Number and Shape Patterns

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

A rule must fit every step. For $4, 9, 14, 19$, add 5 each time; the next term is 24. In a repeating circle–square–triangle pattern, every third position is a triangle.

Worked example

The rule is start at 6, add 4. Write five terms and explain their parity.

1. $6 + 4 = 10$ and $10 + 4 = 14$.
2. $14 + 4 = 18$ and $18 + 4 = 22$.
3. The start 6 is even and adding even 4 keeps every term even.
Answer: $6, 10, 14, 18, 22$; all even.

Practice Problems

Show your thinking.

1. Extend $3, 10, 17, 24$ by two terms. State the rule.

2. Start at 80 and subtract 9. Write the next four terms.

3. Circle, square, square repeats. What shape is in position 8?

4. Fix the wrong term in $5, 11, 17, 24, 29$ for an add 6 rule.

5. A pattern adds 8 each time. Its fourth term is 31. Find the first term.

6. Complete the output row for multiply the input by 3, then add 1.

Input	Output
2	☐
4	☐
6	☐

7. A tile border has $4, 7, 10, 13$ tiles in designs 1–4. How many in design 6?

8. Will start at 1, add 4 ever produce an even number? Explain with terms.

Answer Key

1. $31, 38$; add 7.
2. $71, 62, 53, 44$.
3. Square.
4. 24 should be 23.
5. 7.
6. $7, 13, 19$.
7. 19 tiles.
8. No.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. $10 - 3 = 7$ and $17 - 10 = 7$.
2. $24 + 7 = 31$.
3. $31 + 7 = 38$.

Problem 2

1. $80 - 9 = 71$ and $71 - 9 = 62$.
2. $62 - 9 = 53$.
3. $53 - 9 = 44$; every step removes 9.

Problem 3

1. The repeat has 3 positions.
2. $8 = 2 \times 3 + 2$, so position 8 matches position 2.
3. Position 2 is a square.

Problem 4

1. $5 + 6 = 11$ and $11 + 6 = 17$ fit.
2. $17 + 6 = 23$, not 24.
3. $23 + 6 = 29$ restores the rule.

Problem 5

1. There are 3 steps from term 1 to term 4.
2. $3 \times 8 = 24$.
3. $31 - 24 = 7$; $7, 15, 23, 31$ checks it.

Problem 6

1. Input 2: $2 \times 3 + 1 = 7$.
2. Input 4: $4 \times 3 + 1 = 13$.
3. Input 6: $6 \times 3 + 1 = 19$.

Problem 7

1. The border grows by $7 - 4 = 3$ tiles per design.
2. Design 5 uses $13 + 3 = 16$ tiles.
3. Design 6 uses $16 + 3 = 19$ tiles.

Problem 8

1. The first terms are $1, 5, 9, 13$.
2. Each is odd: $1 = 2 \times 0 + 1$, $5 = 2 \times 2 + 1$.
3. Adding 4, two pairs, leaves one unpaired unit every time.

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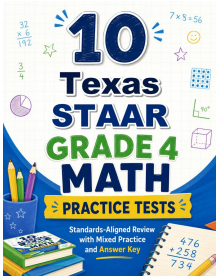

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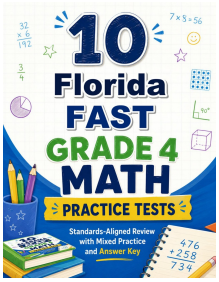

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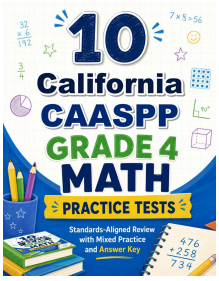

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