

Angle Relationships and Unknown Angles

Grade 7 math · Lesson · Standards: 7.G.B.5

Quick answer: Complementary angles add to 90° , and supplementary angles add to 180° . Vertical angles, the opposite angles formed by two crossing lines, are always equal. Adjacent angles share a vertex and a side. To find an unknown angle, write an equation from the relationship and solve for the variable.

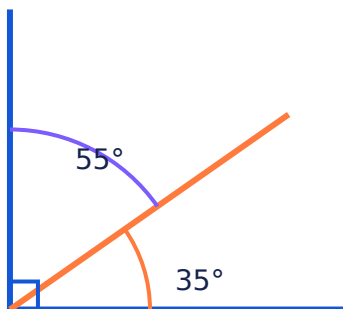
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What do complementary and supplementary angles mean?

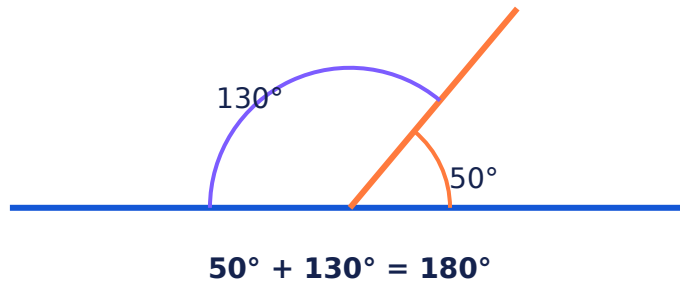
Angle relationships describe how the measures of two angles are linked. Two of them depend on a total.

Key terms

- **Complementary angles:** two angles whose measures add to 90° .
- **Supplementary angles:** two angles whose measures add to 180° .
- **Adjacent angles:** two angles that share a vertex and one side and do not overlap.
- **Vertical angles:** the pair of opposite angles formed when two lines cross.



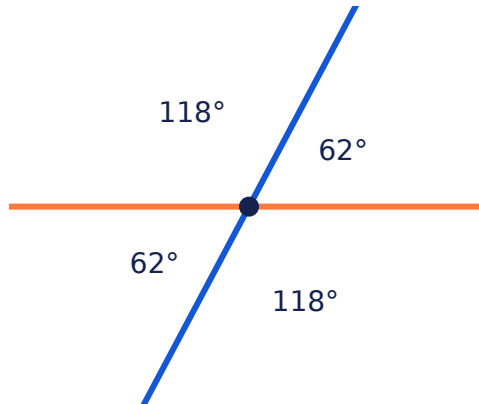
Complementary angles fill a right angle: $35^\circ + 55^\circ = 90^\circ$.



Supplementary angles fill a straight line: $50^\circ + 130^\circ = 180^\circ$.

Which angles are always equal?

When two lines cross, they form four angles. Opposite angles are vertical angles, and they always have the same measure. Each angle also forms a linear pair with the angles next to it, so neighbors are supplementary.



Opposite angles match (62° and 62°); neighbors add to 180° .

Angle facts

complementary: $a + b = 90^\circ$ supplementary: $a + b = 180^\circ$

Vertical angles: equal measures.

How do you write an equation for an unknown angle?

Pick the relationship, set the sum or equality, then solve like any one-variable equation.

1. Read the picture or words to name the relationship.
2. Write the equation: a sum of 90 or 180, or two equal expressions.
3. Solve for x with inverse operations.
4. Substitute x back to find each angle and check the total.

Worked example

Two angles are supplementary. Their measures are $(2x + 10)^\circ$ and $(x + 20)^\circ$. Find both angles.

Equation: $(2x + 10) + (x + 20) = 180$, so $3x + 30 = 180$ and $3x = 150$, giving $x = 50$.

The angles are $2(50) + 10 = 110^\circ$ and $50 + 20 = 70^\circ$. Check: $110 + 70 = 180$.

Common mistake

Mixing up the totals. Complementary pairs make a corner (90°); supplementary pairs make a straight line (180°). Also remember that adjacent angles are not always supplementary.

Mathbot's tip

Say it with letters: C comes before S in the alphabet, and 90 comes before 180. Complementary goes with 90, supplementary with 180.

Key points to remember

- Complementary angles: sum 90° .
- Supplementary angles: sum 180° , as on a straight line.
- Vertical angles are equal; neighbors at an intersection are supplementary.
- Angles around a straight line on one side add to 180° .
- Check each answer by substituting back into the sum.

Angle Relationships and Unknown Angles: frequently asked questions

Can two angles be both complementary and supplementary?

No. The sums 90° and 180° differ, so one pair of angles cannot have both totals. Three or more angles can have a sum of 180° , but complementary and supplementary describe only pairs.

Are vertical angles the same as adjacent angles?

No. Vertical angles are opposite each other at an intersection and are equal. Adjacent angles are next to each other, share a side, and are not equal in general.

What is a linear pair?

A linear pair is two adjacent angles whose outer sides form a straight line. Their measures add to 180° , so they are supplementary.

How do I find the complement of an angle?

Subtract the angle from 90° . For example, the complement of 38° is $90^\circ - 38^\circ = 52^\circ$. For the supplement, subtract from 180° instead.

What if the angle is written with an expression like $3x + 5$?

Treat the expression as the measure. Add it to the other angle, set the total equal to 90 or 180, and solve for x . Then put x back into the expression to get the actual angle.