Angles in Triangles and Parallel Lines

Applications and design

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

A triangle has angle sum 180°. An exterior angle equals the sum of the two remote interior angles and forms a 180° linear pair with the adjacent interior angle. For parallel lines cut by a transversal, corresponding and alternate interior angles are equal; same-side interior angles sum to 180°. State the relationship before substituting the given measures.

Worked example

A triangle has angles 48° and 67°. Find the third angle and its adjacent exterior angle.

1. The two known interior angles total $48^\circ + 67^\circ = 115^\circ$.
2. The third is $180^\circ - 115^\circ = 65^\circ$. Its adjacent exterior angle is $180^\circ - 65^\circ = 115^\circ$.
3. The exterior also equals the remote-angle sum $48^\circ + 67^\circ = 115^\circ$, checking both results.
Answer: 65° and 115°

Practice Problems

Show your thinking.

1. A triangular roof has equal base angles of 38°. Find the top angle.

2. A triangular sail has angles 45° and 63°. Find the third corner and its adjacent exterior turn.

3. Parallel rail tracks meet a transversal road. One corresponding road angle is 71°. Find the matching angle at the second track.

4. Design an isosceles triangular sign with a top angle 50°. Specify the two equal corner angles.

5. A ramp brace forms a right triangle. The ramp angle is 17°. Find the other acute brace angle.

6. A triangular walking route has a 124° exterior turn and a 56° remote interior corner. Find the other remote corner.

7. Two parallel shelves and a diagonal support form same-side interior angles. One is 118°. Find the other.

8. Design a triangle whose angles are $x^\circ, (x+20)^\circ, (x+40)^\circ$. Give all three measures.

9. A triangular banner has exterior angle 140° at its top and equal base angles. Find all interior angles.

10. A survey triangle has two angles $64^\circ, 59^\circ$. A plan requires the third to be at least 55°. Does it qualify?

Answer Key

1. 104°
2. 72°; 108°.
3. 71°
4. 65° each.
5. 73°
6. 68°
7. 62°
8. $40^\circ, 60^\circ, 80^\circ$
9. $40^\circ, 70^\circ, 70^\circ$
10. Yes; the third angle is 57°.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The two base angles total $38 + 38 = 76$ degrees.
2. The top angle is $180 - 76 = 104$ degrees.
3. The check $38 + 38 + 104 = 180$ confirms the roof triangle. The top is obtuse, which is allowed in a triangle.

Problem 2

1. The known sail angles sum to $45 + 63 = 108$ degrees.
2. The third interior is $180 - 108 = 72^\circ$; its exterior is $180 - 72 = 108^\circ$.
3. The exterior turn equals $45 + 63 = 108^\circ$, the remote-angle sum, rather than the third interior measure.

Problem 3

1. Parallel tracks give equal corresponding angles, so the second matching angle is 71°.
2. The adjacent road angle there is $180 - 71 = 109^\circ$.
3. Thus choose 71°, not 109°, when marking the same relative position at the second intersection.

Problem 4

1. The equal corners share $180 - 50 = 130$ degrees.
2. Divide equally: $130/2 = 65$ degrees for each base corner.
3. The design check is $50 + 65 + 65 = 180$. Both base measures must be specified as 65°.

Problem 5

1. The right angle leaves $180 - 90 = 90$ degrees for the two acute angles.
2. The brace angle is $90 - 17 = 73$ degrees.
3. The sum $90 + 17 + 73 = 180$ verifies the triangular brace; the ramp's supplement is not the requested angle.

Problem 6

1. The remote angles must total the exterior: $56 + r = 124$.
2. Thus $r = 124 - 56 = 68$ degrees. The adjacent interior corner is $180 - 124 = 56^\circ$.
3. The triangle check $56 + 68 + 56 = 180$ confirms the requested remote corner is 68°.

Problem 7

1. Parallel shelves make these same-side angles supplementary: $118 + b = 180$.
2. The remaining angle is $b = 180 - 118 = 62$ degrees.
3. The sum $118 + 62 = 180$ fits the straight-angle relationship; the support does not make the two same-side angles equal.

Problem 8

1. The sum gives $x + (x + 20) + (x + 40) = 180$, or $3x + 60 = 180$.
2. Solve $3x = 120$ to obtain $x = 40$; the other angles are 60° and 80°.
3. The check $40 + 60 + 80 = 180$ verifies a valid triangle with the requested 20° increments.

Problem 9

1. The top interior angle is $180 - 140 = 40$ degrees.
2. The equal base angles share $180 - 40 = 140$ degrees, so each is $140/2 = 70^\circ$.
3. The total $40 + 70 + 70 = 180$ checks the banner. The two remote base angles also sum to its 140° exterior.

Problem 10

1. The known angles total $64 + 59 = 123$ degrees.
2. The remaining angle is $180 - 123 = 57$ degrees.
3. Since $57 \geq 55$, the plan qualifies, with a margin of $57 - 55 = 2^\circ$. The exact triangle sum is still 180°.

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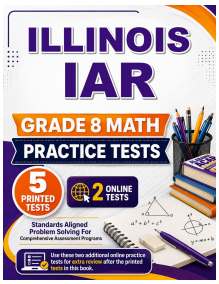

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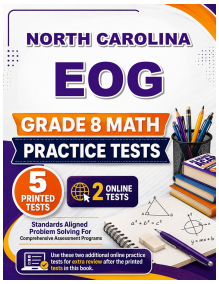

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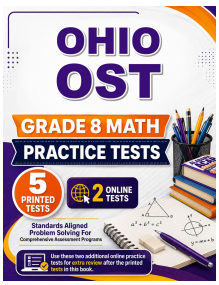

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