1. Consider the pyramid of bricks shown to the right.
   (a) Write a formula for the number of bricks on the $n^{th}$ level.

   (b) Find the total number of bricks needed to build this pyramid 100 rows high (don’t just find the number for the 100th level).

2. Determine if the sequence converges and determine the limit of each convergent sequence.
   (a) $f(n) = \frac{n+1}{n} - \frac{n}{n+1}$
   (b) $f(n) = \frac{1}{\sqrt{2}}$
   (c) $f(n) = \left(1 + \frac{2}{n}\right)^n$
   (d) $f(n) = (-1)^n \left(\frac{9}{10}\right)^n$

3. A superball rebounds to 70% of its previous height every time it bounces. If it is dropped initially from a height of 6 feet, what is the total vertical distance it travels as it bounces up and down?

4. Write $5.4321321321\ldots$ as a fraction.

5. Show $\sum_{n=1}^{\infty} \frac{1}{(2n-1)(2n+1)} = \frac{1}{2}$.
6. Provide an example that shows if \( \sum a_n \) diverges and \( \sum b_n \) diverges, \( \sum a_n - b_n \) does not diverge.

7. Determine whether the series converges or diverges.

(a) \( \sum_{n=1}^{\infty} \frac{\ln n}{\sqrt{n}} \)  
(b) \( \sum_{n=1}^{\infty} \frac{3}{n + \sqrt{n}} \)  
(c) \( \sum_{n=1}^{\infty} \frac{1}{\ln (\ln n)} \)  
(d) \( \sum_{n=1}^{\infty} \frac{1}{\sqrt{n \ln n}} \)  
(e) \( \sum_{n=1}^{\infty} n! e^{-n} \)

(f) \( \sum_{n=1}^{\infty} \frac{n^2 - 1}{n^3 + 1} \)  
(g) \( \sum_{n=1}^{\infty} \frac{(-1)^{n+1} (n - 1)}{n + 1} \)  
(h) \( \sum_{n=1}^{\infty} \frac{1}{n^{\sqrt{2}}} \)  
(i) \( \sum_{n=1}^{\infty} (-1)^n \left( \frac{9}{10} \right)^n \)

8. Find the Taylor Series, centered on \( x = 0 \), for \( f(x) = \frac{1}{1 - x^2} \).

Then determine which values of \( x \) it converges for.

9. Find the Taylor Series, centered on \( x = 0 \), for \( f(x) = \frac{1}{(1 - x^2)^3} \).

Then determine which values of \( x \) it converges for.

10. The Taylor series for \( \arctan x \) (centered at \( x = 0 \)) is given below.

\[
\arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \cdots
\]

We know that \( \arctan(1) = \frac{\pi}{4} \) so using the series above we can approximate \( \pi \) (\( \pi = 4 \arctan(1) \)).

Use the error bound for the series above to determine the degree of the Taylor Polynomial necessary to approximate \( \pi \) accurate to 6 decimal places.

11. Write a power series that has \( (1, 5) \) as its interval of convergence.