

## Section 1.6: Geometric (or Exponential) Sequences

**Geometric (or Exponential) Sequence** - a number sequence that is built by always multiplying by the same number. These sequences will **NEVER** have a common difference. Instead, they have a **common ratio (r)**.

To find the common ratio, you divide the latter term by the previous term.

$$r: t_2 \div t_1, t_3 \div t_2, t_4 \div t_3$$

Example: {2, 6, 18, 54, 162, ...}

$$\begin{array}{l} D_1 \quad \checkmark \quad \checkmark \quad \checkmark \quad \checkmark \\ \quad \quad 4 \quad 12 \quad 36 \quad 108 \quad \rightarrow \text{Not linear} \\ D_2 \quad \quad \checkmark \quad \checkmark \quad \checkmark \\ \quad \quad \quad 8 \quad 24 \quad 72 \quad \rightarrow \text{Not quadratic} \\ D_3 \quad \quad \quad \checkmark \quad \checkmark \\ \quad \quad \quad \quad 16 \quad 48 \quad \rightarrow \text{Not cubic} \end{array}$$

$$\begin{array}{l} \{2, \checkmark 6, \checkmark 18, \checkmark 54, \checkmark 162, \dots\} \\ r \quad \times 3 \quad \times 3 \quad \times 3 \quad \times 3 \Rightarrow \text{Common Ratio} = 3 \\ \Rightarrow \text{Geometric or Exponential} \end{array}$$

Example: {3, 6, 12, 24, 48, ...}

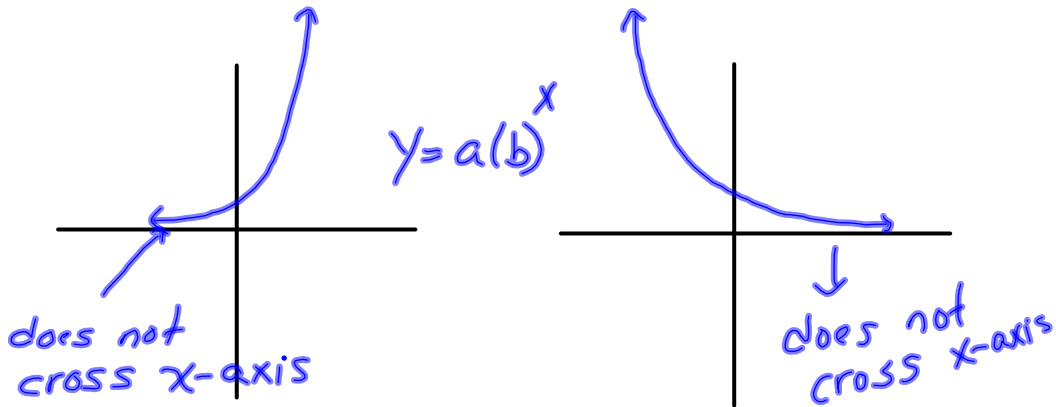
$$r = \checkmark \times 2 \quad \checkmark \times 2 \quad \checkmark \times 2 \quad \checkmark \times 2 \quad r = 2 \text{ Geometric}$$

A geometric sequence has an equation of the form:

$$y = a(b)^x \quad t_n = a(b)^n$$

We can get the equation of an exponential sequence by performing an exponential regression using our calculator.

The graph of an exponential function has special features.



Growth

{ 2, 4, 8, 16, ... }

$r = \times 2 \times 2 \times 2$

ratio  $(r) > 1 \Rightarrow$  Growth

Decay

{ 30, 15, 7.5, 3.75, ... }

$r = \times 0.5 \times 0.5 \times 0.5$

ratio  $(r) < 1 \Rightarrow$  Decay.

Example: Show that each sequence is geometric and then find its equation. Then find  $t_6$ .

A) { 10, 15, 22.5, 33.75, ... }

$r = \times 1.5 \times 1.5 \times 1.5$

$L_1 = 1, 2, 3, 4$

$L_2 = 10, 15, 22.5, 33.75$

Use Calculator to get equation.

**Stat**  $\rightarrow$  **calc**  $\downarrow$  **0:ExpReg**

$y = a \times b^x$      $a = 6.\underline{6}66666667$   
 $b = 1.5$

$t_n = 6.7(1.5)^n$

$t_6 = 6.7(1.5)^6$

$6.7 \times 1.5 \wedge 6$

$t_6 = 76.3$

B)  $\{6, 24, 384, 1536, \dots\}$

Example: You are saving for a new car. Day 1 you put 2 cents in your bank. Day 2 you put in 4 cents, day 3, 8 cents, day 4, 16 cents and so on. How much must you deposit on day 21?