Lesson 1

Glencoe Geometry Chapter 1.2

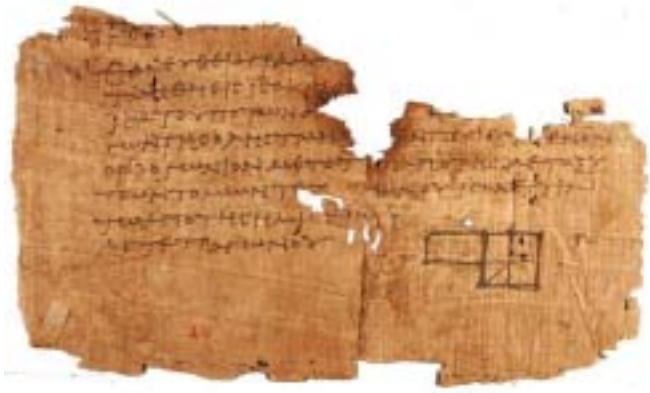
What is Geometry & Points, Lines, and Planes

Geometry gets its name from the Greek ***geo*** meaning Earth and from ***metry*** meaning Measure. It was developed to meet the practical needs in surveying, construction, and astronomy.

Although it existed as early as 3000 B.C. in ancient Babylonia, it wasn't until a Greek mathematician named Euclid wrote around 300 B.C. his famous work, *Elements of Geometry*, that geometry began to resemble the axiomatic form we have today.

The geometry you study in high school is appropriately a study of Euclidean geometry. Today we will learn about three undefined, or primitive, concepts, namely points, lines, and planes in a two-dimensional environment.

So . . . here's looking at Euclid!!



One of the oldest and most complete diagrams from Euclid's *Elements*

http://www.math.ubc.ca/~cass/Euclid/papyrus/papyrus.html

Euclid
(325–265 BC)

http://micro.magnet.fsu.edu/optics/timeline/people/euclid.html

A **Point** is a geometric element that has position but no extension; It is defined by its coordinates on the coordinate plane and is represented by a capital letter.

A coordinate plane is divided into four quadrants with a center at the origin.

Example 1:

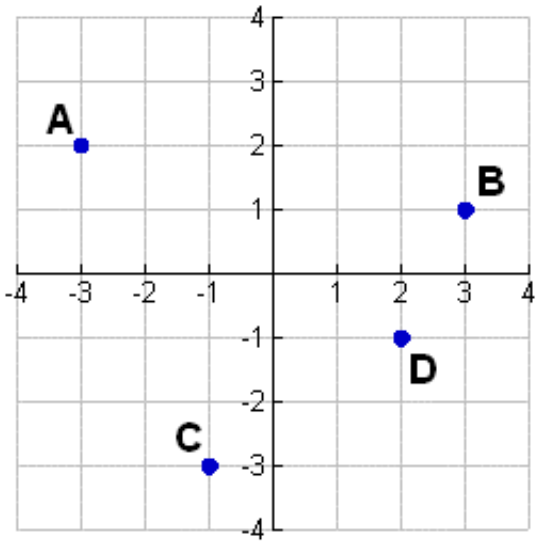
Find the coordinates (x, y) of the following points:

Point A: $(-3, 2)$

Point B: $(3, 1)$

Point C: $(-1, -3)$

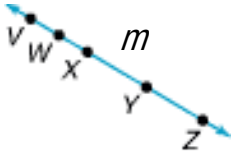
Point D: $(2, -1)$



A **Line** is a one-dimensional object defined by two points that extends indefinitely in both directions. It is shown by drawing an arrow at both ends and is named by a lower-case script letter, such as *m*, or by any two points on the line.

Example 2:

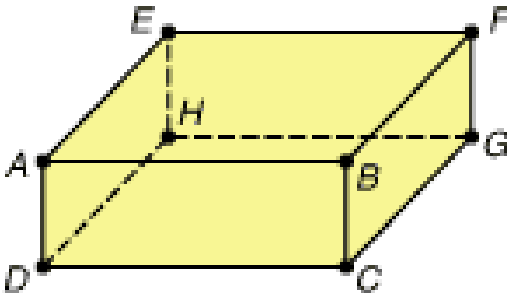
List some other possible names for line $\overleftrightarrow{VZ}$?



$\overleftrightarrow{VW}, \overleftrightarrow{WV}, \overleftrightarrow{VX}, \overleftrightarrow{XV}, \overleftrightarrow{VY}, \overleftrightarrow{YV}, \overleftrightarrow{WX}, \overleftrightarrow{XW}$
$\overleftrightarrow{WY}, \overleftrightarrow{YW}, \overleftrightarrow{WZ}, \overleftrightarrow{ZW}, \overleftrightarrow{XY}, \overleftrightarrow{YX}, \overleftrightarrow{XZ}, \overleftrightarrow{ZX},$
$\overleftrightarrow{YZ}, \overleftrightarrow{ZY}, m$ these are all the same line.

