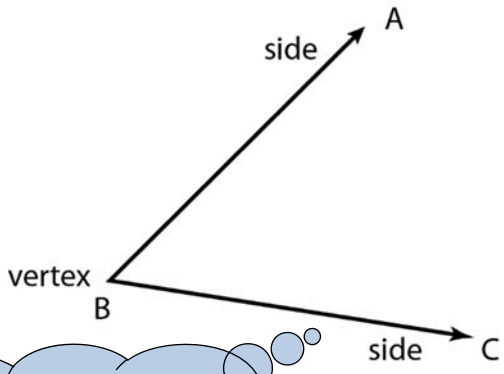
We will learn many terms for various angles and how to measure them.

Technology Integrated Mathematics
Class Notes
Geometry: Angles and Their Measures (Section 8.1)

We start off with the idea of a **plane**. Imagine a piece of paper that does *not* bend and whose edges go on forever and you have a **plane**. On this plane, we will draw shapes like rectangles and hexagons. These shapes are made up of **angles**, so let's study those first.

An **angle** is made up of two **rays** (called **sides**) that meet at a single point called the **vertex**.

This angle could be called **angle ABC**, or using the abbreviation for angle, $\measuredangle ABC$. It could also be simply called $\measuredangle B$ (since that would not cause confusion).

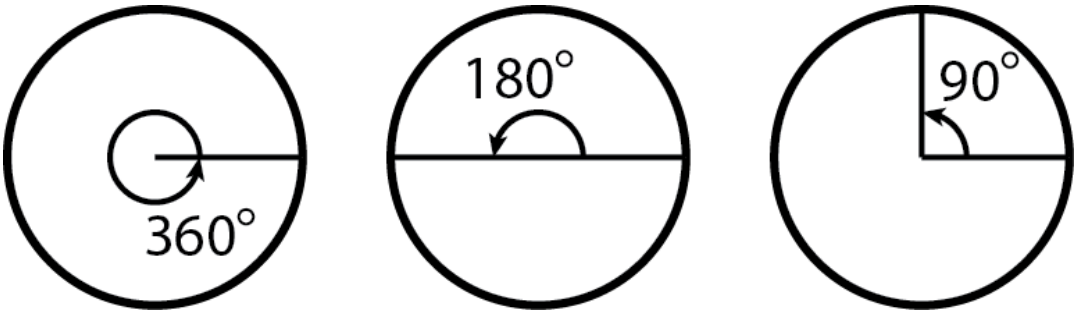


Also, this angle could be called $\measuredangle CBA$. You may also see a letter inside the angle that names it (not shown).

Measuring Angles:

We will measure an angle with a protractor which measures the span of the angle, *not* the side lengths. We will use **degrees** (and to some extent, **minutes** and **seconds**) to measure angles.

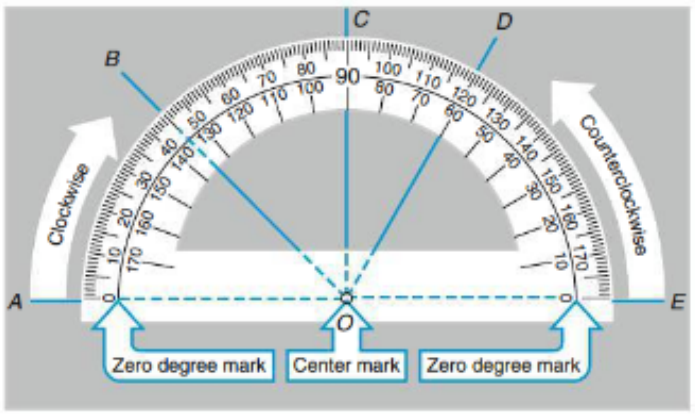
For reference, a full circle is 360 degrees (or 360°).
A half circle is 180° and a quarter circle is 90°.



Can you picture what 45° or 30° would look like? What about 720°?

Protractors:
Here is a protractor. To use it, line up the center mark with the vertex of the angle and one side of the angle along one of the dashed lines at the bottom of the protractor.

