2022-2023 James E Davis Trimester 1 Geometry Week 2 Class Notes

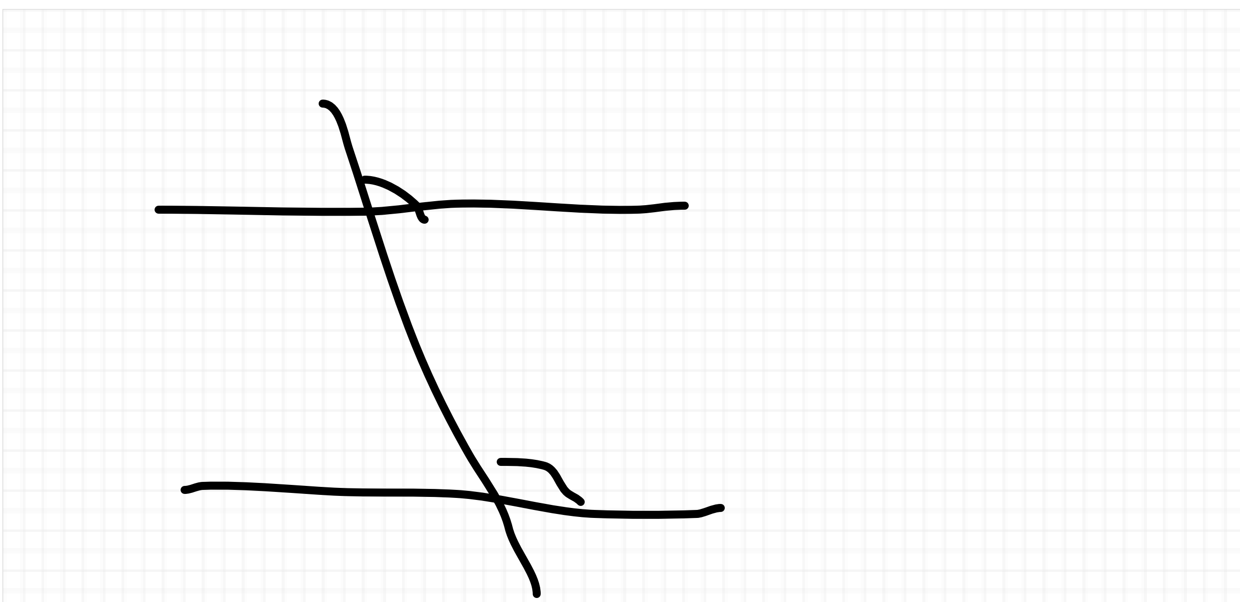
9/26

Previously...

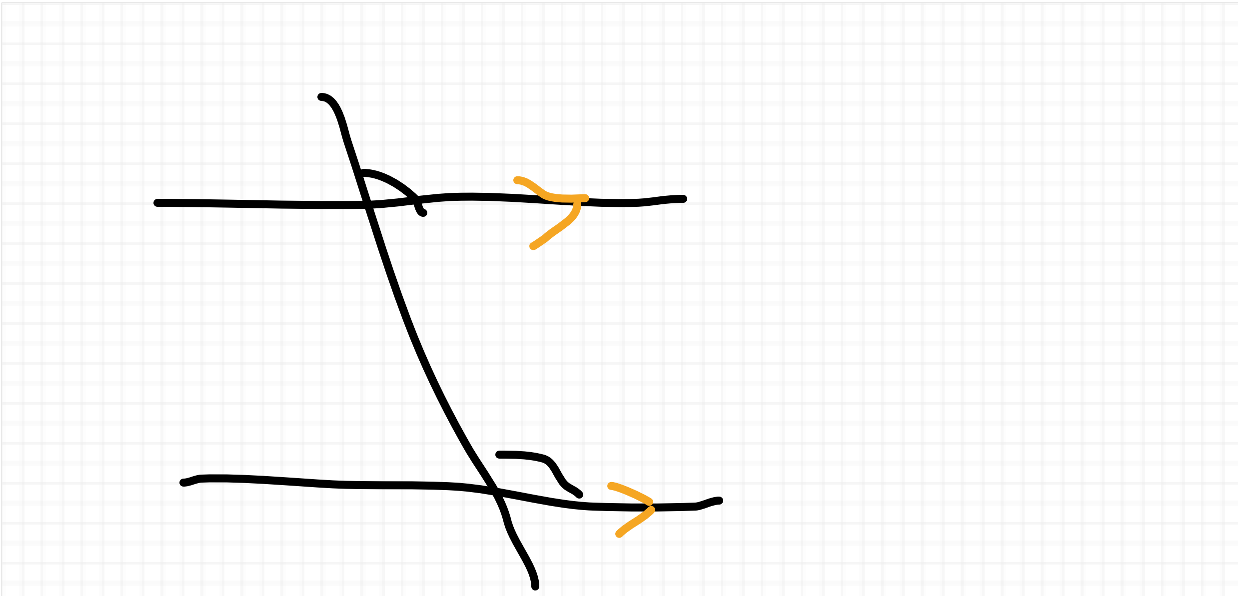
This section starts with the following important postulate, which we call the "corresponding angles converse"

Corresponding Angles Shoe Postulate. If two lines are cut by a transversal line and their corresponding angles are congruent, then the lines are parallel.