Example 3:

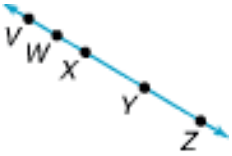
Name some lines that lie in plane *ADH*



$\overleftrightarrow{AE}, \overleftrightarrow{EA}$, $\overleftrightarrow{AD}, \overleftrightarrow{DA}$, $\overleftrightarrow{AH}, \overleftrightarrow{HA}$,
$\overleftrightarrow{DE}, \overleftrightarrow{ED}$, $\overleftrightarrow{HE}, \overleftrightarrow{EH}$, $\overleftrightarrow{HD}, \overleftrightarrow{DH}$
These occur in equivalent pairs of different lines.

Lines also have two other close relatives:

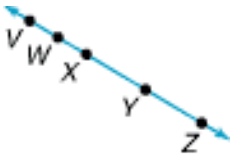
1. A Line segment is a piece of a line that consists of two endpoints and all the points between them. It is denoted by the capital letters of the two endpoints with a line above them, for example $\overline{XZ}$ in the figure below. What are some others?



$\overline{XZ}, \overline{ZX}$, $\overline{VW}, \overline{WV}$, $\overline{VX}, \overline{XV}$, $\overline{VY}, \overline{YV}$, $\overline{VZ}, \overline{ZV}$, $\overline{WX}, \overline{XW}$, $\overline{WY}, \overline{YW}$, $\overline{WZ}, \overline{ZW}$

These occur in equivalent pairs. Here, the length and position of the segment matters!!

2. A ray is a combination of a line and a line segment consisting of one fixed endpoint and extending indefinitely in a direction. It is denoted by listing the fixed point first, then any other point with an arrow above. For example $\overrightarrow{YV}$ in the figure below. What are some others?



$\overrightarrow{VW}, \overrightarrow{VX}, \overrightarrow{VY}, \overrightarrow{VZ}$ are all the same ray

$\overrightarrow{WV}$ is different from $\overrightarrow{VW}$ since it points in the opposite direction.

A **Plane** is any two-dimensional surface defined by 3 non-collinear points, meaning not on the same line. It can be thought of as a flat surface that extends infinitely in all directions. Planes are usually notated by a capital script letter, such as $\mathcal{W}$, or as three points, such as plane *ABC*.

http://www.shopireland.ie/electronics/search/B0000WXD0W/image/

Ever wonder why a tripod, with only three legs, is used in photography? Wouldn't four or five legs be better?

Actually, no the three non-collinear legs of the tripod create their own plane, providing maximum stability.

Example 4:

How many planes appear in the figure shown?

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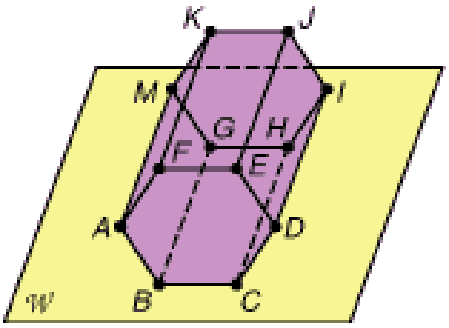
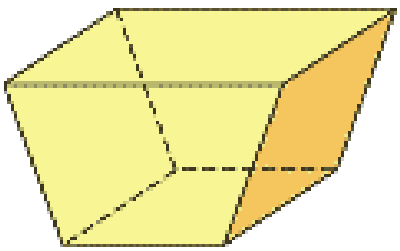


Example 5:

How many planes appear on the figure shown?



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Say what??!!

1. A picture frame is best modeled by a

A. line. B. plane. C. quadrant. D. point.

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2. The intersection of two planes could be a _____.

A. line B. plane C. point D. segment

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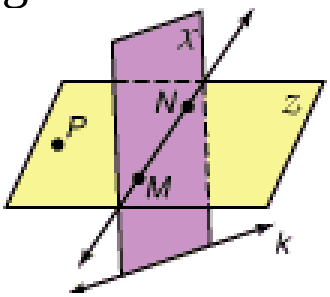
3. Which of the following statements is not true?



A. $\overleftrightarrow{MN}$ is in X and is in Z

B. X contains M and k.

C. X and Z intersect in $\overleftrightarrow{MN}$

D. $\overline{MN}$ and P are in X

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4. How many planes appear below?

http://www.sbac.edu/~tpl/clipart/cliparthumbs.htm

0 geometric planes

Summary

Point-_ 0 dimensions _____

Line-_ 1 dimension _____

Plane-_ 2 dimensions _____

space _-_ 3 dimensions _____

Note: all graphics are from Glencoe's website, http://www.glencoe.com/sec/math/studytools/geolblr.shtml, unless noted otherwise.