# Factors, Multiples, Prime, and Composite Numbers

Apply the skill to decisions and designs

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**QUICK REVIEW**

Factors multiply to a number: $1 \times 12$, $2 \times 6$, and $3 \times 4$ are the factor pairs of $12$. Multiples of $4$ include $4, 8, 12$. A prime has exactly two factors; $7$ has $1, 7$. $12$ is composite; $1$ is neither prime nor composite.

**Worked example**

Find all factor pairs of $18$.

**1.** $1 \times 18 = 18$, $2 \times 9 = 18$, $3 \times 6 = 18$.

**2.** All factors are $1, 2, 3, 6, 9, 18$.

**3.** The largest smaller partner needed is $4$; larger first partners repeat a pair.

**Answer:** Pairs: $(1, 18)$, $(2, 9)$, $(3, 6)$.

## Practice Problems

Show your thinking.

**1.** Design every rectangular array of $32$ chairs; rotations count as one design.

**2.** Bags hold $6$ shells each. What totals between $20$ and $40$ use full bags?

**3.** A $35$-tile floor is planned in $6$ equal rows. Explain why it cannot work without leftover tiles.

**4.** Choose a prime team size greater than $5$ and less than $10$. Verify it.

**5.** A square array has $49$ tiles. Is $49$ prime or composite?

**6.** Find the smallest positive total that can fill bags of $4$ or bags of $6$ exactly.

**7.** Model the factor pairs of $20$ with row-by-column dimensions.

**8.** Explain why $9$ is a factor of $45$ but not a multiple of $45$.

# Answer Key

1. Pairs: $(1, 32)$, $(2, 16)$, $(4, 8)$.
2. $24, 30, 36$ shells.
3. $5$ tiles are left after $5$ in each row.
4. $7$ players.
5. Composite.
6. $12$ items.
7. Pairs: $(1, 20)$, $(2, 10)$, $(4, 5)$.
8. $45 = 9 \times 5$; no positive whole number times $45$ is $9$.

## Step-by-Step Solutions

Follow each calculation, then check your own work.

### Problem 1

**1.** $1 \times 32 = 32$, $2 \times 16 = 32$, $4 \times 8 = 32$.
**2.** All factors are $1, 2, 4, 8, 16, 32$.
**3.** The largest smaller partner needed is $5$; larger first partners repeat a pair.

### Problem 2

**1.** $6 \times 3 = 18$ is too small.
**2.** $6 \times 4 = 24$, $6 \times 5 = 30$, $6 \times 6 = 36$ fit.
**3.** $6 \times 7 = 42$ is too large.

### Problem 3

**1.** $6 \times 5 = 30$ tiles fill $6$ rows of $5$.
**2.** $35 - 30 = 5$ tiles remain.
**3.** $6 \times 6 = 36$ is too many, so $6$ is not a factor of $35$.

### Problem 4

**1.** The candidates are $6, 7, 8, 9$.
**2.** $6 = 2 \times 3$, $8 = 2 \times 4$, and $9 = 3 \times 3$ are composite.
**3.** Only $7$ has just the factors $1, 7$.

### Problem 5

**1.** The positive factors are $1, 7, 49$.
**2.** There are $3$ factors.
**3.** $49$ has more than $2$ factors, so it is composite.

### Problem 6

**1.** The first multiples of $4$ are $4, 8, 12$.
**2.** The first multiples of $6$ are $6, 12$.
**3.** $12$ is the first common total: $3 \times 4 = 2 \times 6 = 12$.

### Problem 7

**1.** $1 \times 20 = 20$, $2 \times 10 = 20$, $4 \times 5 = 20$.
**2.** All factors are $1, 2, 4, 5, 10, 20$.
**3.** The largest smaller partner needed is $4$; larger first partners repeat a pair.

### Problem 8

**1.** $45 \div 9 = 5$ is a whole number, so $9$ is a factor.
**2.** The first positive multiple of $45$ is already $45 > 9$.
**3.** Thus $9$ cannot be a positive multiple of $45$.

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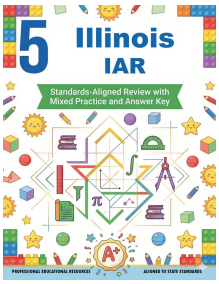


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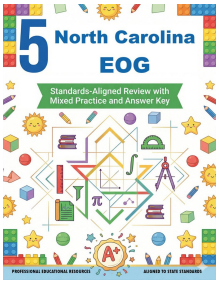


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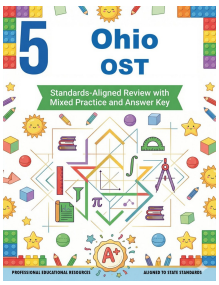


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