

Defining Patterns Using Algebra

Variable: a letter that represents a number or numbers

n^{th} term: an item in a sequence or pattern. The variable, n , represents the position in the pattern

Nov 20-18:34

Look at this pattern of toothpicks



Start with one red pick and then add black ones to make a row of squares.

Copy and complete the table

Number of Squares	Number of Red Picks	Number of Black Picks	Total Number of Picks
1	1	3	4
2	1	6	7
3	1	9	10
4	1	12	13
5	1	15	16
6	1	18	19

Nov 27-15:10

Describe the pattern of black picks needed to extend the string of squares.

Add on 3 each time

Write a formula to find the total number of picks needed to form a given number of squares.

Remember to define your **variables**.

Let T = Total number of picks
and n = Number of squares

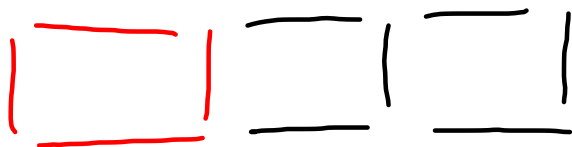
$$T = 1 + (n \times 3)$$

$$T = 1 + 3n$$

(means "n"
multiplied by 3

Nov 27-15:33

If all four picks in the first square were red, how will your results change?



Square #	Reds	Blacks	Total
1	4	0	4
2	4	3	7
3	4	6	10
4	4	7	13

Blacks and reds change
Total stays the same

Nov 27-15:35

Examine the pattern of regular hexagons with side length 1 unit.



- Describe the relationship between the number of hexagons and the perimeter of the shape.
- Find the perimeter of a string of five hexagons.
- Write a formula to model the perimeter of a string of n hexagons.
- You have a string of 15 hexagons. Find the perimeter of the shape.

a)

# Hexagons	1	2	3	4	5
Perimeter	6	10	14	18	22

b) Let $P = \text{perimeter}$ and $n = \# \text{ hexagons}$

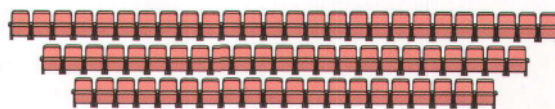
$$P = 4n + 2$$

c) $P = 4(15) + 2 = 62$

Nov 27-15:37

Example 2: The n th Term of a Pattern

A theatre has 20 seats in the first row, 23 seats in the second row, 26 seats in the third row, and so on.



- Describe the pattern in words.
- Show the relationship between a row in the theatre and the number of seats in the row.
- Develop an algebraic expression for the value of the n th term of the pattern.
- How many seats are in row 12?

a) Add 3

b)

Row #	1	2	3	4	5
# of seats	20	23	26	29	32

c) Let $T = \text{total seats in a row}$, $n = \text{row \#}$

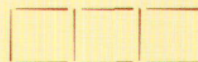
$$T = 3n + 17$$

Nov 27-15:39

Copy the Key Ideas box

Key Ideas

- Patterns can be modelled using formulas.
- To develop a formula:
 - Create a table to identify the pattern.
 - Write a number sentence algebraically.
- You can use an expression for the value of the n th term to make predictions about a pattern.



Let t represent the number of toothpicks.
Let s represent the number of squares.

$$t = 1 + 3s$$

first toothpick } number of toothpicks
added to form each square

5, 10, 15, 20, ...

The value of the n th term is $5n$.

$n = 9$ refers to the ninth term.

The value of the ninth term is $5(9)$ or 40.

Page 189 #s 1, 2, 5 - 11 & 14

Nov 27-15:42