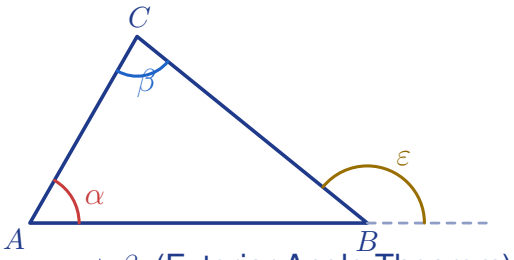
Exterior Angle Theorem

Name: _____	Date: _____	Score: _____ / 17

Extend one side of a triangle and you create an **exterior angle**—and here is the cool shortcut: that exterior angle equals the sum of the two **remote interior angles** (the two inside angles that do not touch it). No need to find the third interior angle first; just add the two remote ones and you are done! This theorem connects right back to the triangle angle sum you already know, giving you a faster path to the answer.



$\varepsilon = \alpha + \beta$ (Exterior Angle Theorem)

Remote interior angles: α and β

Key Concepts & Quick Review

Exterior Angle Theorem: Exterior angle = sum of the two remote interior angles.
$\varepsilon = \alpha + \beta$ (where α and β are the angles *not* adjacent to the exterior angle).

Also useful: the exterior angle and its adjacent interior angle are a **linear pair**: they sum to $180°$.

Examples

① A triangle has remote interior angles $48°$ and $67°$. Find the exterior angle at the third vertex.

Think It Through: Use the Exterior Angle Theorem: an exterior angle equals the sum of the two remote interior angles. So the exterior angle is $48° + 67° = 115°$. A good check is to find the interior angle next to it: $180° - 115° = 65°$. Then verify that the three interior angles of the triangle add to $180°$.

Answer: *Exterior angle* $= 115°$

② The exterior angle at vertex C of a triangle is $(8x - 4)°$. The two remote interior angles are $(3x + 10)°$ and $(2x + 14)°$. Find x and all three interior angles.

Think It Through: Set the exterior angle equal to the sum of the two remote interior angles: $8x - 4 = (3x + 10) + (2x + 14)$. Simplify the right side to get $8x - 4 = 5x + 24$, so $3x = 28$ and $x = \frac{28}{3}$. Now substitute back. The exterior angle is about $70.7°$, so the adjacent interior angle at C is $180° - 70.7° \approx 109.3°$. The other two interior angles are $(3x + 10)° \approx 38.0°$ and $(2x + 14)° \approx 32.7°$. Together they add to the exterior angle, which is exactly what the theorem predicts.

Answer: $x = \frac{28}{3} \approx 9.3$; *exterior* $\approx 70.7°$

Practice Problems

Apply the Exterior Angle Theorem to find the missing angle or value of x.

1. A triangle has remote interior angles $40°$ and $65°$. Find the exterior angle. _____
2. A triangle has remote interior angles $72°$ and $54°$. Find the exterior angle. _____
3. A triangle has remote interior angles $33°$ and $88°$. Find the exterior angle. _____
4. An exterior angle is $110°$, and one remote interior angle is $48°$. Find the other remote interior angle. _____
5. An exterior angle is $95°$, and one remote interior angle is $50°$. Find the other remote interior angle. _____
6. A triangle has remote interior angles $(3x)°$ and $40°$, and the exterior angle is $82°$. Find x. _____
7. A triangle has remote interior angles $x°$ and $2x°$, and the exterior angle is $102°$. Find x. _____
8. An exterior angle is $(5x + 3)°$, and the remote interior angles are $(2x + 9)°$ and $36°$. Find x. _____
9. An exterior angle is $(4x-2)°$, and the remote interior angles are $(x+15)°$ and $(x+5)°$. Find x. _____
10. A triangle has remote interior angles $(2x + 5)°$ and $(3x - 1)°$, and the exterior angle is $(6x + 2)°$. Find x. _____
11. An exterior angle is $135°$. One remote interior angle is twice the other. Find both remote interior angles. _____
12. The remote interior angles are $28°$ and $47°$. Find the exterior angle and the adjacent interior angle. _____
13. An exterior angle is $(7x - 3)°$, and the sum of the remote interior angles is $(4x + 15)°$. Find x. _____
14. A triangle has remote interior angles $(x + 8)°$ and $(2x - 3)°$, and the exterior angle is $(4x)°$. Find x and each angle. _____
15. An exterior angle is $100°$, and the two remote interior angles are equal. Find each remote interior angle. _____

Study Tips

- The exterior angle is always **larger** than either remote interior angle alone. If your answer is smaller, check your setup.
- **Remote** means "not touching" the exterior angle. The adjacent interior angle is *not* remote — it forms a linear pair with the exterior angle.
- Two methods always give the same answer: (1) exterior $=$ sum of remotes, or (2) find all three interior angles first, then subtract from $180°$.

