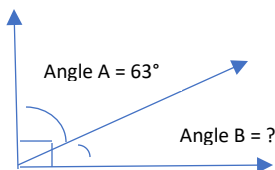


Complementary Angles

An angle is the measurement, usually given in degrees, between two lines that meet at a point (called the vertex). An angle that is exactly 90° is called a “right” angle. A square shape in the inner part of the angle shows it is a right angle.



When an angle is divided by another line, measurement of the parts adds up to the whole. So, when a right angle is divided by another line, the two new angles that are created add up to 90° .



In the drawing above, there is a right triangle that is divided into two angles, Angle A and Angle B. We know the total of the two angles is 90° . If Angle A = 63° , then Angle B equals 27° .

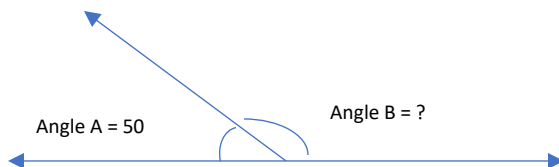
$$A + B = 90$$

$$63 + B = 90$$

$$B = 27$$

Supplementary Angles

A 180° angle makes a straight line. Supplementary angles add up to 180° . So if a straight line is divided by another line, making two angles, the measurement of those two angles adds up to 180° .



In this drawing, Angle A = 50 degrees. Angles A and B are supplementary because together they make a straight line. That means Angle B = 130° .

$$A + B = 180$$

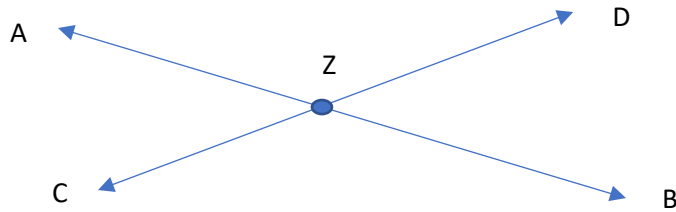
$$50 + B = 180$$

$$B = 130$$

One way to remember the difference is that complementary angles make a corner, and supplementary angles make a straight line.

Vertical Angles

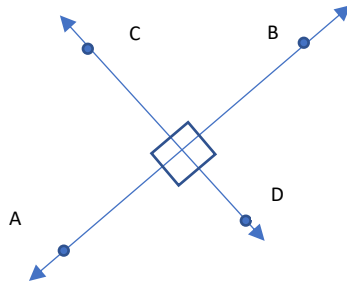
When two lines intersect, the angles that are formed are a pair of “vertical angles. Vertical angles are congruent, which means they have the same measurement.



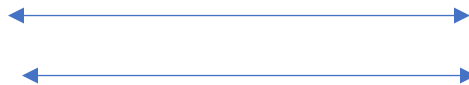
In the diagram above, lines AB and CD intersect at point Z. Two pairs of vertical, congruent, angles are formed. The measurement of Angle AZC equals the measurement of Angle BZD. The measurement of Angle AZD equals the measurement of Angle BZC.

Parallel and Perpendicular Lines

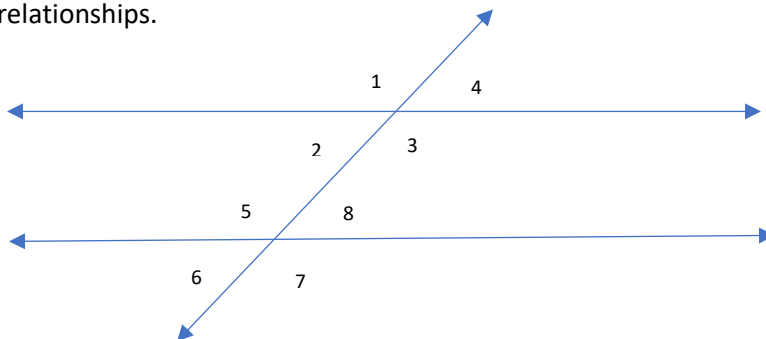
Perpendicular lines intersect at 90° angles. The slope of each perpendicular lines is the negative reciprocal of the other line's slope. For example, if the slope of line AB = 2, the slope of line CD = $-1/2$. Remember that a reciprocal is the “flipped” version of a fraction, with the numerator and denominator reversed. A slope of 2 as a fraction is $\frac{2}{1}$, so its negative (opposite) reciprocal is $-\frac{1}{2}$.



Parallel lines run side by side the same distance apart, and they never intersect. Parallel lines have the same slope.



Many angles are formed when a line, called a “transversal,” is drawn diagonally across two parallel lines. These angles have relationships.



Angles that are adjacent to each other, like Angle 1 and Angle 4, are supplemental. Angle 1 and Angle 2 are also adjacent (along the transversal line), and they are also supplemental.

Angles that are opposite each other, like Angle 1 and Angle 3, are congruent vertical angles with the same measurement. If Angle 1 is 130° , Angle 3 is also 130° . Angle 2 and Angle 4 are also a pair of vertical angles.