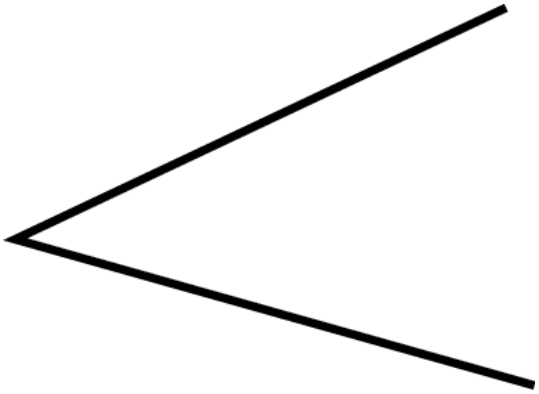
Degree measures run in both directions so you can read the angle from the left or right.



At the bottom of the page, there is a protractor for you to cut out and use here and on homework.

expl 1: Use a protractor to measure the following angles. Round to the nearest whole degree.

a.)



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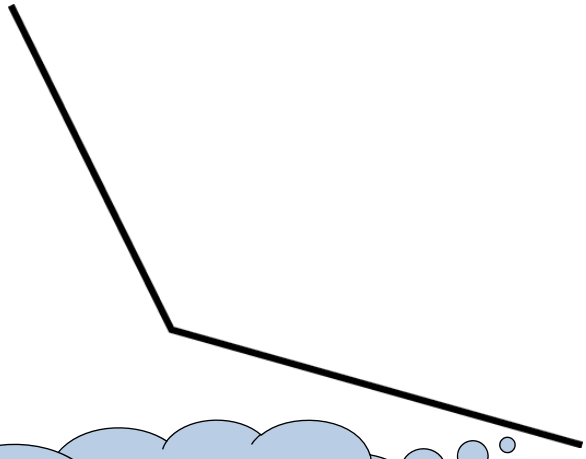
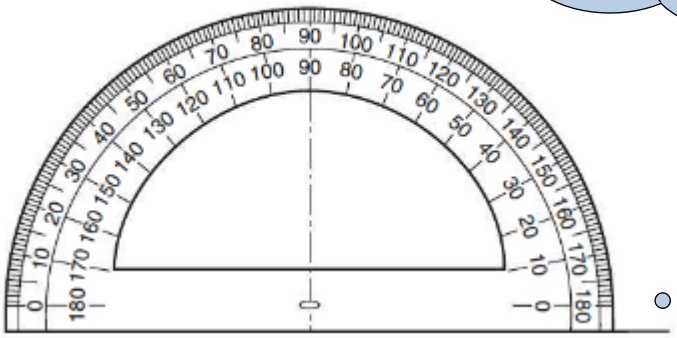


You may need to extend the sides to fit the protractor. Do so with a straight edge carefully.

Protractor



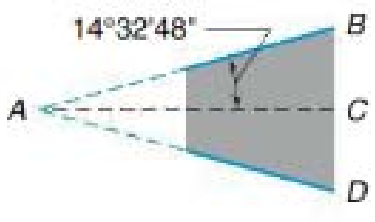
Line up the vertex and be sure one side goes through the 0 mark at the bottom of the protractor.

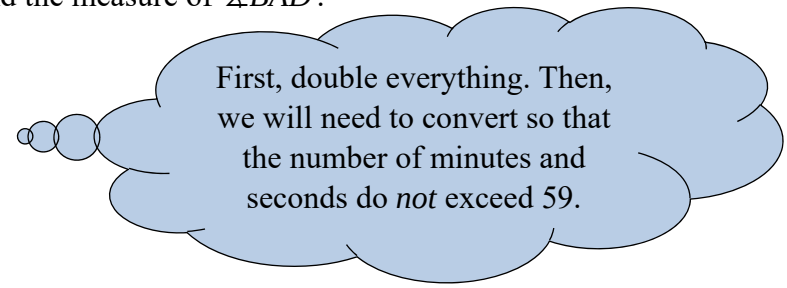
Degrees, Minutes, and Seconds:
Sometimes we need to be more precise than the number of degrees. We have these smaller units.

We define $1° = 60$ minutes, abbreviated $60'$
and also $1' = 60$ seconds, abbreviated $60''$. (These are unrelated to time.)

