

**12.1 Small Investment, Big Reward
Exponential Functions**

Vocabulary

Define each term in your own words.

1. exponential function 2. half-life

Problem Set

Write the explicit formula for each geometric sequence. Then, use the equation to determine the 10th term. Round answers to the nearest thousandth, if necessary.

3.

1	2	3	4	5	6	10
5	15	45	135	405	1,215	98,415

$$\begin{aligned} a_n &= 5 \cdot 3^{n-1} \\ a_{10} &= 5 \cdot 3^{10-1} \\ &= 5 \cdot 3^9 \\ &= 5 \cdot 19,683 \\ &= 98,415 \end{aligned}$$

4.

1	2	3	4	5	6	10
200	100	50	25	12.6	6.25	

5.

1	2	3	4	5	6	10
1	1.25	1.563	1.953	2.441	3.052	

6.

1	2	3	4	5	6	10
1	0.8	0.64	0.512	0.410	0.328	

7.

1	2	3	4	5	6	10
0.4	0.8	1.6	3.2	6.4	12.8	

8.

1	2	3	4	5	6	10
27	9	3	1	$\frac{1}{3}$	$\frac{1}{9}$	

Write an exponential function to represent each geometric sequence.

Evaluate the function for the given value of n . Round to the nearest thousandth, if necessary.

9. $a_n = 4 \cdot 2.5^{n-1}$ $f(n) = 4 \cdot 2.5^{n-1}$
 $n = 10$
 $= 4 \cdot 2.5^n \cdot \left(\frac{5}{2}\right)^{-1}$
 $= 4 \cdot 2.5^n \cdot \frac{2}{5}$
 $= 1.6 \cdot 2.5^n$
 $f(10) = 1.6 \cdot 2.5^{10}$
 $\approx 1.6 \cdot 9536.743$
 $\approx 15,258.789$

12. $a_n = 0.05 \cdot 1.25^{n-1}$
 $n = 24$

10. $a_n = 0.3 \cdot 8^{n-1}$
 $n = 3$

13. $a_n = 10 \cdot 4^{n-1}$
 $n = 7$

11. $a_n = 150 \cdot 0.8^{n-1}$
 $n = 2$

14. $a_n = 1,000 \cdot 0.5^{n-1}$
 $n = 5$

Write an exponential function $A(t)$, where t represents elapsed time, to represent each half-life situation. Then, use the function to complete each table. Round as necessary.

15.

Elapsed Time (hours)	0	2	4	6	8	20
Drug in Bloodstream (mg)	120	60	30	15	7.5	0.1172
Number of Half-Life Cycles	0	1	2	3	4	10

$$A(t) = 120\left(\frac{1}{2}\right)^{\frac{t}{2}}$$

$$A(20) = 120\left(\frac{1}{2}\right)^{\frac{20}{2}}$$

$$= 120\left(\frac{1}{2}\right)^{10}$$

$$\approx 120(0.00098)$$

$$\approx 0.1172$$

16.

Elapsed Time (minutes)	0	5	10	15	20	100
Bacteria Subject to Growth Inhibitor	800	400	200	100	50	
Number of Half-Life Cycles	0	1	2	3	4	

17.

Elapsed Time (years)	0	14	21	28	42	56
Strontium in Rock Sample (grams)	16	8		4	2	1
Number of Half-Life Cycles	0	1		2	3	4

18.

Elapsed Time (years)	0	5,700	11,400	15,675	17,100	22,800
C-14 in Rock Sample (grams)	1	0.5	0.25		0.125	0.0625
Number of Half-Life Cycles	0	1	2		3	4

19.

Elapsed Time (Days)	0	6	12	18	24	42
Rat Population Exposed to Virus	5000	2500	1250	625	313	
Number of Half-Life Cycles	0	1	2	3	4	

20.

Elapsed Time (Hours)	0	2	4	6	8	16
Participants in Tennis Tournament	256	128	64	32	16	
Number of Half-Life Cycles	0	1	2	3	4	