

Mathematical Induction

Lesson 9.4 – Finite Differences

Determine if the sequence is arithmetic. If so, write the n^{th} term formula.

$\{114, 106, 98, 90, \dots\}$ *yes it's arithmetic*

-8 -8 -8

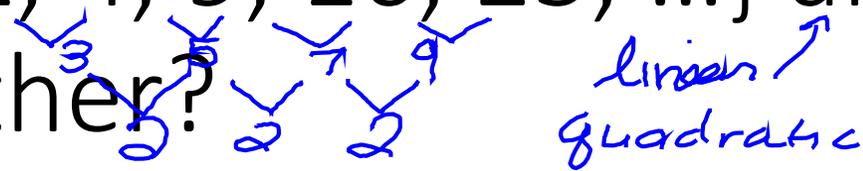
$$a_n = -8n + 122$$

$$a_1 = 114 \quad a_{n+1} = a_n - 8$$

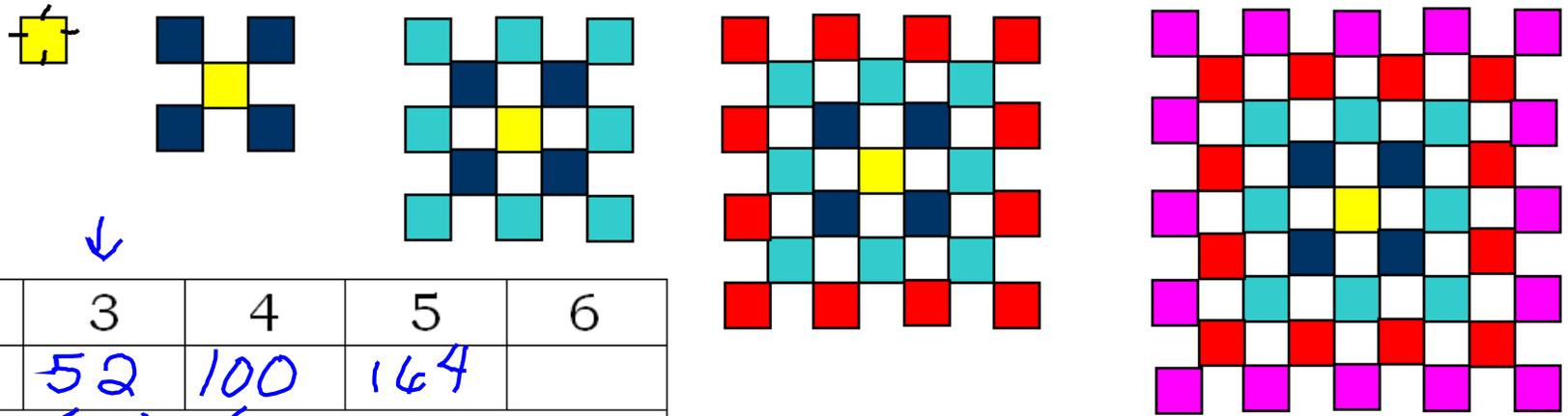
Is $\{1, 4, 9, 16, 25, \dots\}$ arithmetic, geometric, or
neither?

$$a_n = n^2$$

neither (quadratic)



Find a model for the sequence based on the pattern below.



N	1	2	3	4	5	6
Number of edges	4	20	52	100	164	

Handwritten annotations on the table:

- Below the 'Number of edges' row, there are handwritten values: 16, 32, 48, 64.
- Arrows point from these values to the differences between consecutive terms: 20-4=16, 52-20=32, 100-52=48, 164-100=64.
- The formula $a_n = 8n^2 - 8n + 4$ is circled in blue.

$$ax^2 + bx + c$$

$$an^2 + bn + c$$

$$a_1 = a(1)^2 + b(1) + c = 4$$

$$\rightarrow a + b + c = 4 \quad \leftarrow 8 - 8 + c = 4$$

$$a_2 = a(2)^2 + b(2) + c = 20$$

$$\rightarrow 4a + 2b + c = 20$$

$$a_3 = a(3)^2 + b(3) + c = 52$$

$$\rightarrow 9a + 3b + c = 52$$

$$a_3 - a_2 \Rightarrow 5a + b = 32$$

$$a_2 - a_1 \Rightarrow 3a + b = 16$$

$$2a = 16$$

$$3(8) + b = 16 \quad a = 8$$

$$12 + b = 16$$

$$b = 4$$

$$c = 4$$

Find a model for the sequence

$\{5, 10, 17, 26, 37, 50\}$.



quadratic

$$\leftarrow a_n = n^2 + 2n + 2$$

$$a_n = an^2 + bn + c$$

$$a_1 = a + b + c = 5$$

$$a_2 = 4a + 2b + c = 10$$

$$a_3 = 9a + 3b + c = 17$$

$$\begin{array}{r} 5a + b = 7 \quad (a_3 - a_2) \\ -3a - b = -5 \quad (a_1 - a_2) \\ \hline 2a = 2 \end{array}$$

$$2a = 2$$

$$a = 1$$

$$5(1) + b = 7$$

$$b = 2$$

$$1 + 2 + c = 5$$

$$c = 2$$

Find a model for the sequence $\{0, 4, 10, 18, 28\}$

Section 9.4 p. 643: 55-60

Section 9.4

Quadratic Models Day 2

Find a quadratic model for the sequence with the indicated terms. $a_0 = -2$, $a_1 = 1$, $a_3 = 13$

Find a quadratic model for the sequence with the indicated terms. $a_1 = -5$, $a_2 = -5$, $a_3 = -3$

Section 9.4; 69, 70, 73, 74