DO NOW

Find the next number:

a. 3, 6, 9, 12, 15...

18

b. 4, 20, 100, 500..

2500

9.4 Sequences and Arithmetic Sequences

sequence - list written in a given order

* related by a numerical pattern

2 ways to define:

1. recursively – value is defined by the preceding value.
2. explicitly – definition from a general rule based on its location in the sequence.

Predict the next term of the sequence.

1. 1, 4, 8, 13, 19... 26 (3 4 5 6 7)
2. 4, 16, 36, 64, 100... 144 (2^2 4^2 6^2 8^2 10^2)
3. 3, 9, 15, 21, 27... 33
4. 2, 4, 8, 16, 32... 64

Arithmetic sequence – add a common difference (d) to find the next #

* LINEAR FUNCTION

Example: 2, 6, 10, 14, 18... d = 4 (4 4 4 4)

Find d and the next three terms.

5. 24, 27, 30, 33... d = 3
   36, 39, 42
6. 13, 8, 3, -2... d = -5
   -7, -12, -17
7. 21, 121, 221, 321... d = 100
   421, 521, 621
8. 32, 25, 18, 11... d = -7
   4, -3, -10

Writing an arithmetic sequence recursively: (based on the item before it in the list)

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

a_n → general term (↳ n is its location in the list)

a_{n-1} → item before a_n

d → common difference

Example: Given 2, 5, 8, 11, 14...

$d = 3$

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

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

Writing an arithmetic sequence explicitly (General Rule): (based on its location in the list, Ex: 4th item)

General Rule:

$a_n = a_1 + (n-1)d$

a_n → general term (↳ n is its location in the list)

a_1 → 1st item in the list

n → location in the list

d → common difference

Example: Given 2, 5, 8, 11, 14...

$d = 3$

$a_n = a_1 + (n-1)d$

$a_n = 2 + (n-1)(3)$

$a_n = 2 + 3n - 3$

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

$a_1 = 3(1) - 1 = 2$

$a_2 = 3(2) - 1 = 5$

$a_3 = 3(3) - 1 = 8$

9. Consider the arithmetic sequence: 6, 9, 12, 15. d=3
   a. Use the general rule to write the explicit formula and simplify.
   b. Find the 9th and 27th terms of this sequence.

a. $a_n = a_1 + (n-1)d$ ← general rule

$a_n = 6 + (n-1)(3)$

$a_n = 6 + 3n - 3$

$\boxed{a_n = 3n + 3}$ ← explicit formula

b. $a_9 = 3(9) + 3$

$a_9 = 27 + 3$

$\boxed{a_9 = 30}$

$a_{27} = 3(27) + 3$

$a_{27} = 81 + 3$

$\boxed{a_{27} = 84}$

10. If an arithmetic sequence is defined recursively as $a_1 = 6$ and $a_n = a_{n-1} + 5$,
    a. Find the common difference.
    b. Write the general rule for a_n and simplify to the explicit formula.
    c. Find the 14th term.

a. $d = 5$

b. $a_n = a_1 + (n-1)d$
$a_n = 6 + (n-1)(5)$
$a_n = 6 + 5n - 5$
$\boxed{a_n = 5n + 1}$

c. $a_{14} = 5(14) + 1$
$a_{14} = 70 + 1$
$\boxed{a_{14} = 71}$

Page 7

11. Write out the first four terms of an arithmetic sequence in which the 8th term is 24 and the 15th term is 10.

$a_8 = 24$ → $a_8 = 24$
$a_{15} = 10$

$d = \frac{a_{15} - a_8}{15 - 8}$
$d = \frac{10 - 24}{15 - 8}$
$d = \frac{-14}{7}$
$d = -2$

$a_n = a_1 + (n-1)d$
$24 = a_1 + (8-1)(-2)$
$24 = a_1 + 7(-2)$
$24 = a_1 - 14$
$24 + 14 = a_1$
$38 = a_1$

$\boxed{38, 36, 34, 32}$

Page 8

HOMEWORK

Worksheet - HW 9.4

Page 9