

## 12.1 Geometric Sequences

Geometric Sequence: Each term after the first is found by multiplying by the same number. (common ratio)

#1 Find the common ratio.

600, 300, 150, 75...

$$r = \frac{\text{2nd term}}{\text{1st term}}$$

$$r = \frac{300}{600}$$

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

#2 Find the common ratio.

3,  $3^x$ ,  $3^9$ ...

$$r = \frac{3^x}{3}$$

$$r = 3^{x-1}$$

$$r = \frac{3^9}{3^x}$$

$$r = 3^{9-x}$$

$$3^{x-1} = 3^{9-x}$$

$$x-1 = 9-x$$

$$2x = 10$$

$$x = 5$$

$$r = 3^{5-1}$$

$$r = 3^4$$

$$r = 81$$

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

$r$  = common ratio

$t_1$  = first term

$n$  = term number

$t_n$  =  $n$ th term.

$t_3$  = 3rd term.

#3 Given the geometric sequence  
3, 6, 12, 24, ... which term is 384?

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

$$t_n = 384$$

$$t_1 = 3$$

$$r = \frac{6}{3} = 2$$

$$384 = 3(2)^{n-1}$$

$$128 = 2^{n-1}$$

$$7 = 2^{n-1}$$

or

$$1 \dots 0 \quad 1 \quad 2^{n-1}$$

$$r = \frac{b}{3} = 2$$

$$n = ?$$

$$2^7 = 2^{n-1}$$

$$7 = n - 1$$

$$8 = n$$

or

$$\log 128 = \log 2^{n-1}$$

$$\log 128 = (n-1) \log 2$$

$$\frac{\log 128}{\log 2} = n - 1$$

$$\frac{\log 128}{\log 2} + 1 = n$$

$$n = 8$$

#4 Find  $t_{10}$  of the sequence

5, 20, 80, ...

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

$$t_{10} = ?$$

$$t_1 = 5$$

$$r = \frac{20-5}{5}$$

$$n = 10$$

$$t_{10} = 5(4)^{10-1}$$

$$t_{10} = 5(4)^9$$

$$t_{10} = 1310720$$

#5 Find the general term of the sequence

$$t_3 = 20 \quad \text{and} \quad t_6 = -540$$

$$t_3 = t_1 (r)^{3-1}$$

$$t_6 = t_1 (r)^{6-1}$$

$$20 = t_1(r^5)$$

$$-540 = t_1(r)^2$$

$$\frac{t_6}{t_3}$$

$$\frac{-540}{20} = \frac{t_1 r^5}{t_1 r^2}$$

$$-27 = r^3$$

$$-3 = r$$

$$\begin{aligned} 20 &= t_1(-3)^2 \\ 20 &= t_1(9) \\ \frac{20}{9} &= t_1 \end{aligned}$$

general term

$$t_n = \frac{20}{9}(-3)^{n-1}$$

#6 Each year a car depreciates by 30% of its current value. What is the value of the car 5 years from now if the original value was \$40,000.

$$t_1 = 40000$$

$$n = 6$$

$$r = 100\% - 30\%$$

$$r = 70\% = 0.7$$

$$t_6 = ?$$

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

$$t_6 = 40000(0.7)^{6-1}$$

$$t_6 = 40000(0.7)^5$$

$$t_6 = \$6722.80$$