

1.3 Geometric Sequences

Monday, September 21, 2015

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Pre-Calculus 11 1.3 Geometric Sequences

1.3 Notes Blank

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Definition

A **geometric sequence** is a sequence in which the ratio (r) of consecutive terms is constant.

Warm-up – Suppose you have the geometric sequence 4, 12, 36, 108, ...

- a) What is t_1 ? 4
- b) What do you multiply by to get the next term? 3
- c) Is the sequence geometric? In other words, is the r value consistent throughout the sequence? yes
- d) What is t_5 ? Explain how you got t_5 . Write a general formula for this.

$$t_5 = 108 \times 3 = 324 \quad t_5 = t_4 r \Rightarrow t_n = t_{n-1} r$$

- e) Show how to get t_5 using only t_1 and r .

$$t_5 = t_1 \times r \times r \times r \times r \quad t_5 = t_1 r^4$$

- f) Show how to get t_8 using only t_1 and r .

$$t_8 = t_1 r^7$$

- g) What do you notice about the exponent on r compared to n ?

it is always one less than n
(4)

- h) Write a general formula for t_n for any geometric sequence

$$t_n = t_1 r^{n-1}$$

The general term of a geometric sequence where n is a positive integer is:

$$t_n = t_1 r^{n-1}$$

OR

$$t_n = t_{n-1} r$$

where t_1 is the first term, n is the number of terms, r is the common ratio, and t_n is a general term



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For a geometric sequence, the **common ratio (r)**, can be found by taking any term (except the first) and dividing that term by the preceding term. So $r = \frac{t_n}{t_{n-1}}$

Example- Are the following sequences geometric (ie. Is the r value consistent)?

a) 2, 4, 6, 8 $r = \frac{t_n}{t_{n-1}}$ NO!

$$\frac{4}{2} = 2 \quad \frac{6}{4} = 1.5$$

b) 4, 10, 25, 62.5

$$\frac{10}{4} = 2.5 \quad \frac{25}{10} = 2.5 \quad \frac{62.5}{25} = 2.5$$

yes!

Example- Bacteria reproduce by splitting into two. Suppose there were three bacteria originally present in a sample. How many bacteria will there be after 8 generations?

$t_1 = 3$ $t_n = t_1 r^{n-1}$
 $r = 2$ $t_8 = 3(2)^{8-1}$
 $n = 8$ $t_8 = 3(2)^7$
 $t_8 = 384$

3, 6, 12, 24, ..., t_8

There will be 384 bacteria after 8 generations.

Example- In a geometric sequence, the second term is 28 and the fifth term is 1792. Determine the value of t_1 and r , and list the first three terms of the sequence.

$t_2 = 28$, $t_5 = 1792$

$t_2 = t_1 r$
 $28 = t_1 \cdot r$
 $t_1 = 7$
 $t_3 = 112$

OR $1792 = t_1 r^4$
 $\div 28 = t_1 r$
 $64 = r^3$
 $r = 4$
 $t_1 = 7$
 $t_2 = 28$
 $t_3 = 112$

etc...

Example- Suppose a photocopier can reduce a picture to 60% of its original size. If the picture is originally 42cm long, what length will it be after five successive reductions?

$60\% = 0.6$ 42, 25.2, 15.12

$t_1 = 42$ $t_6 = 42(0.6)^5$
 $r = 0.6$
 $n = 6$ $t_6 = 42(0.07776)$
 $t_6 = 3.27 \text{ cm}$

$$t_6 = 3.27 \text{ cm}$$

HW: p. 35-42 #3-9, 11, 15

Quiz next class 1.1 & 1.2 only