1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4$

   (b) $\sin x \approx x - \frac{1}{6}x^3 + \frac{1}{120}x^5$

   (c) $\ln(1+x) \approx x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4$