1.5 Infinite Geometric Series

Tuesday, September 29, 2015 11:32 AM

Pre-Calculus 11 1.5 Name_____ _____

Infinite Geometric Series Blk_____

Notes

Definition:

An **infinite geometric series** is a series that..... goes forever

Therefore it does not have a final term

#1) Consider the infinite geometric series **1 + 2 + 4 + 8 + 16+ …** What would the sum be? What is the r value?

sum is ∞

$r = 2$

#2) Consider the infinite geometric series that has $t_1 = 4$ and $r = \frac{1}{2}$. Write the series up to 13 terms and find the sum for S_5, S_7, S_9, S_{11} & S_{13}.

$4 + 2 + 1 + 0.5 + 0.25 + 0.125 + 0.0625 + 0.03125 + \ldots + t_{13}$

$S_5 = 7.75$

$S_7 = 7.9375$

$S_9 = 7.984375$

$S_{11} = 7.99609375$

$S_{13} = 7.999023438$

The sum approaches 8

When the sum approaches a fixed value, the series is said to be **convergent.** When this is the case, *r* must be between -1 and 1.

$r = \frac{1}{2}$ for ex. #2

If, in an infinite series, each term continues to grow, the sum does not approach a fixed value. It actually approaches infinity or negative infinity. In these situations, *r* is less than -1 or greater than 1. The infinite series is said to be **divergent.** $r = 2$ #1

For infinite series that are convergent, the formula for finding the sum that the series converges to is $S_\infty = \frac{t_1}{1-r}$

where t_1 is the first term, *r* is the common ratio, and S_∞ is the sum of an infinite number of terms

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Use the formula to find the sum of the infinite series from #2 above:

$4+2+1+\cdots$ $\quad S_\infty = \frac{t_1}{1-r} = \frac{4}{1-(\frac{1}{2})} = 8$

$t_1 = 4$

$r = \frac{1}{2}$

Example – Determine whether each infinite geometric series converges or diverges.

Calculate the sum.

a) $1+\frac{1}{5}+\frac{1}{25}+\cdots$

b) $4-8+16-32+\cdots$

a) terms are getting smaller ⇒ converging

$r = \frac{1/5}{1} = \frac{1}{5}$

r is between -1 & 1

confirms a convergent series

$\therefore S_\infty = \frac{t_1}{1-r}$

$= \frac{1}{1-\frac{1}{5}}$

$= 1.25$

b) Terms are getting larger ⇒ divergent

$r = \frac{-8}{4} = -2$

r is less than -1, confirms a divergent series.

$S_\infty = \infty$

Example – If the first term of an infinite geometric series is 12, and the sum is 48, determine *r*.

$t_1 = 12$

$r = ?$

$S_\infty = \frac{t_1}{1-r}$

$48 = \frac{12}{1-r}$

$48(1-r) = 12$

$\frac{48}{48} \quad \frac{12}{48}$

$1-r = \frac{12}{48}$

$r = 1 - \frac{1}{4}$

$r = \frac{3}{4}$ or 0.75

↑ must be convergent

- Quiz Friday 1.3/1.4
- CH 1 TEST THURSDAY OCT 8.

HW p. 67-73 #1-5, 7, 8, 10, 13