Name: _____   Date: _____

UNIT 5   **LESSON 17**

DO NOW: Write the first 5 terms of the recursive sequence:

$a_1 = -5$

$a_n = 2 \cdot a_{n-1}$

$a_1 = -5$

$a_2 = -5(2) = -10$

$a_3 = -10(2) = -20$

$a_4 = -20(2) = -40$

$-5, -10, -20, -40$

AIM: HOW CAN WE USE THE EXPLICIT FORMULA TO SOLVE FOR GEOMETRIC SEQUENCE WORD PROBLEMS?

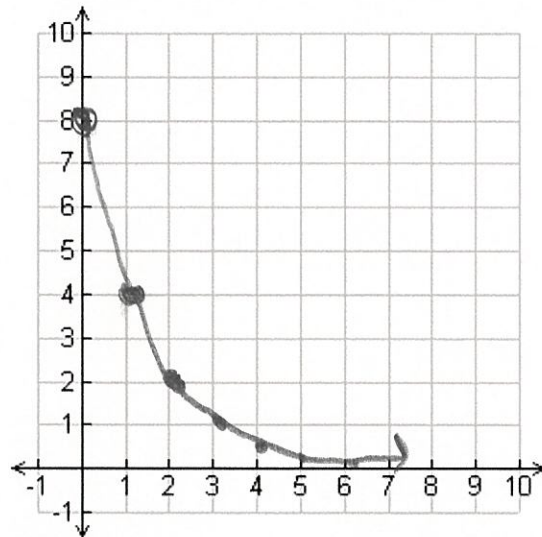| Geometric Sequence Formula: $a_n = a_1 r^{n-1}$ | → | **ON** Reference Sheet |

| Geometric Recursive Formula: $a_n = r \cdot a_{n-1}$ | → | **NOT ON** Reference Sheet |

1. A ball is dropped from 8 feet. When it bounces, it rises to 50% of the height from which it was dropped.

a) Fill in the table.

Peaks	Height
0	8
1	4
2	2
3	1
4	.5
5	.25
6	.125

b) What type of graph will the ball represent? __exponential decay__

c) Write the explicit formula for this sequence.

$a_n = a_1 r^{n-1}$

$a_n = 4\left(\frac{1}{2}\right)^{n-1}$

d) Write the recursive formula for this sequence.

$a_n = r \cdot a_{n-1}$

$a_n = \frac{1}{2} a_{n-1}$

2. Thomas is saving pennies in a jar. The first day he saves three pennies, the second day twelve pennies, the third day forty-eight pennies, and so on. How many pennies does Thomas save on the eighth day?

$$a_1 = 3$$

$$r = \frac{12}{3}$$

$$r = 4$$

$$a_n = a_1 r^{n-1}$$

$$a_n = 3(4)^{n-1}$$

$$a_8 = 3(4)^{8-1}$$

$$a_8 = 3(4)^7$$

$$\boxed{a_8 = 49,152}$$

3. A salesman offered to sell David a new $48,000 car for 15 monthly payments. He said the first payment would be $3 and would then double each month for the 15 months.

$$3,6,9,12,24,.., \quad r = \frac{6}{3} = 2$$

a) If David accepts the seemingly great deal, what would his 12th payment be?

$$\boxed{6,144}$$

$$a_n = a_1 r^{n-1}$$

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

$$a_{12} = 3(2)^{12-1}$$

$$a_{12} = 6,144$$

b) What would his last payment be?

$$a_{15} = 3(2)^{15-1}$$

$$a_{15} = 49,152$$

$$\boxed{\$49,152}$$

c) Should he accept the deal? Explain.

No, he would be paying too much!

49,152 - 48,000

$$\boxed{\$1,152 \text{ too much}}$$

4. What is the formula for the nth term of the sequence $100, 50, 25...$? $a_n = a_1 r^{n-1}$

1) $a_n = \left(\dfrac{1}{2}\right)^n$

2) $a_n = 100\left(\dfrac{1}{2}\right)^n$

3) $a_n = 100\left(\dfrac{1}{2}\right)^{n-1}$

4) $a_n = 100^n$

5. A large snowfall of 45 inches fell on Buffalo.

a) If one-third of the snow melts each day, how much snow will remain after Day 1?

$$\frac{45}{3} \text{ or } \frac{1}{3}(45) = \boxed{15 \text{ in}}$$

b) Write a recursive formula for the sequence.

$$a_n = r\, a_{n-1}$$

$$\boxed{a_n = \frac{1}{3} a_{n-1}}$$

c) Write an explicit formula for the sequence.

$$a_n = a_1 r^{n-1}$$

$$\boxed{a_n = 15\left(\frac{1}{3}\right)^{n-1}}$$

$$r = \frac{1}{3}$$

$$a_1 = 15$$

d) After 5 days, will there be more or less than an inch of snow on the ground. Explain.

$$a_n = 15\left(\frac{1}{3}\right)^{n-1}$$

$$a_5 = 15\left(\frac{1}{3}\right)^{5-1}$$

$$a_5 = 15\left(\frac{1}{3}\right)^{4}$$

$$a_5 = \frac{5}{27} = .1851$$

$n = 5$

Yes! less than an inch of snow

e) If you were to graph the sequence of the snowfall, what type of graph would it be?

exponential decay

6. A virus reproduces by dividing into two, and after a certain growth period, it divides into two again. As the virus continues to reproduce, it will continue to divide in two. How many viruses will be in a system starting with a single virus AFTER 10 divisions?

a) Is the sequence arithmetic or geometric? Explain your answer.

the virus is dividing by two common ratio is $\frac{1}{2}$

b) Write out the sequence using blanks where appropriate. Fill in the first three terms.

__1__ __2__ __4__

c) Write an explicit formula for the sequence.

$$a_n = a_1 r^{n-1}$$
$$a_{10} = 2(2)^{10-1}$$
$$a_{10} = 2(2)^9$$

d) How many viruses will be in a system starting with a single virus AFTER 10 division?

$$\boxed{1024}$$

7. Suppose you drop a tennis ball from a height of 15 feet. After the ball hits the floor, it rebounds to 85% of its previous height. How high will the ball rebound after its third bounce? Round to the nearest tenth.

a. Is the sequence arithmetic or geometric? Explain your answer.

$$r = .85$$

b. Write an explicit formula for the sequence.

$$a_n = a_1 r^{n-1}$$
$$a_n = 15(.85)^{n-1}$$

c. Use the explicit formula to solve the problem.

$$a_n = 15(.85)^{n-1}$$
$$a_3 = 15(.85)^{3-1}$$
$$a_3 = 10.84$$

.85 ft
• 10.84 ft

$$\boxed{84.81 ft}$$