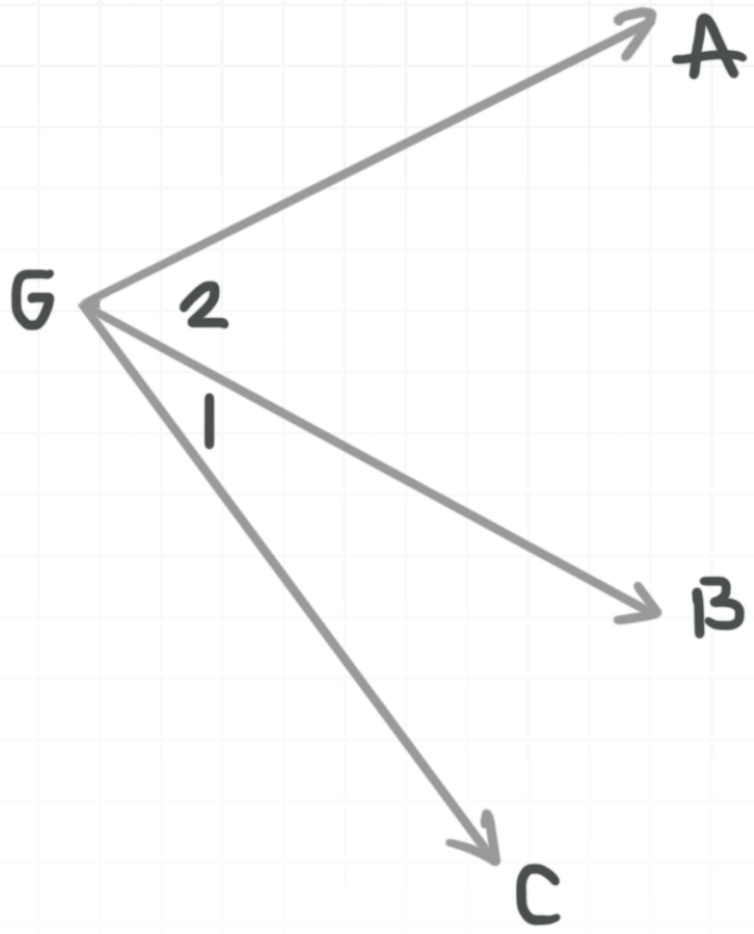
Adjacent and nonadjacent angles

In this lesson we'll look at how to identify adjacent angles in a diagram and how to interpret the name of an angle if it's given as a sequence of three letters.

Adjacent angles

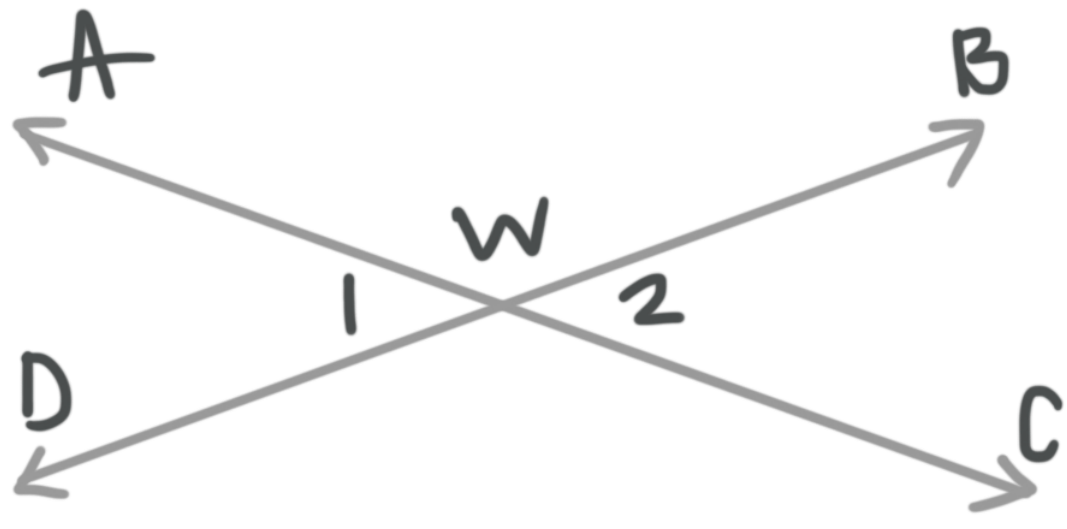
A pair of angles are **adjacent angles** if (a) they share a vertex and one ray (or side) and (b) their interiors don't overlap. The **interior of an angle** is made of all the points between the two rays that make the angle. It excludes the vertex and the rays themselves.

For instance, in this diagram of $\angle AGC$, angles 1 and 2 are adjacent because they share vertex G and ray $\overrightarrow{GB}$, and their interiors don't overlap.



Nonadjacent angles

Nonadjacent angles may or may not share a vertex, but either they don't share a ray or (even if they do share a ray) their interiors overlap.

