

1.3 Geometric Sequences

A **Geometric Sequence** is a sequence in which the ratio of consecutive terms is constant. It is known as the common ratio, r .

$$\text{So, } r = \frac{t_n}{t_{n-1}}$$

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

t_n = general term

t_1 = first term

r = common ratio

n = term number or position

Example 1: Find the common ratio: 4, 12, 36, 108, 324, ...

$$r = \frac{t_2}{t_1} = \frac{12}{4} = 3$$

Example 2: Determine the 12th term of this geometric sequence: 512, -256, 128, -64, ...

$$r = \frac{t_2}{t_1} = \frac{-256}{512} = -0.5$$

$$n = 12$$
$$t_1 = 512$$

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

$$t_{12} = (512)(-0.5)^{12-1}$$

$$= (512)(-0.5)^{11}$$

$$t_{12} = -0.25$$

Example 3: Determine the 9th term of this geometric sequence: 8, 4, 2, 1, .5, 0.25, ...

$$r = \frac{t_2}{t_1} = \frac{4}{8} = 0.5$$

$$t_1 = 8$$
$$n = 9$$

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

$$t_9 = (8)(0.5)^{9-1}$$

$$= (8)(0.5)^8$$

$$t_9 = 0.03125$$

Example 4: In a finite geometric sequence, $t_1 = 5$ and $t_5 = 1280$. Determine t_2 and t_6 .

need to find "r" first

use info about t_5

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

$$t_5 = t_1 \cdot r^{5-1}$$

$$\frac{1280}{5} = \frac{5 \cdot r^4}{5}$$

$$(256)^{\frac{1}{4}} = (r^4)^{\frac{1}{4}}$$

$$4 = r$$

$$t_2 = t_1 \cdot r$$

$$t_2 = (5)(4) = 20$$

$$t_6 = t_5 \cdot r$$

$$t_6 = (1280)(4) = 5120$$

Example 5: In a geometric sequence, the third term is 54 and the sixth term is -1458. Determine the values of t_1 and r , and list the first 3 terms of the sequence.

$$-, -, \frac{54}{t_3}, -, -, \frac{-1458}{t_6}$$

$$t_6 = t_3 \cdot r \cdot r \cdot r$$

$$t_6 = t_3 \cdot r^3$$

$$\frac{-1458}{54} = \frac{54 \cdot r^3}{54}$$

$$-27 = r^3$$

$$-3 = r$$

$$t_n = t_1 \cdot r^{n-1} \quad \text{use } t_3 \text{ info}$$

$$54 = t_1 \cdot (-3)^{3-1}$$

$$\frac{54}{9} = \frac{t_1(9)}{9}$$

$$6 = t_1$$

$$t_2 = t_1 \cdot r = (6)(-3) = -18$$

$$t_3 = t_2 \cdot r = (-18)(-3) = 54$$

$$6, -18, 54$$

Practice: p.39 #1bcd, 3acd, 4, 5abc, 6abc, 7
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