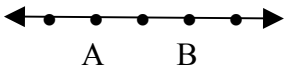
Introduction to Geometry

Objective A: Problems involving lines and angles

Three basic concepts of Geometry are:

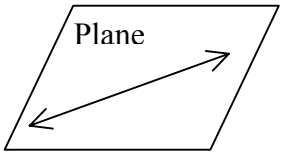
Points – are a single place represented by a dot

Lines – are a collection of points that continue in both directions. They can be represented by the symbol ($\leftrightarrow$) shown above two points of the line (see example to the right)



$\leftrightarrow$
AB

Planes – are a flat surface that extends in all directions (in two dimensions)



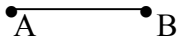
Parts of lines:

A Ray – is part of a line which has one end point and extends indefinitely in only one direction. It is represented by the symbol ($\rightarrow$ or $\leftarrow$) depending on which way the ray is continuing.

$\overrightarrow{AB}$

A Line Segment – is part of a line that has two end points. It is represented by the symbol (—).

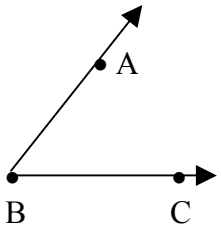
$\overline{AB}$



The length (the distance between end points) of a line segment is represented as $m(\overline{AB})$.

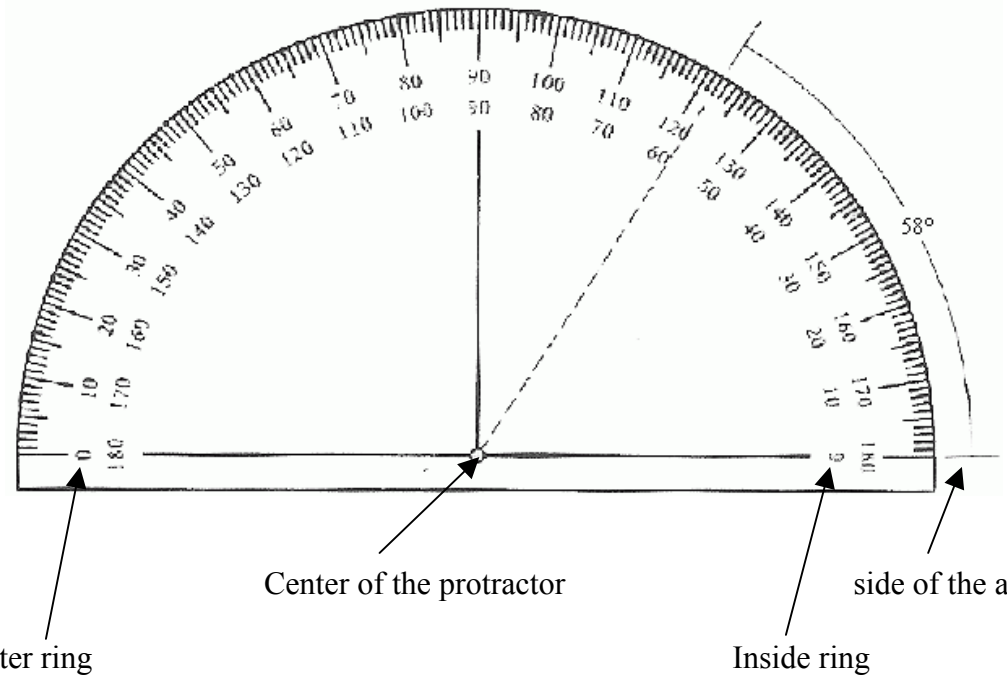
Angles:

An **angle** is formed by two rays that have a common end point. This common end point is referred to as the **vertex** and the rays are the **sides** of the angle.



Angles are represented by the symbol (∠). When naming angles the letter representing the vertex is either used by itself (example "∠B") or as the second point (example "∠ABC")

Angles are measured in degrees, which is represented by the symbol (°). The size of an angle is measured by using an instrument called a "protractor." To use a protractor, place the center of the protractor at the vertex of the angle and the edge along a side of the angle. See below for an example of how a protractor is used to measure angles.



If the angle starts from the right side of the protractor (as in the example above), then you will use the numbers on the inside ring to get your measurement.

If the angle starts from the left side of the protractor, then you will use the numbers on the outer ring to get your measurement.

Types of Angles:

There are several different categories that angles can be placed in depending on what their angle measurement is and their relative location.

Right Angles – are angles with a measurement of 90°.

Complementary Angles – are two angles whose **combined** measurement equals 90°.

Straight Angles – are angles with a measurement of 180°. Lines would be considered to be straight angles.

Supplementary Angles – are two angles whose combined measurement equals 180°.

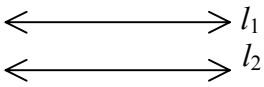
Acute Angles – are angles with a measurement between 0° and 90°.

