

**CLO: Students will DEFINE Geometric RECURSION as GROWTH or DECAY and be able to WRITE Recursive formulas for both.**

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## Warm-Up

Use the Recursive formulas to find the SEQUENCE of the next 5 terms:

1.  $u_n = u_{n-1} (1 - .2)$      $u_0 = 380$ , 304, 243.2, 194.56, 155.648

2.  $u_n = u_{n-1} (1 + .3)$ ;     $u_1 = 6$ , 7.8, 10.14, 13.18, 17.14

Identify which sequence is growth and which one is decay and write a sentence justifying your reason for each

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- Partner Table Task: Write your solutions on ONE paper, TWO names...

- With your partner, use your number pair to complete the following: Use the FIRST number as  $u_1$ .

1. Find the COMMON DIFFERENCE between the two numbers

2. Write an ARITHMETIC RECURSIVE FORMULA

3. Find the COMMON RATIO between the 2 numbers (3 dec. pl.)

4. Write a GEOMETRIC RECURSIVE FORMULA. Is your number pair GROWTH or DECAY? Explain TWO ways.

Find the next 5 terms for each recursive formula

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Modeling growth and decay goes along with geometric sequences. Remember that a geometric sequence is shown by

$$u_n = r * u_{n-1}$$

In the last section we used  $u_1$  as the starting term of each sequence. However, in some situations, like the one we will look at next, it is more important and meaningful if we treat the starting term as a zero term, or  $u_0$ . The zero term tells us the starting value before any change occurs and is used when we write the algebraic expression.

Let's look at an example.



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**Example 1:**

**An automobile DEPRECIATES, or loses value as it gets older. Suppose that a particular automobile loses one - fifth of its value each year. Write a recursive formula to find the value of this car when it is 6 years old, if it cost \$23, 999 when it was new.**

$$u_0 = 23999$$

$$u_n = .8 u_{n-1}$$

$$u_n = .2 u_{n-1} = u_n = (1 - .20) u_{n-1}$$

$$u_6 = 6291.19$$

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### **CALCULATOR NOTES**

Step 1: Press the **mode** key; go down to either row 4 or 5 depending on your calculator, **FUNCTION** **PARAMETRIC** **POLAR** **SEQUENCE**

Step 2: Press **Y=** to make sure you are in recursive mode.

Step 3: **nMin** represents your starting term of  $u_0$  or  $u_1$ , so it should always be a **0** or **1**

Step 4:  **$u_n$**  = represents where you will write your recursive formula

$u_n = u_{n-1} + 7$   
**2<sup>nd</sup> key 7** will give you the  $u$ ; parentheses, then **X, T, 0, n** key to get the **n** then **- 1** close parentheses, **+ 7**

Step 5:  **$u(nMin)$**  = represents the start term value; enter in **3**

Step 6: **2<sup>nd</sup> graph** = your table of values once you enter your recur. formula

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## WARM - UP

Using the tables, describe the pattern of change for each table as either arithmetic or geometric. Write a recursive formula for each table.

1.

geo  
 $u_1 = 3$   
 $u_n = 4u_{n-1}$

x	y
1	3
2	12
3	48
4	192
5	768

2.

Arit.  
 $u_0 = -12$   
 $u_n = u_{n-1} - 6$

x	y
0	-12
1	-18
2	-24
3	-30
4	-36

3.

Geo  
 $u_1 = 15$   
 $u_n = u_{n-1} \cdot \frac{1}{3}$

x	y
1	15
2	5
3	$\frac{5}{3}$
4	$\frac{5}{9}$
5	$\frac{5}{27}$



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**Example 2:**

**Gloria deposits \$2000 into a bank account that pays 7% annual interest compounded annually. This means that her bank pays her 7% of her account balance as interest at the end of each year and she leaves the original amount and the interest in the account. When will the original deposit double in value?**

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When we work with these types of problems it is sometimes easier to think of the common ratio as the whole, 1, plus or minus a percent change. Instead of using  $r$  we can write either  $(1 + p$  or  $1 - p)$  sometimes it will be seen as  $(1 + r$  or  $1 - r)$

8% ↑ ↓  
1 + .08    1 - .08  
1.08    .92

**CLASSWORK**

**PAGES 41 - 42 #1-5, 8, 10**