Visually, if we have the following setup



Then we can expand on this setup as follows:

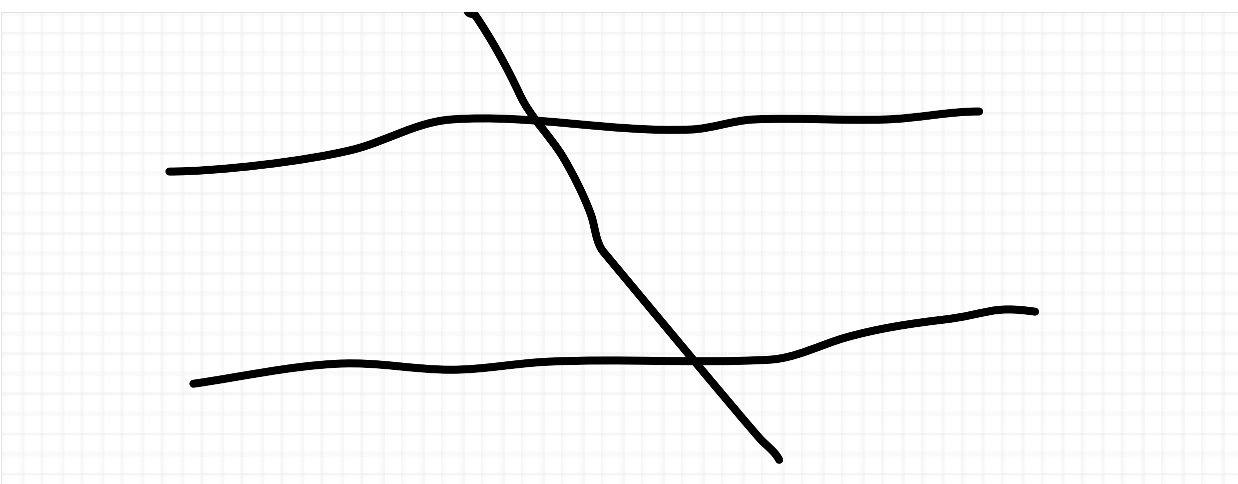


Important Note: Why we call the Corresponding Angles Shoe Postulate the "Corresponding Angles Converse Postulate" is because it's in fact the converse of the corresponding angles posulate.

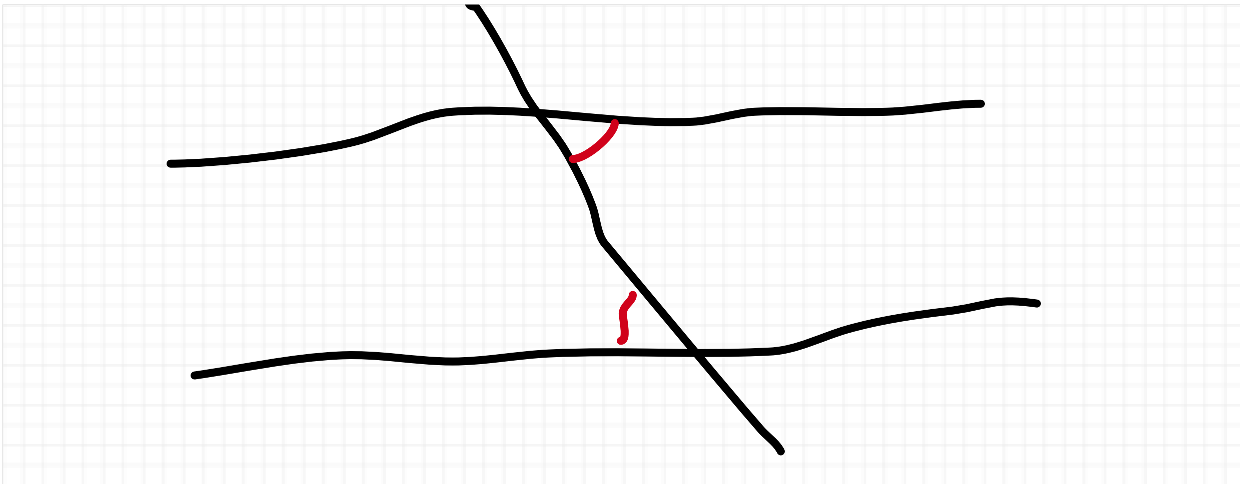
So based on our postulations, it holds true that two lines divided by a transversal line are parallel if and only if they have the same angle.

