LESSON MAKER PRO

Pattern Paths

Find terms and explain how sequences grow.

HIGH SCHOOL · FM.R.A.12

FM.R.A.12 "Determine characteristics of sequences, including the Fibonacci Sequence, the triangular numbers, and pentagonal numbers."

NAME _____ DATE _____

THREE WAYS TO GROW

A Fibonacci sequence starts 1, 1, and each new term is the sum of the two before it. To find triangular term n, use $T_n = n(n + 1)/2$. To find pentagonal term n, use $P_n = n(3n - 1)/2$.

WORKED EXAMPLE

Find triangular term 11.

1. Use $T_n = n(n + 1)/2$.
2. Substitute $n = 11$: $T_{11} = 11(11 + 1)/2$.
3. Calculate: $11 \times 12/2 = 66$.

Answer: $T_{11} = 66$

PRACTICE 6 problems

1 The Fibonacci sequence begins 1, 1, 2, 3, 5. Write the next two terms.

ANSWER _____

2 In the Fibonacci sequence, $F_7 = 13$ and $F_8 = 21$. Find F_9.

ANSWER _____

3 Find triangular term 6.

ANSWER _____

4 The triangular numbers begin 1, 3, 6, 10, 15. Which term number has a value of 45?

ANSWER _____

5 Find pentagonal term 4.

ANSWER _____

6 The pentagonal numbers begin 1, 5, 12, 22, 35. Find the next term and state how much you added to 35.

ANSWER _____

APPLY IT Show your work

1 A student designs pentagonal sticker patterns for a school club. Design n uses $P_n = n(3n - 1)/2$ stickers. How many stickers does design 9 use?

WORK SPACE

ANSWER _____

2 For a school concert, the first row of a seating section has 1 seat, the second has 2 seats, and each row after that has one more seat than the row before. How many seats are in the first 10 rows altogether?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Explain why pentagonal term n is greater than triangular term n by n(n - 1). Then find the difference between the two terms when n = 12.

WORK SPACE AND ANSWER

Pattern Paths

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	The Fibonacci sequence begins 1, 1, 2, 3, 5. Write the next two terms.	**8, 13**
2	In the Fibonacci sequence, $F_7 = 13$ and $F_8 = 21$. Find F_9.	**34**
3	Find triangular term 6.	**21**
4	The triangular numbers begin 1, 3, 6, 10, 15. Which term number has a value of 45?	**9**
5	Find pentagonal term 4.	**22**
6	The pentagonal numbers begin 1, 5, 12, 22, 35. Find the next term and state how much you added to 35.	**51; add 16**

PART 2 · APPLY IT

1. **117 stickers** Substitute n = 9: $P_9 = 9(27 - 1)/2 = 117$.
2. **55 seats** The total is triangular term 10: $T_{10} = 10(10 + 1)/2 = 55$.

CHALLENGE

$P_n - T_n = n(3n - 1)/2 - n(n + 1)/2 = n(2n - 2)/2 = n(n - 1)$. When n = 12, the difference is 12(11) = 132.

Accept a list of added differences or the term formulas as a valid path to a sequence answer. For the challenge, accept any equivalent correct algebraic explanation.