

Lesson 11-1

Mathematical Patterns

<p>Lesson Objectives</p> <p>1 Identifying mathematical patterns</p> <p>2 Using a formula for finding the nth term in a sequence</p>	<p>NAEP 2005 Strand: Algebra</p> <p>Topic: Patterns, Relations, and Functions</p> <p>Local Standards: _____</p>
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Vocabulary

A sequence is _____

A term in a sequence is _____

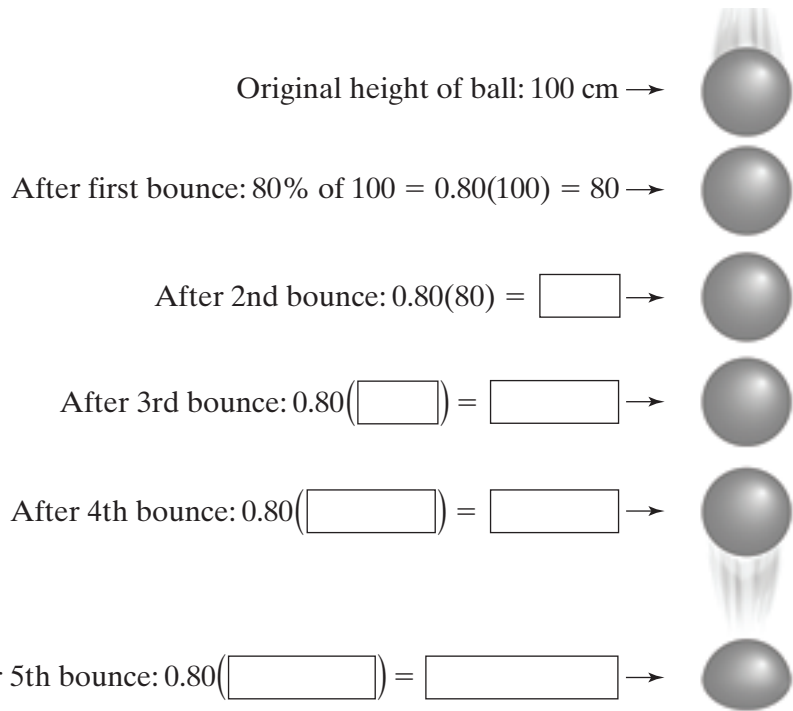
A recursive formula _____

An explicit formula _____

Examples

1 **Physics** Suppose you drop a ball from a height of 100 cm. It bounces back to 80% of its previous height. About how high will it go after its fifth bounce?

- A. 100 cm B. 80 cm C. 32.8 cm D. 26.2 cm



The ball will rebound about 32.8 cm after the fifth bounce.

The correct choice is C.

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2 Using a Recursive Formula

- a. Describe the pattern that allows you to find the next term in the sequence 2, 6, 18, 54, 162, . . . Write a recursive formula for the sequence.

Multiply a term by 3 to find the next term. A recursive formula is

$$a_n = \boxed{} \boxed{} \cdot \boxed{}, \text{ where } a_1 = \boxed{}.$$

- b. Find the sixth and seventh terms in the sequence.

Since $a_5 = 162$, $a_6 = 162 \cdot 3 = \boxed{}$, and $a_7 = \boxed{} \cdot 3 = \boxed{}$.

- c. Find the value of a_{10} in the sequence.

The term a_{10} is the tenth term. $a_{10} = a_9 \cdot 3 = (a_8 \cdot 3) \cdot 3 = ((a_7 \cdot 3) \cdot 3) \cdot 3 = ((\boxed{} \cdot 3) \cdot 3) \cdot 3 = \boxed{}$.

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Quick Check

1. Use the information from Example 1.

- a. About how high will the ball rebound after the eighth bounce?

- b. After what bounce will the rebound height be less than 11 cm?

2. Use the sequence from Example 2. Find terms a_{11} and a_{13} in the sequence.

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Example

3 Geometry The spreadsheet shows the perimeters of regular pentagons with sides from 1 to 4 units long. The numbers in each row form a sequence.

	A	B	C	D	E	F
1		a_1	a_2	a_3	a_4	...
2	Length of a Side	1	2	3	4	...
3	Perimeter	5	10	15	20	...

a. For each sequence, find the next term (a_5) and the twentieth term (a_{20}).

In the sequence in row 2, each term is the same as its subscript. Therefore,
 $a_5 = \square$ and $a_{20} = \square$.

In the sequence in row 3, each term is \square times its subscript. Therefore,
 $a_5 = 5(\square) = \square$ and $a_{20} = 5(\square) = \square$.

b. Write an explicit formula for each sequence.

The explicit formula for the sequence in row 2 is $\square \square = \square$. The explicit formula for the sequence in row 3 is $\square \square = \square$.

Quick Check

3. The spreadsheet shows the perimeters of squares with sides from 2 to 12 units long.

	A	B	C	D	E	F	G	H
1		a_1	a_2	a_3	a_4	a_5	a_6	...
2	Length of a Side	2	4	6	8	10	12	...
3	Perimeter	8	16	24	32	40	48	...

a. Write the first six terms in the sequence showing the areas of the squares. Then find a_{20} .

b. Write an explicit formula for the sequence from part (a).