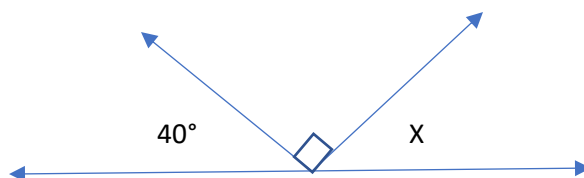
Angle 1 and Angle 5 are corresponding angles. In this drawing, they are both “upper left” of the transversal and one of the parallel lines. The other corresponding pairs are Angles 2 and 6, Angles 3 and 7, and Angles 4 and 8. Corresponding angles are congruent, which means they have the same measurement.

In a drawing of parallel lines with a transversal line, we can determine the measurement of all the angles even if we just know the measurement of one angle. In the drawing above, we know that Angle 1 is 130° . That means that Angle 3 is 130° because it is opposite Angle 1. Angle 5 must also be 130° because it is a corresponding angle of Angle 1. Angle 7 must also be 130° because it is opposite Angle 7.

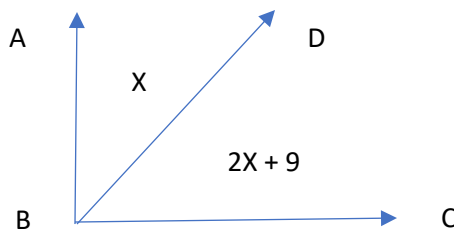
We also know that Angle 4 must be 50° because it is supplemental to Angle 1. Angle 2 is 50° because it is opposite Angle 4. Angle 8 is 50° because it is a corresponding angle to Angle 4. And Angle 6 is 50° because it is opposite Angle 8.

Practice Problems

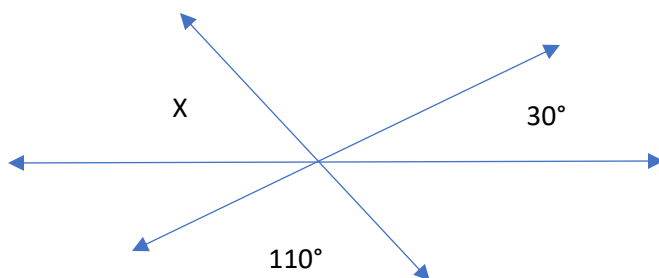
1. What is the measurement of angle X?



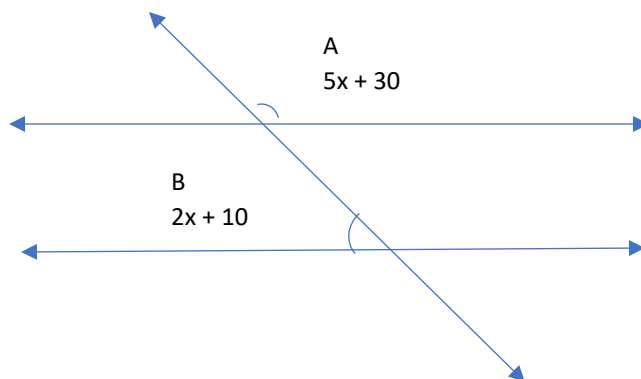
2. If Lines AB and BC form a right angle, what is the measurement of $\angle ABD$ and $\angle DBC$?



3. What is the measurement of Angle X?



4. What is the slope of a line perpendicular to the line $y = \frac{2}{3}x + b$? What is the slope of a line parallel to it?
5. In this drawing of two parallel lines and a transversal, what are the measurements of Angles A and B?



Answer Key for Practice Problems

1. 50° 2. Angle ABD = 27° ; Angle DBC = 63° 3. 40°
4. Perpendicular line slope = $-\frac{3}{2}$; parallel line slope = $\frac{2}{3}$ 5. Angle A = 130° ; Angle B = 50°

Practice Problems Solved with Explanation

1. The drawing shows a straight line, 180° , divided into three angles. One angle is 40° , and one angle is labeled as a right angle, which is 90° . The remainder, Angle X makes up the difference with 180° .

$$40 + 90 + X = 180$$

$$130 + X = 180$$

$$X = 50$$

2. It is given that Lines AB and BC form a right angle, which measures 90° . The right angle is divided into two complementary angles that add together to 90° .

$$X + 2X + 9 = 90$$

The two angles added together = 90.

$$3X + 9 = 90$$

Combine like-terms.

$$3x = 81$$

Subtract 9 from both sides.

$$X = 27$$

Divide by 3.

$$\text{Angle ABD} = X = 27^\circ$$

$$\text{Angle DBC} = 2X + 9$$

$$= 2(27) + 9$$

Substitute 27 for X.

$$= 54 + 9$$

$$= 63^\circ$$

3. The vertical angle opposite 110° is also 110° . That angle, plus X, plus 30° are supplementary angles that form a straight line.

$$X + 110 + 30 = 180$$

$$X = 40^\circ$$

4. Perpendicular lines have negative reciprocal slopes. The negative reciprocal of $\frac{2}{3}$ is $-\frac{3}{2}$. Parallel lines have the same slope, so the slope is $\frac{2}{3}$.

5. The angles marked are supplementary, so added together they total 180° .

$$2X + 10 + 5X + 30 = 180$$

$$7X + 40 = 180$$

Combine like-terms.

$$7X = 140$$

Subtract 40 from both sides.

$$X = 20$$

$$A = 5X + 30$$

$$A = 5(20) + 30$$

$$A = 130^\circ$$

$$B = 2X + 10$$

$$B = 2(20) + 10$$

$$B = 50^\circ$$