Prime and Composite Numbers

Prime and Composite Numbers: Apply, Compare, and Design

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QUICK REVIEW

A prime whole number has exactly two positive factors, 1 and itself; 13 has factors $1, 13$. A composite has more than two; $15 = 3 \times 5$ has factors $1, 3, 5, 15$. The number 1 is neither. The only even prime is 2.

Worked example

Classify 28 as prime, composite, or neither. Show its factor pairs.

1. The complete factor pairs are $1 \times 28 = 28$, $2 \times 14 = 28$, $4 \times 7 = 28$.
2. The positive factors are $1, 2, 4, 7, 14, 28$, a total of 6; more than two means composite.
Answer: 28 is composite.

Practice Problems

Show your thinking.

1. A designer has 23 square tiles. List every whole-number rectangle size, ignoring rotations, and decide whether 23 is prime.

2. A designer has 30 square tiles. List every whole-number rectangle size, ignoring rotations, and decide whether 30 is prime.

3. Can 37 tokens make equal groups with more than one token per group and more than one group? Explain with factors.

4. How many different rectangular arrays of 45 tiles are possible if rotations count as the same? Use this to classify 45.

5. A tile count must be composite, greater than 20, and less than 25, with no factor 2. Find it.

6. Can 19 students stand in equal rows with at least 2 rows and at least 2 students per row?

7. A pack designer wants exactly three positive factors. Do 25 tokens work? Show every factor.

8. A student says adding 1 to any prime gives a composite. Test the claim using 2 and 7.

Answer Key

1. 1×23; 23 is prime.
2. 1×30, 2×15, 3×10, 5×6; 30 is composite.
3. No; 37 is prime.
4. 1×45, 3×15, 5×9; 45 is composite.
5. 21.
6. No.
7. Yes: $1, 5, 25$.
8. False: $2 + 1 = 3$ is prime, though $7 + 1 = 8$ is composite.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The complete factor pairs are $1 \times 23 = 23$.

2. The positive factors are $1, 23$, a total of 2; exactly two factors means prime.

Problem 2

1. The complete factor pairs are $1 \times 30 = 30$, $2 \times 15 = 30$, $3 \times 10 = 30$, $5 \times 6 = 30$.

2. The positive factors are $1, 2, 3, 5, 6, 10, 15, 30$, a total of 8; more than two means composite.

Problem 3

1. The complete factor pairs are $1 \times 37 = 37$.

2. The positive factors are $1, 37$, a total of 2; exactly two factors means prime.

Problem 4

1. The complete factor pairs are $1 \times 45 = 45$, $3 \times 15 = 45$, $5 \times 9 = 45$.

2. The positive factors are $1, 3, 5, 9, 15, 45$, a total of 6; more than two means composite.

Problem 5

1. The candidates are $21, 22, 23, 24$; rejecting even counts leaves $21, 23$.

2. $21 = 3 \times 7$ is composite, while 23 has only factors $1, 23$.

Problem 6

1. The only factor pair is $1 \times 19 = 19$.

2. Each arrangement therefore has a side of 1, violating the minimum of 2.

Problem 7

1. The factor pairs are $1 \times 25 = 25$ and $5 \times 5 = 25$.

2. The distinct factors are $1, 5, 25$, exactly 3, not four because 5 repeats.

Problem 8

1. $2 + 1 = 3$, and 3 has factors $1, 3$.

2. $7 + 1 = 8 = 2 \times 4$; one composite result does not rescue the false universal claim.

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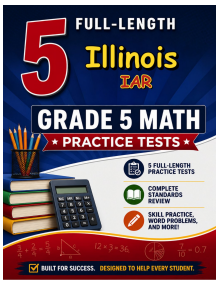

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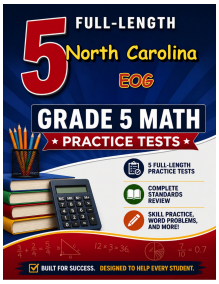

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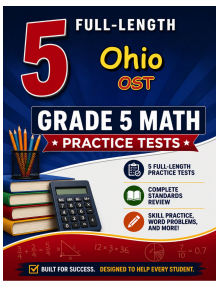

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