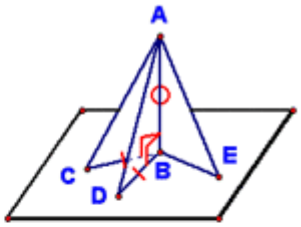
Basic Facts about Parallel Planes - Lesson 6-3

Today, we started with the following warmup problem:

Given: $\overleftrightarrow{AB} \perp \overleftrightarrow{BC}$
$\overleftrightarrow{AB} \perp \overleftrightarrow{BE}$
$\overline{BC} \cong \overline{BD}$

Prove: $\angle CAB \cong \angle DAB$



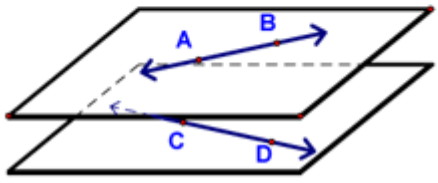
	Statements	Reasons
	1. $\overleftrightarrow{AB} \perp \overleftrightarrow{BC}$	1. Given
	2. $\overleftrightarrow{AB} \perp \overleftrightarrow{BE}$	2. Given
	3. $\overleftrightarrow{AB} \perp$ plane BCDE	3. Line ⊥ Plane Theorem
	4. $\overleftrightarrow{AB} \perp \overleftrightarrow{BD}$	4. Defn. of Line ⊥ to Plane
	5. $\angle ABC$ & $\angle ABD$ are right $\angle$s	5. Defn. of ⊥ lines
A	6. $\angle ABC \cong \angle ABD$	6. RAT
S	7. $\overline{BC} \cong \overline{BD}$	7. Given
S	8. $\overline{AB} \cong \overline{AB}$	8. Reflexive property
	9. $\triangle ABC \cong \triangle ABD$	9. SAS (7, 6, 8)
	10. $\angle CAB \cong \angle DAB$	10. CPCTC

After reviewing the 6.2 homework, we discussed some basic facts about parallel planes. We started by defining what it meant for lines and planes to be parallel, for planes to be parallel and for lines to be *skew*.

A line and a plane are *parallel* if they do not intersect.

Two planes are *parallel* if they do not intersect.

Two lines are *skew* if they are not coplanar.

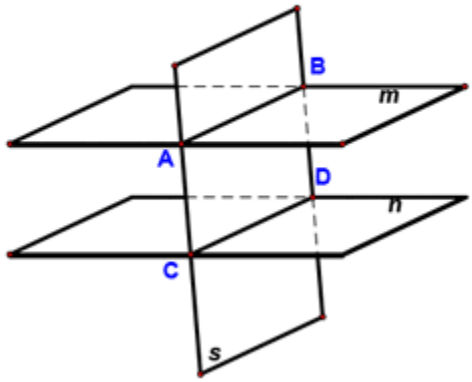


We then discussed the following theorem. This is a key theorem to understand!!

Theorem 48: **If a plane intersects two parallel planes, the lines of intersection are parallel.**

Given: $m \parallel n$
s intersects m & n in lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$

Prove: $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$



The proof for this should make sense...I won't ask you to prove it, but you should understand it. Basically, since m and n are parallel planes, they never intersect. That means that line AB and line CD never intersect. Since those lines are on the same plane (and never intersect), they have to be parallel by definition.

With this information, we talked about the following properties of lines and planes. Make sure you know these...they are great fodder for sometimes, always, never type questions!!

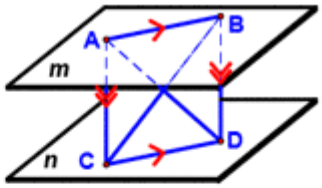
Parallelism of Lines and Planes

1. **If two planes are ⊥ to the same line, they are parallel to each other.**
2. **If a line is ⊥ to one of two parallel planes, it is ⊥ to the other plane as well.**
3. **If two planes are parallel to the same plane, they are parallel to each other.**
4. **If two lines are ⊥ to the same plane, they are parallel to each other.**
5. **If a plane is ⊥ to one of two parallel lines, it is ⊥ to the other line as well.**

Before going over homework, we went through the following example. Note the use of some of the theorems we've covered!!

Given: $m \parallel n$
$\overleftrightarrow{AB}$ lies in m
$\overleftrightarrow{CD}$ lies in n
$\overleftrightarrow{AC} \parallel \overleftrightarrow{BD}$

Prove: $\overline{AD}$ bisects $\overline{BC}$



Statements	Reasons
1. $m \parallel n$	1. Given
2. $\overleftrightarrow{AB}$ lies in m	2. Given
3. $\overleftrightarrow{CD}$ lies in n	3. Given
4. $\overleftrightarrow{AC} \parallel \overleftrightarrow{BD}$	4. Given
5. $\overleftrightarrow{AC}$ and $\overleftrightarrow{BD}$ determine a plane, ACDB	5. Two $\parallel$ lines determine a plane
6. $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$	6. If a plane intersects two $\parallel$ planes, the lines of intersection are $\parallel$
7. ACDB is a parallelogram	7. If both pairs opp. sides of a quad are $\parallel$, it is a parallelogram
8. $\overline{AD}$ bisects $\overline{BC}$	8. The diagonals of a parallelogram bisect each other