

Angle Relationships in Triangles and Parallel Lines

Grade 8 math · Worksheet Answer Key · Standards: 8.G.A.5

Each solution names the angle fact used, shows the equation, and checks the result. If an answer differs, find the fact you used and test it against the picture, since a wrong relationship is the most common source of errors.

Standards: 8.G.A.5 · **Level:** Grade 8

Problem 1 Third angle

$$180 - (48 + 73) = 180 - 121 = 59.$$

The third angle is **59°**.

Problem 2 Right triangle

The angles total 180° and the right angle is 90° , so the acute angles total 90° .

$$90 - 37 = \mathbf{53^\circ}$$

Problem 3 Isosceles apex

The base angles are equal and share $180 - 40 = 140$.

$$140 \div 2 = 70.$$

Each base angle is **70°**.

Problem 4 Exterior angle

The exterior angle equals the sum of the remote interior angles: $52 + 64 = 116$.

116°

Problem 5 Vertical and adjacent

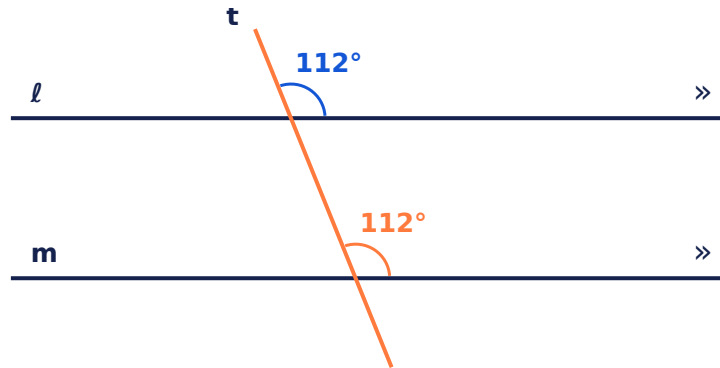
Vertical angles are equal, so the vertical angle is 128° .

Adjacent angles form a linear pair: $180 - 128 = 52$.

Vertical angle 128° ; adjacent angle 52°

Problem 6 Corresponding angles

The marked angles are in the same position at the two intersections, so they are corresponding angles. Parallel lines make them equal.



The two marked angles are corresponding angles, so they are equal.

$x = 112^\circ$; corresponding angles

Problem 7 Alternate interior

The marked angles lie between the lines on opposite sides of the transversal: alternate interior angles. They are equal.

$y = 74^\circ$

Problem 8 Same-side interior

The two angles share a straight angle of 180° : $180 - 143 = 37$.

37°

Problem 9 Triangle with x

$(x + 10) + (2x - 5) + (3x + 13) = 180$, so $6x + 18 = 180$ and $x = 27$.

Angles: $27 + 10 = 37$; $2 \cdot 27 - 5 = 49$; $3 \cdot 27 + 13 = 94$. Check: $37 + 49 + 94 = 180$.

$x = 27$; angles 37° , 49° , 94°

Problem 10 Exterior with x

$$5x - 12 = (x + 20) + (2x + 10) = 3x + 30.$$

$2x = 42$, so $x = 21$. The exterior angle is $5 \cdot 21 - 12 = 93$. Check: $41 + 52 = 93$.

