

Angle Relationships and Unknown Angles

Grade 7 math · Worksheet Answer Key · Standards: 7.G.B.5

Each solution names the angle relationship, writes the equation, solves it and checks the total by substitution. Compare your equation first. If it matches, a slip in arithmetic is easy to find.

Standards: 7.G.B.5 · **Level:** Grade 7

Problem 1 Find the complement

Complement = $90^\circ - 38^\circ = 52^\circ$.

52°

Problem 2 Find the supplement

Supplement = $180^\circ - 127^\circ = 53^\circ$.

53°

Problem 3 Vertical and adjacent

The vertical angle is equal: 64° . An adjacent angle is supplementary: $180^\circ - 64^\circ = 116^\circ$.

vertical 64°, adjacent 116°

Problem 4 Complementary equation

$x + 41 = 90$, so $x = 90 - 41 = 49$.

x = 49

Problem 5 Straight line equation

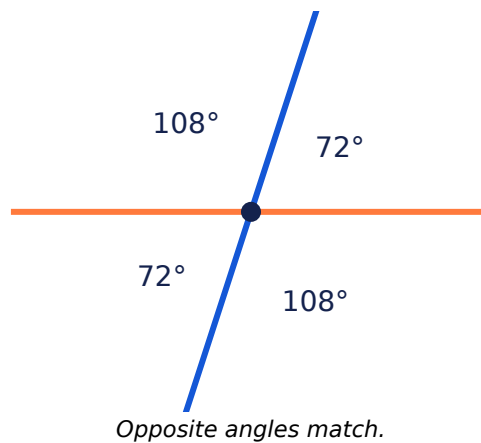
$118 + x = 180$, so $x = 62$.

x = 62

Problem 6 Four angles at a crossing

$\angle 2$ is adjacent to $\angle 1$: $180^\circ - 72^\circ = 108^\circ$. $\angle 3$ is vertical to $\angle 1$: 72° . $\angle 4$ is vertical to $\angle 2$: 108° .

$\angle 2 = 108^\circ$, $\angle 3 = 72^\circ$, $\angle 4 = 108^\circ$



Problem 7 Classify the pairs

(a) $68 + 22 = 90$, complementary. (b) $99 + 81 = 180$, supplementary. (c) $45 + 135 = 180$, supplementary. (d) $30 + 50 = 80$, neither.

(a) complementary, (b) supplementary, (c) supplementary, (d) neither

Problem 8 Triple angle

Let the smaller angle be x . Then $x + 3x = 180$, so $4x = 180$ and $x = 45$. The larger is 135.

45° and 135°

Problem 9 Complementary expressions

$(2x + 4) + (x + 17) = 90$, so $3x + 21 = 90$, $3x = 69$, $x = 23$.

Angles: $2(23) + 4 = 50$ and $23 + 17 = 40$. Check: $50 + 40 = 90$.

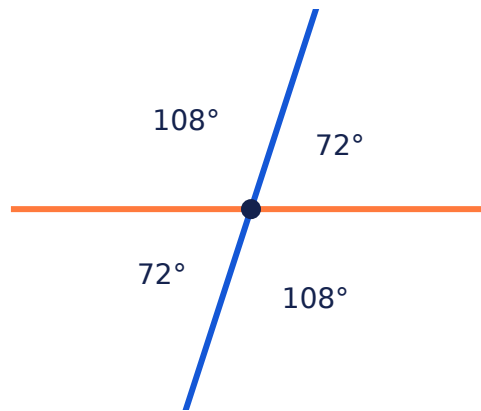
$x = 23$; angles 50° and 40°

Problem 10 Vertical angle expressions

Vertical angles are equal: $4x - 12 = 2x + 30$, so $2x = 42$ and $x = 21$.

Angle: $4(21) - 12 = 72$; check $2(21) + 30 = 72$.

$x = 21$; each angle is 72°



The other two angles are 108° each.

Problem 11 Linear pair expressions

$(6x - 5) + (4x + 15) = 180$, so $10x + 10 = 180$, $x = 17$.

Angles: $6(17) - 5 = 97$ and $4(17) + 15 = 83$. Check: $97 + 83 = 180$.

$x = 17$; angles 97° and 83°

Problem 12 Less than its complement

Let the angle be x . Its complement is $90 - x$. So $x = (90 - x) - 24$, giving $2x = 66$ and $x = 33$.

Check: complement 57, and $57 - 33 = 24$.

33°

Problem 13 More than its supplement

Let the angle be x . Then $x = (180 - x) + 30$, so $2x = 210$ and $x = 105$.

Check: supplement 75, and $75 + 30 = 105$.

105°

Problem 14 Three angles on a line

$x + 2x + (3x + 30) = 180$, so $6x + 30 = 180$, $6x = 150$, $x = 25$.

Angles: 25° , 50° and $3(25) + 30 = 105^\circ$. Check: $25 + 50 + 105 = 180$.

$x = 25$; angles 25° , 50° , 105°

Problem 15 Leaning ladder

The wall and ground meet at 90° , so the ladder-wall angle is the complement of 74° : $90 - 74 = 16^\circ$.

The angle on the other side of the ladder along the ground is supplementary to 74° : $180 - 74 = 106^\circ$.

16° with the wall and 106° on the other side

Problem 16 Crossing roads

Vertical angles are equal: $3x + 15 = 5x - 25$, so $40 = 2x$ and $x = 20$.

Each of the two vertical angles is $3(20) + 15 = 75^\circ$. Each neighbor is $180 - 75 = 105^\circ$.

$x = 20$; the angles are 75° , 105° , 75° , 105°

Problem 17 Split right angle

The angles are complementary: $(5x + 4) + (4x + 14) = 90$, so $9x + 18 = 90$ and $x = 8$.

$\angle AOB = 5(8) + 4 = 44^\circ$ and $\angle BOC = 4(8) + 14 = 46^\circ$. Check: $44 + 46 = 90$.

$x = 8$; angles 44° and 46°

Problem 18 Supplement versus complement

Let the angle be x . Supplement: $180 - x$. Complement: $90 - x$. Equation: $180 - x = 4(90 - x)$.

$180 - x = 360 - 4x$, so $3x = 180$ and $x = 60$.

Check: supplement 120, complement 30, and $4 \times 30 = 120$.

60°

Problem 19 Bridge cables

Adjacent angles at a crossing are supplementary: $(7x - 4) + (2x + 13) = 180$, so $9x + 9 = 180$ and $x = 19$.

$7(19) - 4 = 129$ and $2(19) + 13 = 51$. The vertical angles repeat these values.

$x = 19$; angles 129° , 51° , 129° , 51°

Problem 20 Sign board angle

The post is perpendicular to the ground, so the two angles are complementary: $(4x + 3) + (x + 12) = 90$, so $5x + 15 = 90$ and $x = 15$.

Angles: $4(15) + 3 = 63^\circ$ and $15 + 12 = 27^\circ$. Check: $63 + 27 = 90$.

$x = 15$; angles 63° and 27°