Unit 1, Lesson 10

Postulates and Theorems relating to points, lines, and planes

"The cowboys have a way of trussing up a steer or a pugnacious bronco which fixes the brute so that it can neither move nor think. This is the hog-tie, and it is what Euclid did to Geometry"

-Eric Temple Bell

Recall we have accepted, without proof, four basic assumptions:

The Ruler Postulate

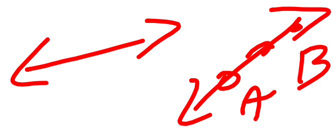
The Segment Addition Postulate

The Protractor Postulate

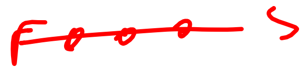
The Angle Addition Postulate

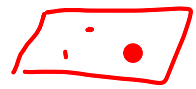
Postulate #5

a) A line contains at least two points.



b) A plane contains at least three points not all in one line

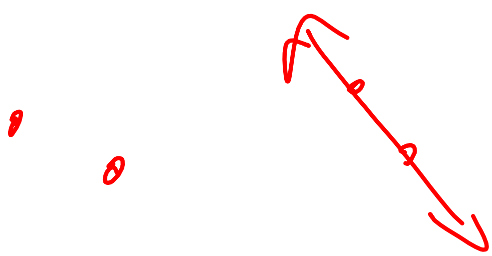




c) Space contains at least four points not all in one plane

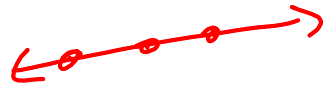
Postulate #6

Through any two points there is exactly one line.

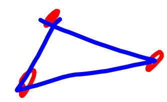


Postulate #7

a) Through any three points there is at least one plane

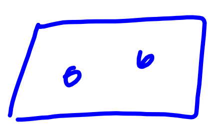


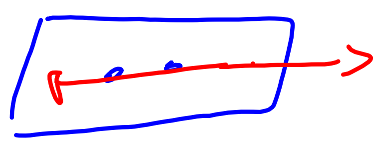
b) Through any three noncollinear points there is exactly one plane.



Postulate #8

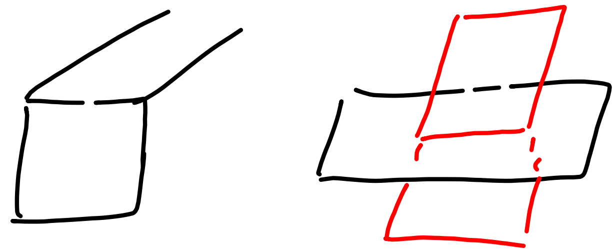
If two points are in a plane, then the line that contains the points is in that plane.





Postulate #9

If two planes intersect, then their intersection is a line.



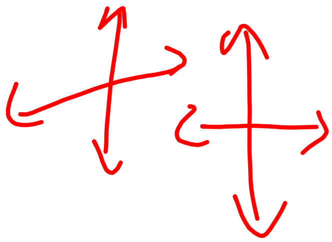
Theorems

-statements that can be shown true (proved) by assumptions, definitions, and previous knowledge that has been shown true.

-There are many different ways to prove statements.

Theorem 1-1

If two lines intersect, then they intersect at exactly one point.



How can we prove this is true?????

Sometimes we need to use the contrapositive to prove a statement.

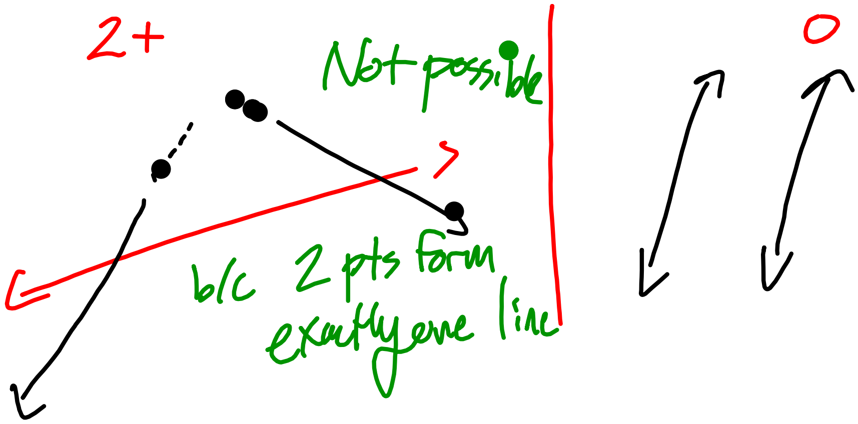
(Remember the contrapostive and original have the same truth value.)

If it is not true that two lines intersect in exactly one point, then they do not intersect.

2+ or 0

How can we use this?

Illustration of the two cases



The no intersection case keeps the statement true.

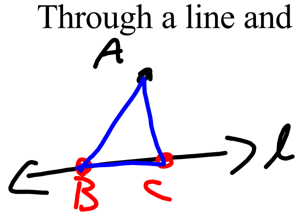
What postulate or definition does the drawing with two intersections contradict?

Now since we have a true contrapositive, the original statement must be true.

Theorem 1-2

3 noncollin

Through a line and a point not in the line there is exactly one plane.



A line has at least 2 pts so add pts B and C to l.

Through 3 noncollinear pts there is exactly one plane so draw plane ABC and

since B+C are in the so is l.

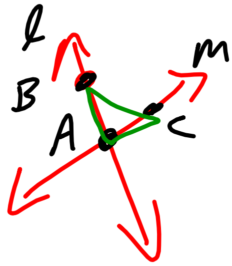
How do we get three points so we can make a plane?

Why can we say there is a plane now???

Theorem 1-3

Prove this. (Hint you do not need the contrapositive.)

If two lines intersect, then exactly one plane contains them.



2 lines intersect in exactly one pt so label the intersection of l and m as A, and a line has at least 2 pts so place B on l and C on m.

Through 3 non collinear pts there is exactly one plane so draw plane ABC ∴

Closure:

What did you find interesting/new today? How would you explain proof to a friend?