$x = 21$; exterior angle 93°

Problem 11 Parallel with x

$$3x + 8 = 5x - 22, \text{ so } 30 = 2x \text{ and } x = 15.$$

$$3 \cdot 15 + 8 = 53 \text{ and } 5 \cdot 15 - 22 = 53.$$

$x = 15$; each angle is 53°

Problem 12 Same-side with x

$$(7x - 5) + (3x + 15) = 180, \text{ so } 10x + 10 = 180 \text{ and } x = 17.$$

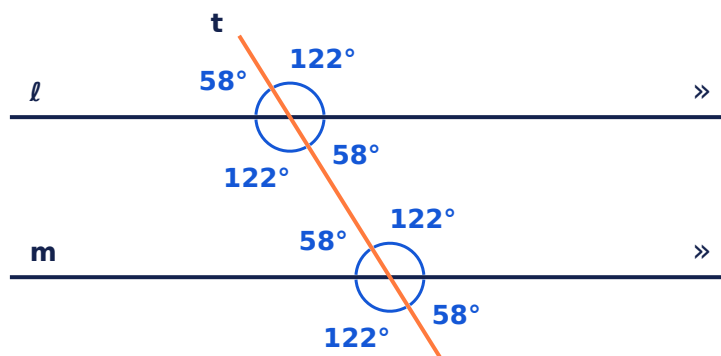
$$7 \cdot 17 - 5 = 114 \text{ and } 3 \cdot 17 + 15 = 66, \text{ which add to } 180.$$

$x = 17$; angles 114° and 66°

Problem 13 All eight angles

$\angle 1$ is vertical to the 58° angle: 58° . $\angle 2$ and $\angle 3$ are linear partners of 58° : $180 - 58 = 122^\circ$.

$\angle 4$ corresponds to $\angle 1$: 58° . $\angle 5$ and $\angle 6$ correspond to $\angle 2$ and $\angle 3$: 122° . $\angle 7$ corresponds to the 58° angle: 58° .



All eight angles: acute angles are 58° , obtuse angles are 122° .

$\angle 1 = 58^\circ$, $\angle 2 = 122^\circ$, $\angle 3 = 122^\circ$, $\angle 4 = 58^\circ$, $\angle 5 = 122^\circ$, $\angle 6 = 122^\circ$, $\angle 7 = 58^\circ$

Problem 14 Parallel or not?

(a) Corresponding angles must be equal for parallel lines. $67^\circ \neq 69^\circ$, so the lines are not parallel.

(b) Equal alternate interior angles show that the lines are parallel.

(a) Not parallel; (b) parallel

Problem 15 AA similarity

Third angle of $\triangle ABC$: $180 - 44 - 79 = 57^\circ$. Third angle of $\triangle DEF$: $180 - 79 - 57 = 44^\circ$.

Both triangles have angles 44° , 57° , and 79° . Two pairs of equal angles are enough (AA).

Yes, the triangles are similar by AA

Problem 16 Roof truss

$180 - 104 = 76$ is shared by the two equal base angles.

$76 \div 2 = 38$.

38° each

Problem 17 Parallel streets

The upper right angle at Elm corresponds to the upper right angle at Oak, which is 123° .

The lower left angle at Oak is vertical to that angle, so it is also 123° .

Check with a linear pair: its neighbor measures 57° and $123 + 57 = 180$.

$y = 123^\circ$

Problem 18 Garden angles

Let the angles be $3k$, $4k$, and $5k$. Then $12k = 180$ and $k = 15$.

$3 \cdot 15 = 45$; $4 \cdot 15 = 60$; $5 \cdot 15 = 75$.

45° , 60° , 75°

Problem 19 Find the interior angle

The exterior angle at C equals $\angle A + \angle B$: $7x - 20 = (2x + 3) + (3x - 7) = 5x - 4$.

$2x = 16$, so $x = 8$. $\angle A = 19^\circ$, $\angle B = 17^\circ$, exterior angle $= 36^\circ$.

Interior angle at C: $180 - 36 = 144$. Check: $19 + 17 + 144 = 180$.

$x = 8$; $\angle C = 144^\circ$

Problem 20 Why 180?

Alternate interior angles match, so $\angle A = 47^\circ$ and $\angle C = 68^\circ$.

The three angles that meet at B along the straight line total 180° : $\angle ABC = 180 - 47 - 68 = 65$.

So $\angle A + \angle B + \angle C = 47 + 65 + 68 = 180$, because the three angles at B match the three angles of the triangle.

$\angle ABC = 65^\circ$