Basics of Geometry

POINTS!

LINES!

PLANES!

OH MY!

- What are the undefined terms in geometry?
- What concepts present the foundations of geometry?
- Can you sketch the intersection of lines and planes?

These questions (and much more!!) will be answered by the end of this presentation.

Are you ready?

Undefined Terms?

The terms points, lines, and planes are the foundations of geometry, but…

point, line, and plane are all what we call **undefined terms**.

How can that be?

Well, any definition we could give them would depend on the definition of some other mathematical idea that these three terms help define. In other words, the definition would be circular!

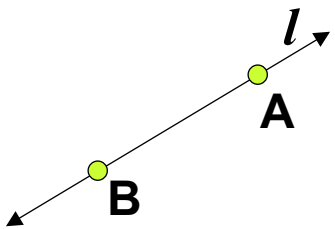
Point

- Has no dimension
- Usually represented by a small dot.

The above is called point A. Note the point is represented with a capital letter.

Line

- Extend in one dimension.
- Represented with straight line with two arrowheads to indicate that the line extends without end in two directions.

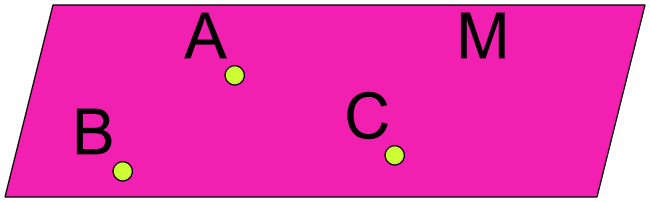


This is Line l, (using the lower case script letter) or symbolically we call it $\overleftrightarrow{AB}$

NOTICE: The arrowheads are in both directions on the symbol $\overleftrightarrow{AB}$

Plane

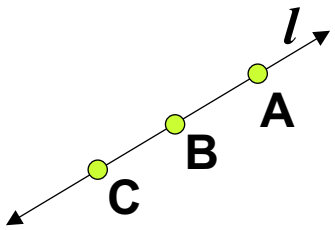
- Extend in two dimensions.
- Represented by a slanted 4 sided figure, but you must envision it extends without end, even though the representation has edges.



This is Plane M or plane ABC (be sure to only use three of the points when naming a plane)

Undefined Concepts

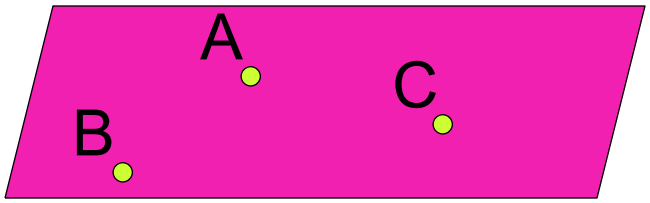
- Collinear points are points that lie on the same line.



Points A, B and C are collinear.

Undefined Concepts

- Coplanar points are points that lie on the same plane.



Points A, B and C are coplanar.

Line Segment

Let's look at the idea of a point in between two other points on a line.

Here is line AB, or recall symbolically $\overleftrightarrow{AB}$

The line segment does not extend without end. It has endpoints, in this case A and B. The segment contains all the points on the line between A and B

This is segment $\overline{AB}$

Notice the difference in the symbolic notation!

Ray

Let's look at a ray:

A is called the initial point

Ray AB extends in one direction without end.

The initial point is always the first letter in naming a ray. Notice the difference in symbols from both a line and segment.

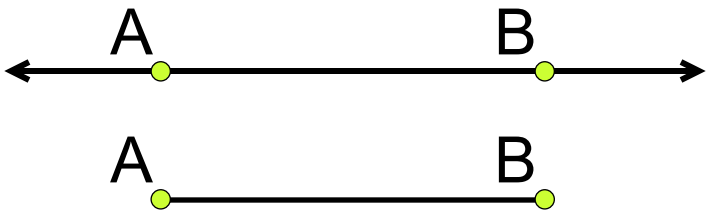
Symbolized by $\overrightarrow{AB}$

Symbol alert!

Not all symbols are created equal!

