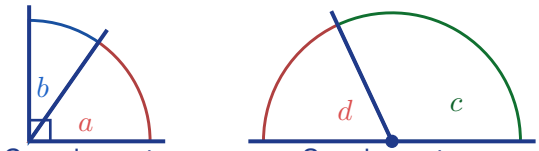
Complementary and Supplementary Angles

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 θ: $90° - \theta$.

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

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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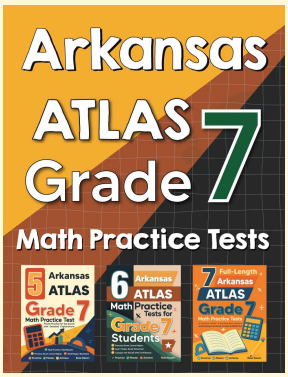

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