

Analytical Thinking in Geometry: Patterns & Sequences

Geometry & Mathematical Reasoning Worksheet · Grade 6–9

Name: _____

Date: _____

Learning Objectives

- Use logical thinking to identify and extend numerical patterns in sequences
- Determine the operation (addition, multiplication, etc.) that governs a given sequence
- Predict unknown terms in a sequence by applying discovered rules

Problems

1. Find the next number in the sequence: 2, 4, 6, 8, 10, ____.

2, 4, 6, 8, 10, ?

2. Find the next number in the sequence: 5, 6, 8, 11, 15, ____.

5, 6, 8, 11, 15, ?

3. Find the next number in the sequence: 3, 4, 6, 9, 13, 18, ____.

3, 4, 6, 9, 13, 18, ?

4. Find the next number in the sequence: 2, 6, 18, 54, ____.

2, 6, 18, 54, ?

5. Find the next number in the sequence: 3, 6, 18, 36, 108, 216, ____.

3, 6, 18, 36, 108, 216, ?

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6. A sequence of squares is drawn where the side lengths follow the pattern 1, 3, 5, 7, 9 cm. What is the perimeter of the next square in the pattern?

$$P = 4s, s = 11$$

7. The number of triangles in a growing geometric figure follows the sequence 1, 4, 9, 16, 25. What is the next number of triangles, and what pattern rule applies?

$$a_n = n^2$$

8. A sequence of geometric figures has perimeters 8, 12, 16, 20, 24 cm. If the perimeter grows at the same rate, write an expression for the n th perimeter and find the 10th term.

$$P_n = 4n + 4$$

9. A sequence of numbers is given as 96, 48, 24, 12, _____. Identify the operation used and find the next two terms.

$$a_n = 96 \cdot \left(\frac{1}{2}\right)^{n-1}$$

10. Two geometric sequences share the same starting value of 4. Sequence A multiplies by 3 each step, and Sequence B adds 12 each step. After 5 terms, which sequence has a greater 5th term and by how much?

$$A : 4 \cdot 3^{n-1}, B : 4 + 12(n - 1)$$

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Analytical Thinking in Geometry: Patterns & Sequences — Answer Key

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Answer Key

1. Answer: 12

- Observe that each term increases by 2: $4 - 2 = 2$, $6 - 4 = 2$, etc.
 - Add 2 to the last term: $10 + 2 = 12$.
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2. Answer: 20

- Find the differences: $6 - 5 = 1$, $8 - 6 = 2$, $11 - 8 = 3$, $15 - 11 = 4$. The differences increase by 1 each time.
 - The next difference is 5, so $15 + 5 = 20$.
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3. Answer: 24

- Differences are: 1, 2, 3, 4, 5 — increasing by 1 each step.
 - The next difference is 6, so $18 + 6 = 24$.
-

4. Answer: 162

- Check if multiplication is involved: $6 \div 2 = 3$, $18 \div 6 = 3$, $54 \div 18 = 3$. Each term is multiplied by 3.
 - Multiply the last term by 3: $54 \times 3 = 162$.
-

5. Answer: 648

- Find the ratios: $6 \div 3 = 2$, $18 \div 6 = 3$, $36 \div 18 = 2$, $108 \div 36 = 3$, $216 \div 108 = 2$. The pattern alternates $\times 2$ and $\times 3$.
 - Following the pattern, the next operation is $\times 3$: $216 \times 3 = 648$.
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6. Answer: 44 cm

- The side lengths increase by 2 each time: 1, 3, 5, 7, 9 → the next side length is $9 + 2 = 11$ cm.
 - Perimeter of a square = $4 \times \text{side} = 4 \times 11 = 44$ cm.
-

7. Answer: 36 (the rule is n^2)

- Recognize that $1=1^2$, $4=2^2$, $9=3^2$, $16=4^2$, $25=5^2$ — these are perfect squares.
 - The next term is $6^2 = 36$.
-

8. Answer: 44 cm

- The perimeters increase by 4 each time (arithmetic sequence). First term is 8, common difference is 4.
 - Formula: $P_n = 8 + (n - 1) \times 4 = 4n + 4$. For $n = 10$: $P_{10} = 4(10) + 4 = 44$ cm.
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9. Answer: 6 and 3

- Check the ratio: $48 \div 96 = 1/2$, $24 \div 48 = 1/2$, $12 \div 24 = 1/2$. Each term is multiplied by $1/2$ (divided by 2).
 - Next two terms: $12 \div 2 = 6$, and $6 \div 2 = 3$.
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10. Answer: Sequence A is greater by 272

- Sequence A: 4, 12, 36, 108, 324. The 5th term is $4 \times 3^4 = 4 \times 81 = 324$.

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- Sequence B: 4, 16, 28, 40, 52. The 5th term is $4 + 12(4) = 52$. Difference: $324 - 52 = 272$, so Sequence A is greater by 272.
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Scan to watch