$\overleftrightarrow{AB}$ is the same as $\overleftrightarrow{BA}$

$\overline{AB}$ is the same as $\overline{BA}$

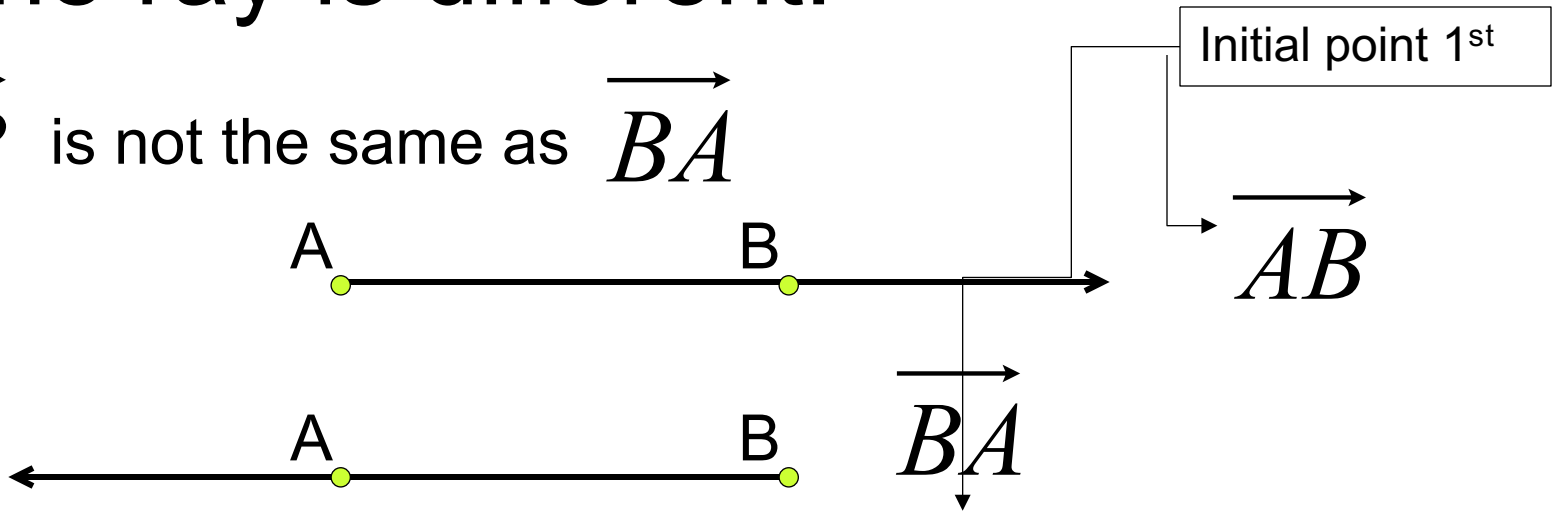


BUT…

Symbol alert!!

The ray is different!

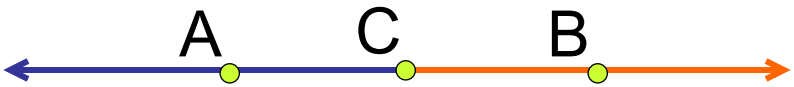
$\overrightarrow{AB}$ is not the same as $\overrightarrow{BA}$



Notice that the initial point is listed first in the symbol. Also note that the symbolic ray always has the arrowhead on the right regardless of the direction of the ray.

Opposite Rays

If C is between A and B,



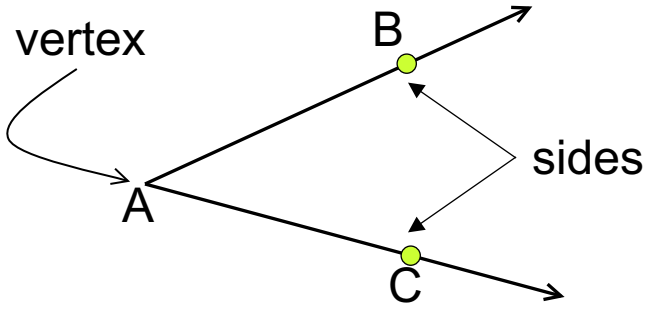
then $\overrightarrow{CA}$ and $\overrightarrow{CB}$ are opposite rays.

C is the common initial point for the rays!

Angles

Rays are important because they help us define something very important in geometry…**Angles**!

An angle consists of two different rays that have the same initial point. The rays are sides of the angles. The initial point is called the vertex.

