Warm Up

Evaluate the related series of each sequence.

6, 11, 16, 21, 26, 31, 36

$a_1 = 4,\ a_n = 22,\ n = 10$

Determine the number of terms *n* in each arithmetic series.

$a_1 = 19,\ a_n = 118,\ S_n = 822$

8.4

Convergent and Divergent Series

Infinite vs. Finite

The difference between a finite and infinite series is whether or not there is a "…" at the end.

Example,

- 3, 5, 7, 9….
- 6, 3, 1.5, .75

What will happen to the terms of this sequences as it continues forever?

$$8, 4, 2, 1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots$$

It approaches 0!

Convergent Sequence

A sequence is converging if its terms approach 0.

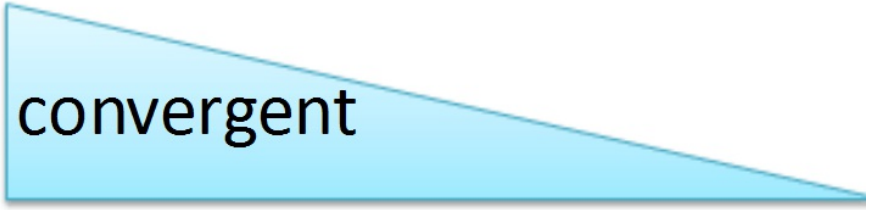
*Only applies to geometric sequences.

Determine if the following sequences are **convergent** or **divergent:**

1) $27, 9, 3, 1, \frac{1}{3}, \frac{1}{9} \ldots$

2) $5, 15, 45, 135 \ldots$

3) $100, 10, 1, .1, .01, .001, \ldots$



Sum of an Infinite Geometric Series

$$8, 4, 2, 1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots$$

We can find the sum of this series, even though it goes on forever, because it is **convergent.**

Sum of an **Infinite** Geometric Series

The following conditions must be true to use this formula:

- ✓ The series must be geometric
- ✓ The series must be convergent
- ✓ The series must be infinite

$$S = \frac{a_1}{1 - r}$$

Example 1

$$S = \frac{a_1}{1 - r}$$

Determine whether each infinite geometric series diverges or converges. If it converges, find the sum.

a) 48 + 12 + 3 + …

b) 4 + 8 + 16 + …

Example 2

$$S = \frac{a_1}{1 - r}$$

Evaluate each infinite geometric series

a) $3 + 1 + \frac{1}{3} + \frac{1}{9} + \cdots$

b) $1 - \frac{1}{5} + \frac{1}{25} - \frac{1}{125} + \cdots$

Formula Recap

Sequence	Series
Arithmetic $a_n = a_1 + (n-1) \cdot d$ Geometric $a_n = a_1 \cdot r^{n-1}$	Arithmetic $S_n = \frac{n}{2}(a_1 + a_n)$ Geometric Finite $S_n = \frac{a_1 \cdot (1 - r^n)}{(1 - r)}$ Infinite $S = \frac{a_1}{1 - r}$

rmine if each geometric series converges or diverges.

$_1 = 5.5,\ r = 0.5$

$1 + 27 + 9 + 3...,$

$3 + \frac{12}{5} - \frac{48}{25} + \frac{192}{125}...,$

4) $a_1 = -1,\ r = 3$

6) $7.1 + 17.75 + 44.375 + 110.937$

8) $\frac{128}{3125} - \frac{64}{625} + \frac{32}{125} - \frac{16}{25}...,$

luate each infinite geometric series described.

$a_1 = 1,\ r = -3$

$1 + 0.5 + 0.25 + 0.125...,$

$31 - 27 + 9 - 3...,$

16) $a_1 = 1,\ r = \frac{1}{2}$

18) $3 - \frac{9}{4} + \frac{27}{16} - \frac{81}{64}...,$

20) $1 - 0.6 + 0.36 - 0.216...,$

rmine the common ratio of the infinite geometric series.

$a_1 = 1,\ S = 1.25$

26) $a_1 = 96,\ S = 64$

ermine if each geometric series converges or diverges.

$a_1 = 5.5,\ r = 0.5$

$81 + 27 + 9 + 3...,$

$-3 + \frac{12}{5} - \frac{48}{25} + \frac{192}{125}...,$

4) $a_1 = -1,\ r = 3$

6) $7.1 + 17.75 + 44.375 + 110.9375$

8) $\frac{128}{3125} - \frac{64}{625} + \frac{32}{125} - \frac{16}{25}...,$

aluate each infinite geometric series described.

$a_1 = 1,\ r = -3$

$1 + 0.5 + 0.25 + 0.125...,$

$81 - 27 + 9 - 3...,$

16) $a_1 = 1,\ r = \frac{1}{2}$

18) $3 - \frac{9}{4} + \frac{27}{16} - \frac{81}{64}...,$

20) $1 - 0.6 + 0.36 - 0.216...,$

ermine the common ratio of the infinite geometric series.

$a_1 = 1,\ S = 1.25$

26) $a_1 = 96,\ S = 64$