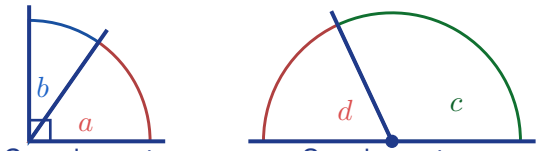
# Complementary and Supplementary Angles

| Name: _____ | Date: _____ | Score: _____ / 17 |
|---|---|---|

Two simple sums unlock a ton of angle problems! **Complementary angles** add to $90°$ and **supplementary angles** add to $180°$—and the angles do not even need to be touching; only the sum matters. If you know one angle, you can find its partner instantly by subtracting from $90$ or $180$. This small idea shows up again and again in geometry, so getting it down now pays off big time!




Complementary
$a + b = 90°$

Supplementary
$c + d = 180°$

## Key Concepts & Quick Review

**Complementary:** $\angle A + \angle B = 90°$. Find complement of $\theta$: $90° - \theta$.

**Supplementary:** $\angle A + \angle B = 180°$. Find supplement of $\theta$: $180° - \theta$.

**Note:** "C" in complementary $\rightarrow$ corner $(90°)$. "S" in supplementary $\rightarrow$ straight $(180°)$.

## Examples

① Angles $P$ and $Q$ are complementary. $\angle P = (3x + 5)°$ and $\angle Q = (2x)°$. Find $x$ and both angles.

**Think It Through:** Complementary angles add to $90°$, so write $(3x + 5) + (2x) = 90$. Combine like terms: $5x + 5 = 90$, so $5x = 85$ and $x = 17$. Substitute back into the expressions: $\angle P = 3(17) + 5 = 56°$ and $\angle Q = 2(17) = 34°$. Since $56° + 34° = 90°$, the pair checks out.

**Answer:** $x = 17$; $\angle P = 56°$, $\angle Q = 34°$

② A ramp makes an angle of $(4n - 6)°$ with the ground. The angle between the ramp and a vertical wall at the same point is its *complement*. If the wall angle is $(2n + 12)°$, find $n$ and both angles.

**Think It Through:** The ramp angle and the wall angle are complementary, so together they make $90°$. Write $(4n - 6) + (2n + 12) = 90$. Simplifying gives $6n + 6 = 90$, so $6n = 84$ and $n = 14$. Substituting back gives a ramp angle of $50°$ and a wall angle of $40°$. Those add to $90°$, which confirms the answer.

**Answer:** $n = 14$; *ramp* $50°$, *wall* $40°$

## Practice Problems

*Find the complement, supplement, or missing angle as indicated.*

1. Find the complement of a $30°$ angle. _____
2. Find the complement of a $67°$ angle. _____
3. Find the supplement of a $45°$ angle. _____
4. Find the supplement of a $112°$ angle. _____
5. Find the complement of $x°$ when $x = 54$. _____
6. Find the supplement of $x°$ when $x = 73$. _____
7. Two complementary angles measure $(x + 10)°$ and $40°$. Find $x$. _____
8. Two supplementary angles measure $(2x)°$ and $60°$. Find $x$. _____
9. Two complementary angles measure $(3x - 5)°$ and $(x + 15)°$. Find $x$ and both angles. _____
10. Two supplementary angles measure $(4x + 10)°$ and $(2x + 20)°$. Find $x$ and both angles. _____
11. An angle is $15°$ more than its complement. Find it. _____
12. An angle is twice its supplement. Find it. _____
13. Two complementary angles measure $(5x)°$ and $(x + 12)°$. Find both angles. _____
14. Two supplementary angles measure $(7x - 3)°$ and $(2x + 3)°$. Find both angles. _____
15. Two equal angles are complementary. Find the measure of each angle. _____

## Study Tips

- ☞ Memory trick: **C**omplementary = **C**orner $(90°)$; **S**upplementary = **S**traight $(180°)$. The initial letters are in alphabetical order, just like $90 < 180$.
- ☞ Two angles don't have to touch to be complementary or supplementary — the *relationship* is about their *sum*, not their position.
- ☞ Set up an equation *first*, then solve. Writing "$x + 40 = 90$" before computing prevents arithmetic errors.

## ✍ Word Problems

**16.** A folded piece of cardboard creates two adjacent angles at the fold. The two angles are supplementary. One angle is $(5k - 10)°$ and the other is $(2k + 15)°$. Find $k$, the measure of each angle, and determine whether the fold creates an obtuse or acute angle on each side. _____

**17.** A right-angle bracket holds a shelf to a wall. The bracket makes angle $(3m + 6)°$ with the wall and angle $(m + 8)°$ with the shelf. If these angles are complementary (the shelf is horizontal and the wall is vertical), find $m$ and each angle. What do these angles tell you about how the bracket is positioned? _____

# Answer Keys

**1)** $60°$
**2)** $23°$
**3)** $135°$
**4)** $68°$
**5)** $36°$
**6)** $107°$
**7)** 40
**8)** 60
**9)** $x = 20$; $55°, 35°$
**10)** $x = 25$; $110°, 70°$
**11)** $52.5°$
**12)** $120°$
**13)** $65°, 25°$
**14)** $137°, 43°$
**15)** $45°$ each
**16)** $k = 25$; angles $115°$ and $65°$; obtuse and acute
**17)** $m = 19$; wall angle $63°$; shelf angle $27°$

## Step-by-Step Explanations

**Strategy:** For Properties of Operations and Simplifying Expressions, use the property name to justify each move: commutative, associative, distributive, or combining like terms. A clean simplification line shows exactly which terms were combined or distributed.

**Practice 1:** 5x+3x **Answer:** $8x$
In the first example, group matching variable terms and constants separately before combining.

**Practice 15:** 9-2(m+3)+4m **Answer:** $2m + 3$
Toward the end, substitute after simplifying so the arithmetic stays short and easy to verify.

**Word-problem notes:**

**16. Answer:** Unsimplified: $3(5s) + 2(4a)$; simplified: $15s + 8a$; evaluated: $\$60 + \$56 = \$116$.
The unsimplified expression follows the groups in the problem exactly: three groups of five student tickets gives $3(5s)$, and two groups of four adult tickets gives $2(4a)$. Now use the distributive property to simplify: $3(5s) = 15s$ and $2(4a) = 8a$, so the total revenue is $15s + 8a$. Substituting $s = 4$ and $a = 7$ gives $15(4) + 8(7) = 60 + 56 = 116$, so the total revenue is \$116.

**17. Answer:** $12(2x+1)+9(x+3) = 33x+39$; $x$=4: \$171; needs 3 more mowing hours to reach at least \$200.
Total earnings come from mowing plus weeding, so write $12(2x + 1) + 9(x + 3)$. Distribute each rate: $24x + 12 + 9x + 27$. Combine like terms to get $33x + 39$. When $x = 4$, substitute and evaluate: $33(4) + 39 = 132 + 39 = 171$, so she earned \$171. To reach at least \$200, she needs $200 - 171 = 29$ more dollars. Since mowing pays \$12 per hour, $29 \div 12 \approx 2.42$, which means she needs 3 more whole mowing hours to meet or pass the goal.

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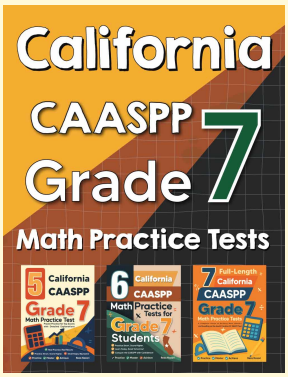


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