LESSON MAKER PRO

Patterns That Add Up

Find terms and totals in arithmetic and geometric sequences.

HIGH SCHOOL · A2.A.3

A2.A.3 "Represent and solve mathematical and real-world problems involving arithmetic and geometric sequences and series. Recognize that arithmetic sequences are linear using equations, tables, graphs, and verbal descriptions. Using the pattern..."

NAME _____ DATE _____

TWO KINDS OF PATTERNS

An arithmetic sequence adds the same amount each time, so its points form a line. A geometric sequence multiplies by the same factor each time and can be written as $f(x) = a(r)^x$, where a is the value at $x = 0$ and r is the factor. To find a finite sum, add only the terms in the requested range.

WORKED EXAMPLE

Use the table. Find $f(4)$ and the sum of the terms from $x = 0$ through $x = 4$.

SEQUENCE VALUES

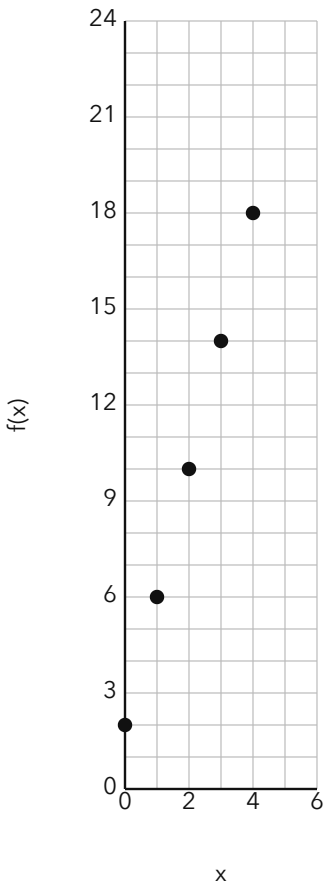
x	f(x)
0	5
1	15
2	45
3	135

1. Each term is 3 times the previous term: $15 / 5 = 3$.
2. The value at $x = 0$ is 5, so $f(x) = 5(3)^x$.
3. $f(4) = 5(3)^4 = 405$.
4. Sum: $5 + 15 + 45 + 135 + 405 = 605$.

Answer: f(4) = 405; sum = 605

PRACTICE 6 problems

1 Use the plotted points. Is this sequence linear or exponential? Find f(5).



ANSWER _____

2 Use the table. Write a formula for f(x), then find f(4).

SEQUENCE VALUES

x	f(x)
0	4
1	8
2	16
3	32

ANSWER _____

3 The first term is 12, and each term increases by 7. Find the 8th term and the sum of the first 8 terms.

ANSWER _____

4 The first term is 7, and each term is twice the previous term. Find the 4th term and the sum of the first 4 terms.

ANSWER _____

5 A sequence follows f(x) = 38 - 4x, starting at x = 0. Is it arithmetic or geometric? Find f(5).

ANSWER _____

6 The number of new viewers in sharing round x follows $f(x) = 3(4)^x$, starting at round 0. Find f(3). What do 3 and 4 mean in this context?

ANSWER _____

APPLY IT Show your work

1 You save $14 in the first week for a concert ticket. Each week after that, you save $6 more than you saved the week before. How much do you save in all over 7 weeks?

WORK SPACE

ANSWER _____

2 In a game, you earn 6 bonus tokens on level 1. On each new level, you earn three times as many bonus tokens as on the previous level. How many bonus tokens do you earn in all through level 4?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two games award points over 4 rounds. Game A gives 12 points in round 1 and 4 more points in each new round. Game B gives 3 points in round 1 and triples the points in each new round. In which round does Game B first give more points than Game A? Which game gives more points in all 4 rounds, and by how many? Show both totals.

WORK SPACE AND ANSWER

ANSWER KEY

Patterns That Add Up

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the plotted points. Is this sequence linear or exponential? Find f(5).	**Linear; f(5) = 22**
2	Use the table. Write a formula for f(x), then find f(4).	**$f(x) = 4(2)^x$; f(4) = 64**
3	The first term is 12, and each term increases by 7. Find the 8th term and the sum of the first 8 terms.	**8th term = 61; sum = 292**
4	The first term is 7, and each term is twice the previous term. Find the 4th term and the sum of the first 4 terms.	**4th term = 56; sum = 105**
5	A sequence follows f(x) = 38 - 4x, starting at x = 0. Is it arithmetic or geometric? Find f(5).	**Arithmetic; f(5) = 18**
6	The number of new viewers in sharing round x follows $f(x) = 3(4)^x$, starting at round 0. Find f(3). What do 3 and 4 mean in this context?	**f(3) = 192 new viewers; 3 is the number of new viewers in round 0, and 4 means each round has four times as many new viewers as the previous round.**

PART 2 · APPLY IT

1. **$224** The 7th week's amount is 14 + 6(6) = 50. The total is 7(14 + 50) / 2 = 224.
2. **240 bonus tokens** The four amounts are 6, 18, 54, and 162. Their sum is 240.

CHALLENGE

Game B first gives more points in round 3. Game A totals 12 + 16 + 20 + 24 = 72 points. Game B totals 3 + 9 + 27 + 81 = 120 points, which is 48 more.

Accept equivalent formulas and valid methods for finding sums. Sequence graphs show discrete points; a line through the points is not required.