Essential Question: How can we distinguish between arithmetic and geometric sequences?

Do Now:

i) Identify each sequence as **arithmetic**, **geometric** or **neither**.

ii) If arithmetic, identify the common difference. If geometric, identify the common ratio.

A. 12, 18, 27, 40.5, … geometric 1.5

B. -123, -137, -151, -165, … arithmetic $d = -14$

C. 3, 7, 15, 31, … neither

D. $1, \frac{1}{4}, \frac{1}{16}, \frac{1}{64}, \ldots$ geometric $r = \frac{1}{4}$

STOP HERE

1. For letters A. and B. above, write an equation that can be used to find the **nth** term of the sequence.

12, 18, 27, 40.5, … $a_1 = 12$ $r = 1.5$

A. $a_n = 12(1.5)^{n-1}$

-123, -137, -151, -165, … $a_1 = -123$ $d = -14$

B. $a_n = -123 - 14(n-1)$

2. Using your equation, find the 10th term in each sequence.

$a_{10} = 12(1.5)^{10-1}$

$= 12(1.5)^9$

$= 461.3203125$

$a_{10} = -123 - 14(10-1)$

$a_{10} = -123 - 14(9)$

$a_{10} = -249$

3. Katie works at the local pet shop. For a single litter of kittens, she puts out 17 ounces of wet food. For 2 litters she puts out 34 ounces of wet food and for 3 litters, she puts out 51 ounces of wet food. She continues this pattern for **n** litters.

a) Write an equation that can be used to find the number of ounces of wet food, a_n, Katie will put out for **n** litters of kittens.

litters ↓

n	1	2	3
a_n	17	34	51

ounces of food ↑

$a_1 = 17$

$d = 17$

$a_n = 17 + 17(n-1)$

b) How much wet food will Katie put out if there are 8 litters of kittens in the store?

$n = 8$

$a_8 = 17 + 17(8-1)$

$a_8 = 136$

136 ounces of wet food

4. A soup kitchen makes 16 gallons of soup every two weeks. Each day they serve 25% of the soup that remains from the previous day. The table below shows how much soup, **f(n)**, remains after **n** days.

# of days ↓

n	1	2	3
f(n)	12	9	6.75

soup remaining (gallons)

a) Write an equation that can be used to find the number of gallons of soup remaining after **n** days.

$f(1) = 12$

$r = .75$

$f(n) = 12(.75)^{n-1}$

b) How many gallons of soup remain after the 12th day? *Round your answer to the nearest tenth.*

$n = 12$

$f(12) = 12(.75)^{12-1}$

$f(12) = 12(.75)^{11}$

$f(12) = .5$

A half gallon of soup remains after the 12th day.

c) On what day is there about 2 gallons of soup left?

n $\quad$ $f(n)$

$2 = \boxed{12(.75)^{n-1}}$

First, put this in the calculator

$y = 12(.75)^{x-1}$

Then, look at the y column in the table of values. when is it closest to 2?

The 7th day

5. Write an explicit rule for an arithmetic sequence if $a_6 = 8$ and $a_{10} = 40$.

8				40
a_6	a_7	a_8	a_9	a_{10}

6	7	8	9	10	11
8				40	

To find the common difference, subtract the numbers and divide by the number of places. Find the R.O.C.

$$\frac{\Delta y}{\Delta x} = \frac{40-8}{10-6} \rightarrow \frac{32}{4} \rightarrow 8$$

$d = 8$

To find the first term, it is 5 places away from the 6th term.

$a_1 = a_6 - 5(8)$

$a_1 = 8 - 40$

$a_1 = -32$

Find the 20th term

$a_n = -32 + 8(n-1)$

$a_{20} = -32 + 8(20-1)$

$a_{20} = 120$

6. Write an explicit rule for a geometric sequence if $a_3 = 10$ and $r = \frac{1}{2}$.

a	1	2	3	4
a_n	40	20	10	

To find the previous term, divide by the ratio

$10 \div \frac{1}{2} = 20$

$20 \div \frac{1}{2} = 40$

The explicit rule finds the value of any term

$a_n = 40(.5)^{n-1}$

The TAKE AWAY

If a sequence of numbers is **arithmetic**, the pattern will display a common difference between consecutive terms. An explicit formula $\mathbf{a_n}$ = $a_1 + d(n-1)$ can be used to find the ***nth*** term of the sequence.

If a sequence of numbers is **geometric**, the pattern will display a common ratio between consecutive terms. An explicit formula $\mathbf{a_n}$ = $a_1(r)^{n-1}$ can be used to find the ***nth*** term of the sequence.