Word Problems

16. A surveyor extends one side of a triangular plot of land beyond vertex Q. The exterior angle at Q measures $(6m + 4)°$. The two remote interior angles at P and R are $(2m + 18)°$ and $(3m - 6)°$. Find m, the exterior angle, and all three interior angles. What type of triangle is this plot (classify by angles)? _____

17. A zip-line cable is anchored at point A on a cliff, stretches to platform B on the ground, and the cable support pole at B is extended upward to a reference point D (making an exterior angle at B). The angle at A (cliff face) is $(4t - 10)°$ and the angle at C (landing zone) is $(2t + 8)°$. The exterior angle at B is $(7t - 6)°$. Find t and the exterior angle. What is the interior angle at B (zip-line's ground angle)? _____

Answer Keys

1) $105°$
2) $126°$
3) $121°$
4) $62°$
5) $45°$
6) 14
7) 34
8) 14
9) 11
10) 2
11) $45°, 90°$
12) $75°$; adjacent $105°$
13) 6
14) $x = 5$; $13°, 7°, 20°$
15) $50°$ each
16) $m = 8$; exterior $52°$; $P = 34°$, $R = 18°$, $Q = 128°$; obtuse
17) $t = 4$; exterior $22°$; interior at $B = 158°$

Step-by-Step Explanations

Strategy: For Solving Two-Step Equations, remove the constant term first, then divide or multiply to isolate the variable. Check the solution in the original equation before accepting it.

Practice 1: 2x+3=11 **Answer:** 4
In the opening example, clear the constant first, then divide by the coefficient of the variable.

Practice 15: -6x-3=-33 **Answer:** 5
For the end-of-set item, reverse the two operations in the order opposite of how they were built.

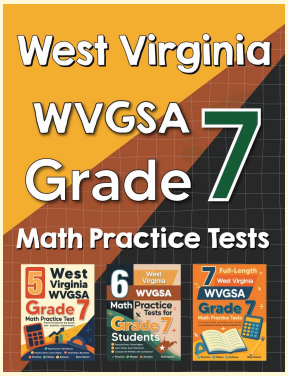
Word-problem notes:

16. Answer: $15n + 50 = 320 \Rightarrow n = 18$ levels; play time: $18 \times 12 = 216\,min = 3.6\,hr$.
Let n be the number of levels. The total score is the starting 50 points plus 15 points for each level, so write $15n + 50 = 320$. Subtract 50 to get $15n = 270$, then divide by 15 to find $n = 18$. For play time, multiply the number of levels by $12\,min$ each: $18 \times 12 = 216\,min$, which is 3.6 hours, or 3 hours and $36\,min$.

17. Answer: $8.5c - 34 = 93.5 \Rightarrow c = 15$ candles; for \$200 profit: $c = 28$ candles.
Profit means money earned minus costs, so the equation is $8.5c - 34 = 93.5$. Add 34 to both sides to get $8.5c = 127.5$, then divide by 8.5 to find $c = 15$. For a profit of \$200, write $8.5c - 34 = 200$. Add 34 to get $8.5c = 234$, and divide: $c \approx 27.5$. Since Priya cannot sell half a candle and needs to reach at least the goal, she must sell 28 candles.

Want Even More Practice?

Check Out Our Other West Virginia WVGSA Test Books!



West Virginia WVGSA Grade 7 Math Preparation Bundle

18 full-length practice tests across three books (5 + 6 + 7)

No repeated questions—maximum practice value!

18 Tests!
3 Books
One Bundle

Important: All our test books contain **unique, completely different tests** from each other! Each book offers fresh practice questions—no repeats!

5 Practice Tests

- ✓ 5 complete practice tests with detailed explanations
- ✓ Perfect foundation for WVGSA test preparation
- ✓ Builds confidence and test-taking skills
- ✓ High-quality questions aligned with state standards

Start your practice journey!

6 Practice Tests

- ✓ 6 complete practice tests with detailed explanations
- ✓ **Unique tests**—different from the 5 tests book
- ✓ Perfect for more practice after mastering 5 tests
- ✓ Builds even more confidence and test-taking skills
- ✓ Same high-quality questions aligned with standards

Take your practice to the next level!

7 Practice Tests

- ✓ 7 complete practice tests for maximum preparation
- ✓ **Unique tests**—different from 5 and 6 tests books
- ✓ The most comprehensive practice for Grade 7
- ✓ Ideal for students aiming for top scores
- ✓ Extensive practice builds mastery and confidence

Go all the way with comprehensive practice!