*Algebra 1:* Unit 5 Notes

*Lesson 4: Arithmetic Sequences*

**Part 1: Patterns: Revisit Warm-up: What patterns did we see...**

| 1, 3, 5, 7, ... | 1, 4, 9, 16, ... | 1, 2, 3, 5, 8, ... |
|---|---|---|
| Add by 2 | Perfect squares | Add terms themselves |

What are some ways we can write patterns with numbers?

- Add/Subtract/Multiply/Divide by a constant
- numbers themselves could have something in common

Give Examples:

1, 2, 4, 8, 16 1, 1, 2, 4, 3, 9, 4, 16 $-27, 9, -3, 1, -\frac{1}{3}$ ...

*Given the rule, write the first three terms of each sequence. Assume that the domain of the function is the set of consecutive integers starting with 1.*

$f(x) = (x+1)^3$

$f(1) = (1+1)^3 = 8$

$f(2) = (2+1)^3 = 27$

$f(3) = (3+1)^3 = 64$

$f(1) = 8$

$f(2) = 27$

$f(3) = 64$

$f(x) = \frac{3x-1}{x+2}$

$f(1) = \frac{2}{3}$

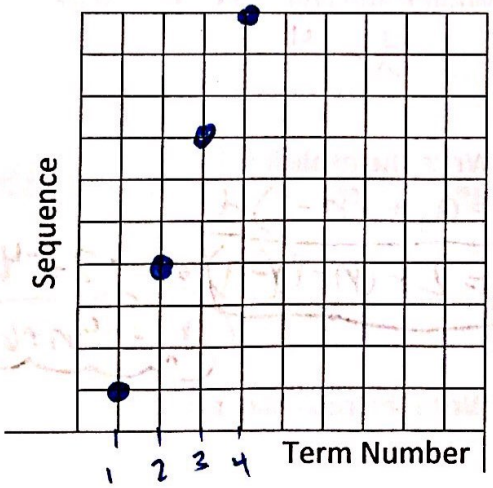
$f(2) = \frac{5}{4}$

$f(3) = \frac{8}{5}$

What about this **sequence:** 1, 4, 7, 10, ...

1ST TERM 2ND TERM 4TH TERMS

Graph it to see a pattern




**Sequence:**
A LIST OF NUMBERS THAT FORM A PATTERN

**Term:**
A NUMBER IN THE SEQUENCE

What is the 3rd **term** of the sequence? 7

What is the 10th term of the sequence? 28

What is the 100th term of the sequence? (YIKES!!) Any ideas for finding the 100th term??

*Algebra 1:* Unit 5 Notes

Part 2: Arithmetic Sequence http://www.shmoop.com/video/arithmetic-sequences/

**Arithmetic Sequence:**

A pattern of terms that differ by the same nonzero number $d$, called the common difference. One is added to a number (the number can be + or −)

How many eyebrow hairs will Irving lose on Day 10?

$a_n = a_1 + (n-1)d$ $\quad d = -4$

$n = 10$ ↑ First day: loses 4 = −4

$a_{10} = -4 + (10-1)(-4)$

$= -4 + (9)(-4)$

$= -4 + -36$

$a_{10} = -40$

Now can you find the 100th term from the sequence 1, 4, 7, 10, …

$a_1 = 1$, $d = 3$, $n = 100$ $\quad a_n = a_1 + (n-1)d$

$a_{100} = 1 + (100-1)3$

$= 1 + (99)3$

$= 1 + 297$

$a_{100} = 298$

**Term ($a_1$ and $a_n$):**

$a_1$: First term

$a_n$: value of nth term

$n$: number we want to find

**Common difference:**

$d$ = difference between terms

**Explicit rule:**

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

**Recursive rule:**

*Part 3 Patterns and Sequences Examples*

1. Given the table

| $n$ | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| $a_n$ | −4 | 0 | 4 | 8 |

Term *

a. What is the common difference?

$d = 4$

b. Write the explicit rule:

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

$a_n = -4 + (n-1)4$ → $-4 + 4n - 4$

$a_n = 4n - 8$

c. Write the recursive rule:

d. Find the 8th term.

$a_8 = -4(8-1)4$

$= -4 + (7)(4)$

$= -4 + 28$

$a_8 = 24$

2. Given the table

| $n$ | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| $a_n$ | −2 | −6 | −10 | −14 |

−4 −4 −4

a. What is the common difference?

$d = -4$

b. Write the explicit rule:

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

$a_n = 2 + (n-1)(-4)$ or $= 2 + -4n + 4$

$a_n = -4n + 6$

c. Write the recursive rule:

d. Find the 24th term.

$a_{24} = 2 + (24-1)(-4)$

$= 2 + (23)(-4)$

$= 2 - 92$

$a_{24} = -90$

3. Consider the sequence –5, –2, 1, 4, …

$a_1$

a. What is the common difference?

$d = 3$

b. Write the explicit rule:

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

$a_n = -5 + (n-1)3$ or $-5 + 3n - 3$

$a_n = 3n - 8$

c. Write the recursive rule:

d. Find the 9th term.

$n = 9$

$a_9 = -5 + (9-1)3$

$= -5 + (8)3$

$a_9 = -5 + 24$

$a_9 = 19$

4. Consider the sequence –1, –4, –7, –10, …

$a_1$ -3 -3 -3

a. What is the common difference?

$d = -3$

b. Write the explicit rule:

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

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

$a_n = -3n + 4$

c. Write the recursive rule:

d. Find the 35th term.

$n = 35$

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

$a_{35} = -1 + (35-1)-3$

$= -1 + (34)\cdot 3$

$= -1 - 102$

$a_{35} = -103$

## ***Ticket out the door:***

***Create your own arithmetic sequence. What makes it an arithmetic sequence?***