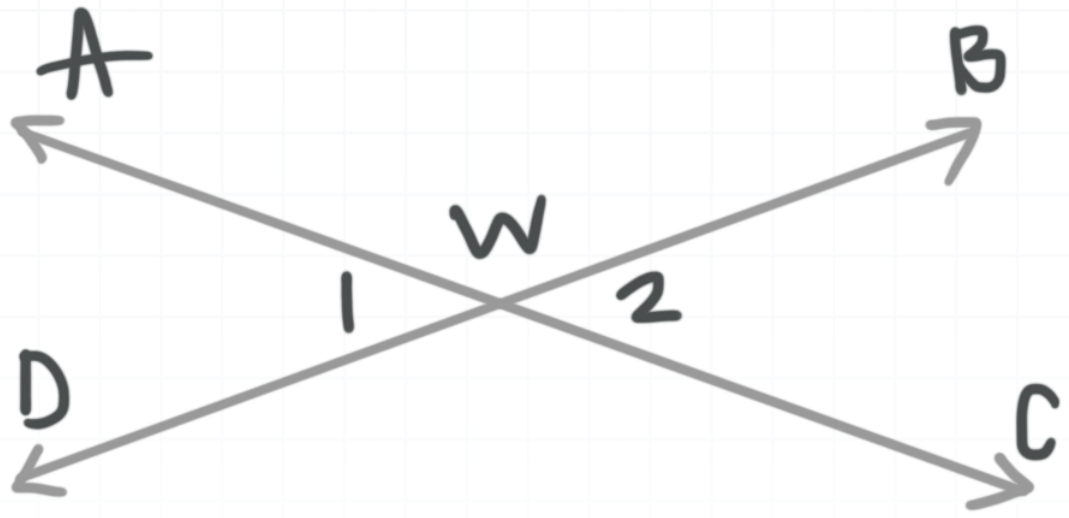


For instance, in this diagram, angles 1 and 2 are not adjacent, even though they share vertex W, because they do not share a ray.

Let’s do a few example problems.

Example

List the pairs of adjacent angles in the diagram.



Adjacent angles share a vertex and one ray, and their interiors don’t overlap.

- $\angle DWA$ is adjacent to $\angle AWB$; they share vertex W and ray $\overrightarrow{WA}$, and their interiors don’t overlap.
- $\angle DWA$ is adjacent to $\angle DWC$: they share vertex W and ray $\overrightarrow{WD}$, and their interiors don’t overlap.
- $\angle DWC$ is adjacent to $\angle CWB$; they share vertex W and ray $\overrightarrow{WC}$, and their interiors don’t overlap.
- $\angle CWB$ is adjacent to $\angle AWB$; they share vertex W and ray $\overrightarrow{WB}$, and their interiors don’t overlap.

Notice that you can tell from the way the names of the angles are written which ray they share. For example,

> $\angle CWB$ is adjacent to $\angle AWB$; they share vertex W (which is the "middle letter" in both of their names) and ray $\overrightarrow{WB}$, since $\angle AWB$ and $\angle CWB$ both have the letters W and B (from ray $\overrightarrow{WB}$) in their name.

Let's see how to identify possible adjacent angles without a diagram.

Example

All of the following pairs of angles are from the same diagram. For each pair, determine whether they're possibly adjacent or definitely nonadjacent.

A. $\angle ABC$ and $\angle CBD$

B. $\angle XYZ$ and $\angle ZYX$

C. $\angle LMN$ and $\angle MNP$

D. $\angle CED$ and $\angle CEP$

Remember that adjacent angles have the same vertex and share one ray. If the name of an angle is given as a sequence of three letters, the letter that corresponds to the vertex is always in the middle. You can then use the name of the angle to identify the rays that make the angle.

Let's look at each pair of angles.

A. $\angle ABC$ and $\angle CBD$. Both of these angles have vertex B. Now we need to look for one common ray. $\angle ABC$ has rays $\overrightarrow{BA}$ and $\overrightarrow{BC}$, and $\angle CBD$ has rays $\overrightarrow{BC}$ and $\overrightarrow{BD}$, which means that these angles share ray $\overrightarrow{BC}$. Therefore, $\angle ABC$ and $\angle CBD$ could be adjacent, but we can't tell for sure, because we don't know if their interiors overlap.

B. $\angle XYZ$ and $\angle ZYX$. Both of these angles have vertex Y. Now we need to look for one common ray. $\angle XYZ$ has rays $\overrightarrow{YX}$ and $\overrightarrow{YZ}$, and $\angle ZYX$ has rays $\overrightarrow{YZ}$ and $\overrightarrow{YX}$, which means that these angles share rays $\overrightarrow{YX}$ and $\overrightarrow{YZ}$. Therefore, $\angle XYZ$ and $\angle ZYX$ are just different ways to name the same angle, so they're nonadjacent.

C. $\angle LMN$ and $\angle MNP$. $\angle LMN$ has vertex M, and $\angle MNP$ has vertex N, so these angles do not share a vertex and therefore are nonadjacent.

D. $\angle CED$ and $\angle CEP$. Both of these angles have vertex E. Now we need to look for one common ray. $\angle CED$ has rays $\overrightarrow{EC}$ and $\overrightarrow{ED}$, and $\angle CEP$ has rays $\overrightarrow{EC}$ and $\overrightarrow{EP}$, which means that these angles share ray $\overrightarrow{EC}$. Therefore, $\angle CED$ and $\angle CEP$ could be adjacent, but we can't tell for sure, because we don't know if their interiors overlap.
