

Agenda:

- Course Evals
- Continue Sequences Discussion
- Quiz 7

Graph these relationships for players $n = 1$ to 10:

Case 1: (handshakes, same number of players)

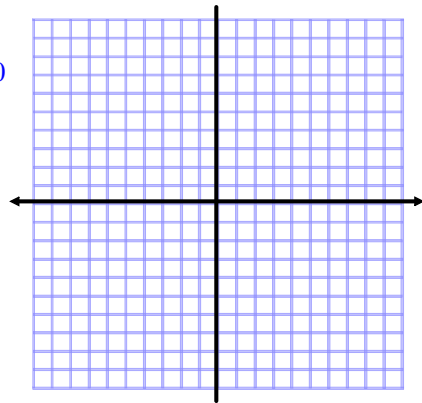
Players:	1	2	3	4	5	6	7	8	9	10
High fives:	1	4	9	16	25	36	49	64	81	100

Case 2: (handshakes, one extra player)
*small team

Players*:	1	2	3	4	5	6	7	8	9	10
High fives:	2	6	12	20	30	42	56	72	90	

Case 3: (high fives on one team)

Players:	1	2	3	4	5	6	7	8	9	10
High fives:	0	1	3	6	10	15	21	28	36	45



1. Are these relationships quadratic?

First and Second Differences:

Calculate the first difference and second difference for the following tables. What do you notice?

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Definition: A sequence is a function whose domain is the set of natural numbers $\{1, 2, 3, 4, 5, \dots\}$.

- A) $f(n) = 5n - 3$ <-- a linear sequence
- B) $g(n) = n^2 - n + 3$ <-- quadratic sequence
- C) $h(n) = 3^n + 1$ <-- exponential sequence

1. Write out the first few terms of the sequences f , g , and h .
2. Calculate the first and second differences for each sequence.

What do you notice?

Definitions:

- Arithmetic sequence: First differences are constant.
* Every linear sequence is arithmetic.
- Quadratic sequence: Second differences are constant.
- Geometric sequence: There is a constant *ratio* between subsequent terms.

Create an example of each type of sequence. Give the function $f(n)$, and write out a few terms.

Arithmetic: $f(n) = \frac{1}{2}n + 3$

n	1	2	3	4
f(n)	3.5	4	4.5	5

Quadratic:

n	1	2	3	4	5
f(n)	9	19	31	45	61

First differences: 8, 10, 12, 14, ...
Second differences: 2, 2, 2, 2

Exponential:

n	1	2	3	4	5
f(n)	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$...

First differences: -2, -1, $-\frac{1}{2}$, $-\frac{1}{4}$

Definitions:

- Arithmetic sequence: First differences are constant.
* Every linear sequence is arithmetic.

$$f(n) = an + b$$

- Quadratic sequence: Second differences are constant.

$$f(n) = an^2 + bn + c$$

- Geometric sequence: There is a constant *ratio* between subsequent terms. (1st & 2nd differences are not constant.)

$$f(n) = a \cdot b^n$$

*Note: Geometric sequences are a special kind of exponential sequence.

Describe the pattern of change in the y -value as the x -value increases or decreases at a constant rate.

A) $y = 2x^2$

B) $y = 3x^2$

C) $y = 0.5x^2$

D) $y = -2x^2$



Predict the pattern of change for:

$y = 5x^2$

$y = -4x^2$

$y = .25x^2$

$y = ax^2$

What type of function is shown here? Can you identify the formula?

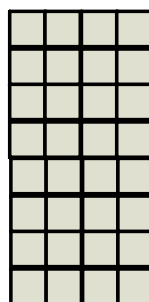
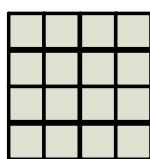
x	y
0	0
1	0.5
2	2
3	4.5
4	8
5	12.5

x	y
0	2
1	0
2	-2
3	-4
4	-6
5	-8

x	y
0	1
1	4
2	13
3	28
4	49
5	76

x	y
0	3
1	4
2	6
3	10
4	18
5	34

Deepening Understanding:



What kind of sequence is evident here?

Deepening Understanding:

Make a Conjecture:

What kind of sequence do you have if the *third differences* are constant? If the *fourth differences* are constant? etc.?

Summary:

Three (+) kinds of sequences:

Linear (or Arithmetic)

- 1st differences constant

Quadratic (or higher powers)

- 2nd differences (or higher) constant

Exponential (Geometric is a special case)

- For Geometric only: Constant ratio between terms

- Exponential or Geometric: No constant differences.