Algebra 1: 4.3 **Name** _____ **Period** _____

Arithmetic and Geometric Sequences – Recursive Formulas

When you want to find the *next* term in an arithmetic or geometric sequence...

Use a recursive formula.

NOW-NEXT Formula! You have a number now, what's the next number?

$$a_n = a_{n-1} + d$$

Example:

Determine the next 3 terms of the sequence 30, 70, 110, . . .

Find the common difference:

d = common difference = 2nd term – 1st term = 70 – 30 = 40

Use the recursive formula to solve:

Given the first 3 terms, find the 4th, 5th, and 6th terms.

$a_4 = 110 + 40 = 150$

$a_5 = 150 + 40 = 190$

$a_6 = 190 + 40 = 230$

Determine the next terms in the given arithmetic sequence using the recursive formula.

1. Determine the next 2 terms of the sequence 16, 30, 44, 58, . . .

$d = 30 - 16 = 14$

Given 4 terms,

$a_5 = 58 + 14 = 72$

$a_6 = 72 + 14 = 86$

2. Determine the next 3 terms of the sequence -68, -83, -98, . . .

$d = -83 - (-68) = -83 + 68 = -15$

Given 3 terms,

$a_4 = -98 + (-15) = -113$

$a_5 = -113 + (-15) = -128$

$a_6 = -128 + (-15) = -143$

3. Determine the next 4 terms of the sequence 7.3, 9.4, 11.5, . . .

$d = 9.4 - 7.3 = 2.1$

Given 3 terms,

$a_4 = 11.5 + 2.1 = 13.6$

$a_5 = 13.6 + 2.1 = 15.7$

$a_6 = 15.7 + 2.1 = 17.8$

$a_7 = 17.8 + 2.1 = 19.9$

4. Determine the next 2 terms of the sequence $\frac{1}{2}$, 1, $\frac{3}{2}$, 2, . . .

$d = 1 - \frac{1}{2} = \frac{1}{2}$

Given 4 terms,

$a_5 = 2 + \frac{1}{2} = \frac{4}{2} + \frac{1}{2} = \frac{5}{2}$

$a_6 = \frac{5}{2} + \frac{1}{2} = \frac{6}{2}$ or 3

Determine the next terms in the given geometric sequence using the recursive formula.

$$g_n = g_{n-1} \cdot r$$

Example:
Determine the next 3 terms in the sequence 100, -50, 25, ...

Find the common ratio:

$$r = \text{common ratio} = \frac{2nd\ term}{1st\ term} = \frac{-50}{100} = -0.5$$

Use the recursive formula to solve:

Given the first 3 terms, find the 4th, 5th, and 6th terms.

$g_4 = 25 \cdot (-0.5) = -12.5$
$g_5 = -12.5 \cdot (-0.5) = 6.25$
$g_6 = 6.25 \cdot (-0.5) = -3.125$

5. Determine the next 2 terms in the sequence 4, 8, 16, 32, ...

$r = \frac{8}{4} = 2$

Given 4 terms,

$g_5 = 32 \cdot 2 = 64$

$g_6 = 64 \cdot 2 = 128$

6. Determine the next 3 terms in the sequence -5, 20, -80, ...

$r = \frac{20}{-5} = -4$

Given 3 terms,

$g_4 = -80 \cdot (-4) = 320$

$g_5 = 320 \cdot (-4) = -1280$

$g_6 = -1280 \cdot (-4) = 5120$

7. Determine the next 4 terms in the sequence 2, -6, 18, ...

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

Given 3 terms,

$g_4 = 18 \cdot (-3) = -54$

$g_5 = -54 \cdot (-3) = 162$

$g_6 = 162 \cdot (-3) = -486$

$g_7 = -486 \cdot (-3) = 1458$

8. Determine the next 2 terms in the sequence 3, 1.5, 0.75, ...

$r = \frac{1.5}{3} = 0.5$

Given 3 terms,

$g_4 = 0.75 \cdot 0.5 = 0.375$

$g_5 = 0.375 \cdot 0.5 = 0.1875$