An angle could be said to be $55° 45' 20''$. Most trade applications require only precision to the nearest degree. However, we will see a few problems involving minutes and seconds.

expl 2: A machinist needs to create a metal wedge in the shape of this larger triangle. Notice that the measure of $\measuredangle BAC$ is given. Find the measure of $\measuredangle BAD$.

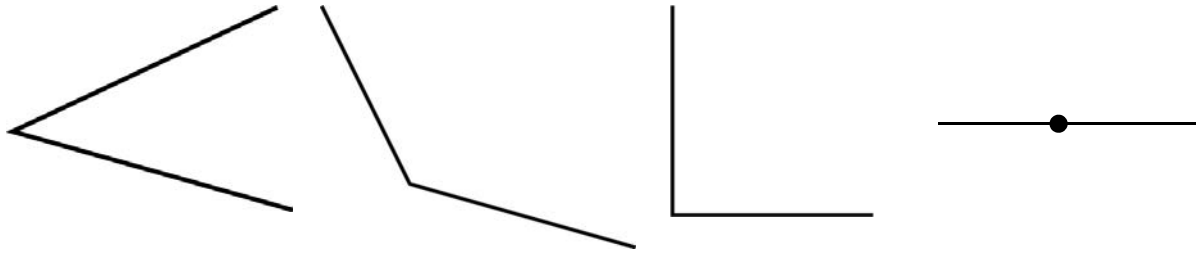




Definitions: An **acute angle** is an angle that is *less than* 90°. A **right angle** is an angle that is *exactly* 90°. An **obtuse angle** is an angle that is *greater than* 90°. A **straight angle** is an angle that measures *exactly* 180°.

expl 3: Label each angle below with its proper type.

a.) b.) c.) d.)

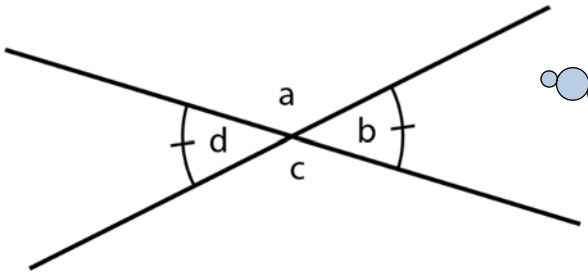


Definition: Two lines that meet at a right angle (or 90°) are called **perpendicular**.

expl 4: Draw an angle that is 45 degrees. Draw another angle that is 120 degrees.

First, draw a side and mark what will be the vertex. Line up the protractor with the center mark on the vertex and the side coinciding with 0. Find the desired angle on the protractor and make a mark. Then use a straight edge to draw in the other side.

Definitions: For a pair of intersecting lines, the opposite angles are called **vertical angles**. If a straight angle is broken into two angles, they are called **adjacent angles**.



Angles *a* and *b* are **adjacent angles**.
Angles *b* and *d* are **vertical angles**.

Angle Facts:

There are several important facts we will use in our work.