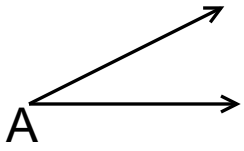


Notation: We denote an angle with three points and $\angle$ symbol. The middle point is always the vertex. We can also name the angle with just the vertex point. This angle can be denoted as:

$$\angle BAC, \angle \text{CAB}, \text{or } \angle \text{A}$$

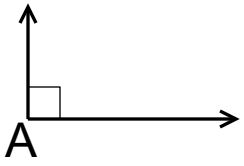
Classifying Angles

Angles are classified as **acute**, **right**, **obtuse**, and **straight**, according to their measures. Angles have measures greater than 0° and less or equal to 180°.



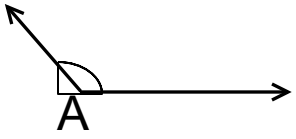
Acute angle

$0° < m\angle A < 90°$



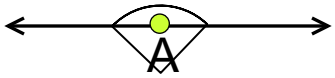
Right angle

$m\angle A = 90°$



Obtuse angle

$90° < m\angle A < 180°$



Straight angle

$m\angle A = 180°$

Intersections of lines and planes

- Two or more geometric figures **intersect** if they have one or more points in common.
- The **intersection** of the figures is the set of points the figure has in common

Think!
!

How do 2 line intersect?

How do 2 planes intersect?

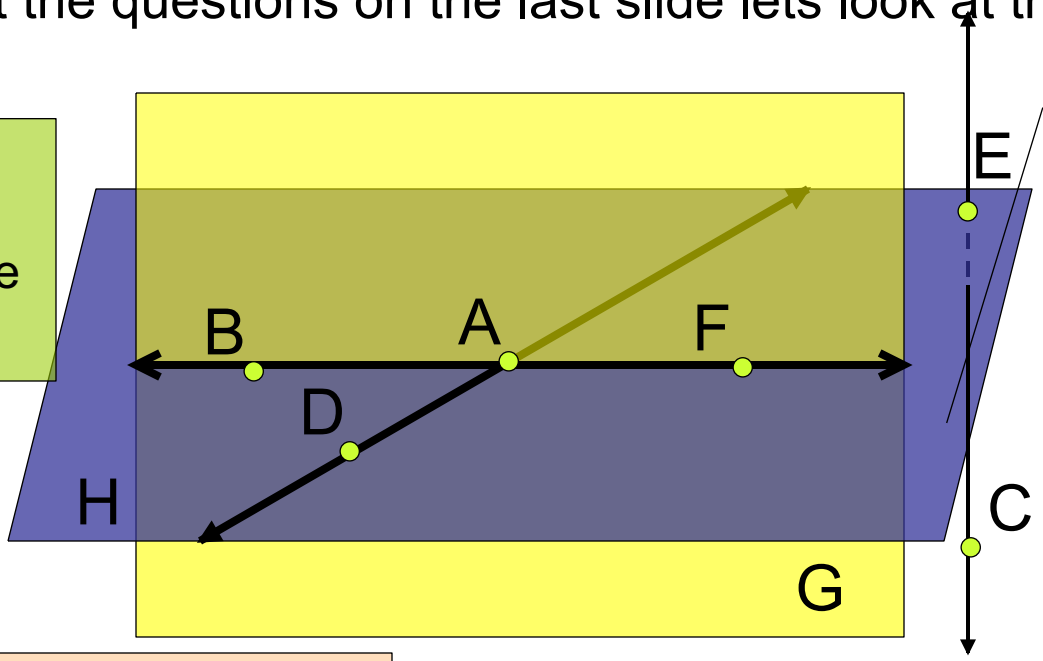
What about a line and a plane?

Basics of Geometry

Modeling Intersections

To think about the questions on the last slide lets look at the following…

Two lines intersect at a point, like here at point A.



Point E is the intersection of plane H and line EC

Line BF is the intersection of the planes G and H.

Something to think about…

You have just finished the first section in Geometry!

This is a very important section because it lays the foundation for the rest of the year! Much of the vocabulary you will encounter in this course will have its foundation in the ideas presented in this lesson.

Can you name the three undefined terms in geometry? Do you know the difference between and obtuse and straight angle? Can you sketch the intersection of a plane and a line? How about two planes? Can you visualize the intersection of two planes? How about three?

The classfun and homefun provided will help you in developing a better understanding of the concepts!