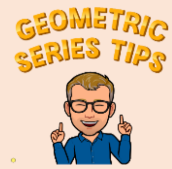
LIM	AP CALCULUS BC	
3	Topic: 10.2	Working with Geometric Series
Learning Objective LIM-7.A: Determine whether a series converges or diverges.		

> **1.** A geometric series does **not** have to begin with an index of $n = 0$.
>
> **2.** A more intuitive way to compute the sum of a convergent geometric series is to think of the sum as
> $$S = \frac{\text{first term of the series}}{1 - \text{the common ratio}}$$
>
> 
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Geometric Series

Specific Example: $3 + 3 \cdot 2 + 3 \cdot 2^2 + 3 \cdot 2^3 + \cdots$

General Form: $\sum_{n=0}^{\infty} ar^n = a + ar + ar^2 + \cdots + ar^n + \cdots, a \neq 0$

THEOREM 10.2: CONVERGENCE OF A GEOMETRIC SERIES

1. A geometric series with a ratio r diverges if $|r| \geq 1$.

2. If $0 < |r| < 1$, then the series converges to the sum:

$$\sum_{n=0}^{\infty} ar^n = \frac{a}{1-r}, 0 < |r| < 1.$$

Example 1: Identifying Geometric Series

State whether or not each of the following series are geometric.

a.) $\sum_{n=1}^{10} \left(\frac{1}{2}\right)^n$ **b.)** $\sum_{n=1}^{20} \frac{1}{n}$ **c.)** $\sum_{n=0}^{20} (2n+1)$

SCAN ME

Scan the QR Code above to watch a video covering Examples 1 & 2

Example 2: **Convergent and Divergent Geometric Series**

Evaluate each of the following geometric series or state the series diverges.

a.) $\sum_{n=0}^{\infty} (1.1)^n$ **b.)** $\sum_{n=0}^{\infty} e^{-n}$ **c.)** $\sum_{n=1}^{\infty} 3(-0.75)^n$

c.) $\sum_{n=0}^{\infty} \frac{3}{2^n}$ **d.)** $\sum_{n=0}^{\infty} \left(\frac{3}{2}\right)^n$ **e.)** $\sum_{n=0}^{\infty} \left(\frac{e}{\pi}\right)^n$