Obtuse Angles – are angles with a measurement between 90° and 180°.

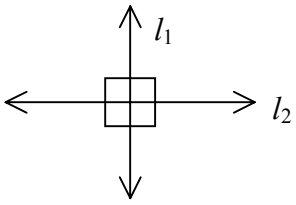
Adjacent Angles – are angles who share a common side.

Lines in a plane can be parallel, perpendicular, or intersecting.

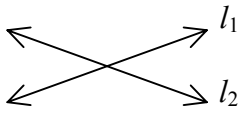
Parallel lines are lines that never intersect. The symbol "||" is used to indicate parallel lines. Example: $l_1 \parallel l_2$ means that the line l_1 is parallel to line l_2.



Perpendicular lines are lines that intersect at 90° angles. The symbol "⊥" is used to represent perpendicular lines. Example: $l_1 \perp l_2$ means that line l_1 is perpendicular to line l_2.

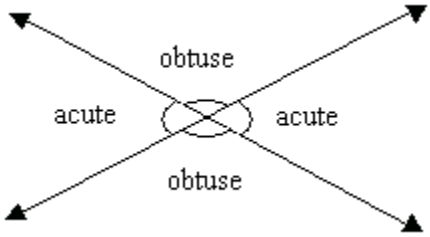


If the lines are not parallel or perpendicular, then they are just two intersecting lines.



Objective B: Problems involving angles formed by intersecting lines

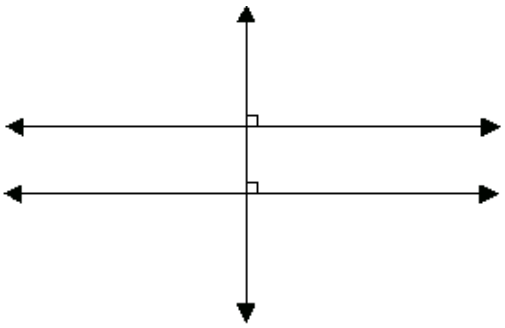
When two lines intersect each other there are four angles that are formed. Two of the angles will be acute and two will be obtuse. The two acute angles will have the same measurement and the two obtuse angles will have the same measurement.



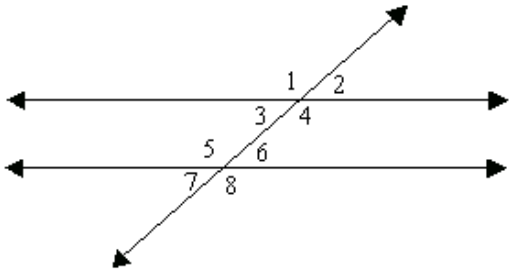
Vertical angles are angles that are on opposite sides of the intersection of the two lines. Vertical angles will have the same measurement. In the image above, the acute angles are vertical angles and the same is true for the obtuse angles.

Transversal – a line that intersects two other lines at different points.

If the two parallel lines are cut by a transversal that is perpendicular to them, then all of the angles created will be 90° .



If the two parallel lines are cut by a non-perpendicular transversal, then all of the acute angles will have the same measurement and all of the obtuse angles will have the same measurement.



$m(\angle 1) = m(\angle 4) = m(\angle 5) = m(\angle 8)$
$m(\angle 2) = m(\angle 3) = m(\angle 6) = m(\angle 7)$

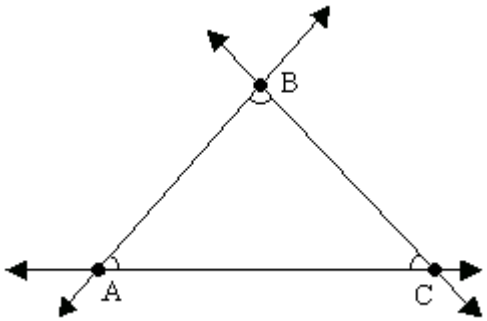
Alternate interior angles – are two angles that are on opposite sides of the transversal and in between the parallel lines. In the example above, $\angle 4$ & $\angle 5$ and $\angle 3$ & $\angle 6$ are alternate interior angles.

Alternate exterior angles – are two angles that are on opposite sides of the transversal and are outside of the parallel lines. In the example above, $\angle 1$ & $\angle 8$ and $\angle 2$ & $\angle 7$ are alternate exterior angles.

Corresponding angles – are angles on the same side of the transversal and are both acute or both obtuse. In the example above, $\angle 1$ & $\angle 5$, $\angle 2$ & $\angle 6$, $\angle 3$ & $\angle 7$, and $\angle 4$ & $\angle 8$ are corresponding angles.

Objective C: Problems involving the angles of a triangle

When two non-parallel lines are intersected by a transversal, the three lines will form a triangle.



The three angles enclosed by the lines are called interior angles. Their sum will equal 180°. Any angle adjacent to an interior angle is an exterior angle.