1. When two lines meet (like above), the *vertical angles are always equal*.

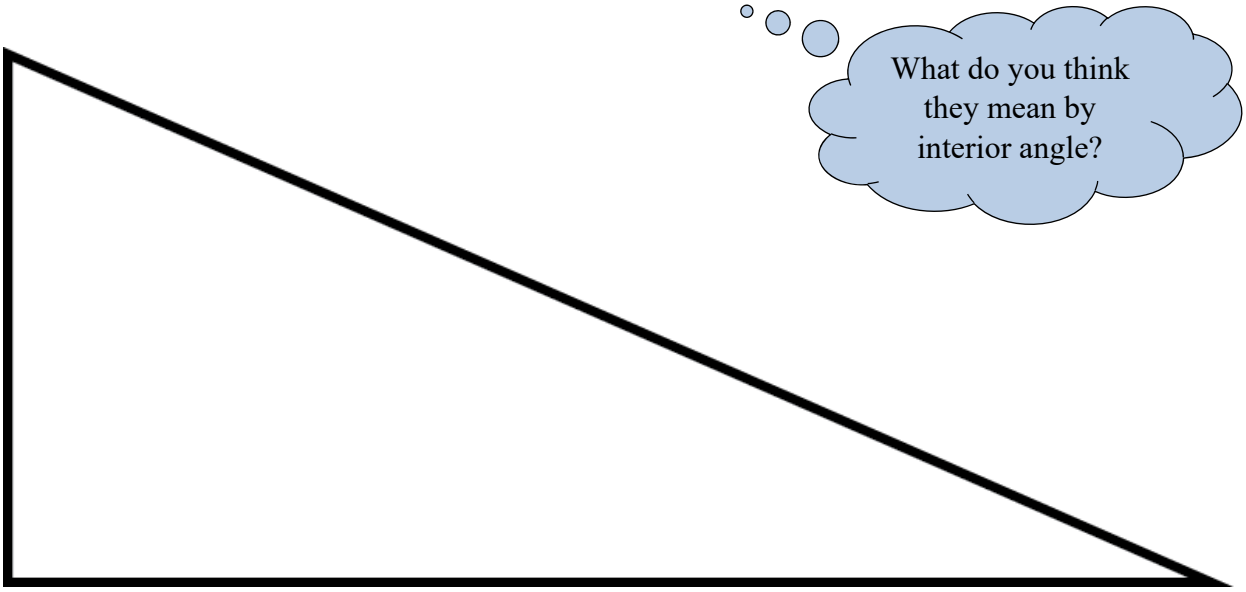
2. A pair of *adjacent angles always sum to 180 degrees*.

3. Never trust an obtuse angle. They are never right. (Okay, that is just a bad joke.)

4. The *interior angles of a triangle always sum to 180 degrees*.

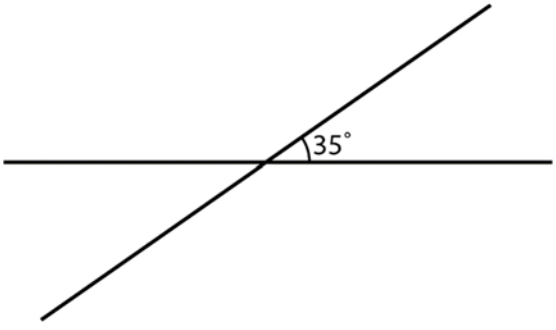
Definitions: A **triangle** is formed by three segments, called **sides**, that meet at **vertices** (plural of vertex).

expl 5: Measure each interior angle and sum them. Do you get 180°?



expl 6: A triangle has been drawn (not shown) with two angles measuring 25° and 80°. What must the third angle measure? Do *not* forget units.

expl 7: One angle below is given. Find the other angles measures without using a protractor.



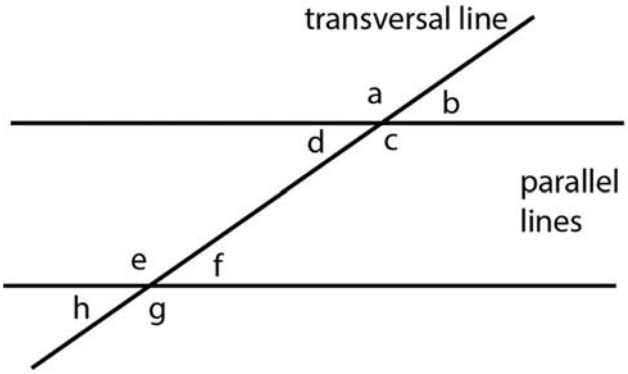
Parallel and Transversal Lines:

One last fact we will use concerns the following pair of **parallel lines** cut by a **transversal** line.

Definitions: Two lines are **parallel** if they are always the same distance apart.

If a pair of parallel lines is cut through by a third line, this is called a **transversal line**.

We can talk about **alternate interior angles** or **corresponding angles**.



Angles d and f are **alternate interior angles**. Can you name another pair? Do you see how the measures of alternate interior angles are related?

Angles a and e are **corresponding angles**. Can you name another three pairs? Do you see how the measures of corresponding angles are related?

Alternate Interior Angles Theorem:
As you may have noticed on the last page, alternate interior angles are always equal.

Corresponding Angles Theorem:
As you may have noticed on the last page, corresponding angles are always equal.

expl 8: Consider the pair of parallel lines and their transversal drawn below. One angle measure is given. Find the missing angles' measures.