Proofy Proving that Lines are Parallel (Cont.)

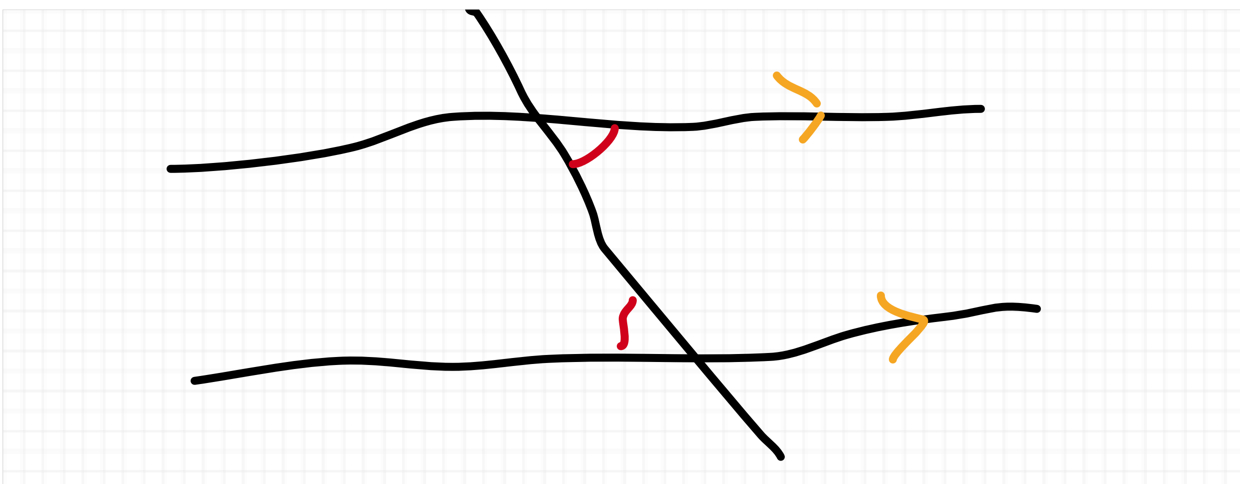
Assume in all theroems that we have two lines divided by a transversal



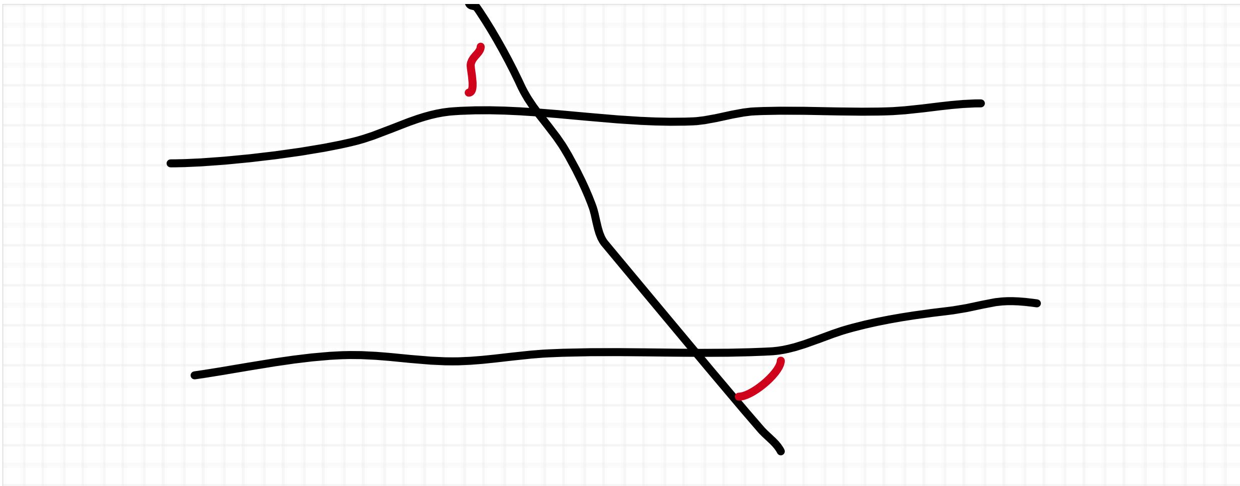
Theorem 1. Alternate Interior Angles Converse. If the alternate interior angles are congruent, then the two lines running through the transversal are parallel.

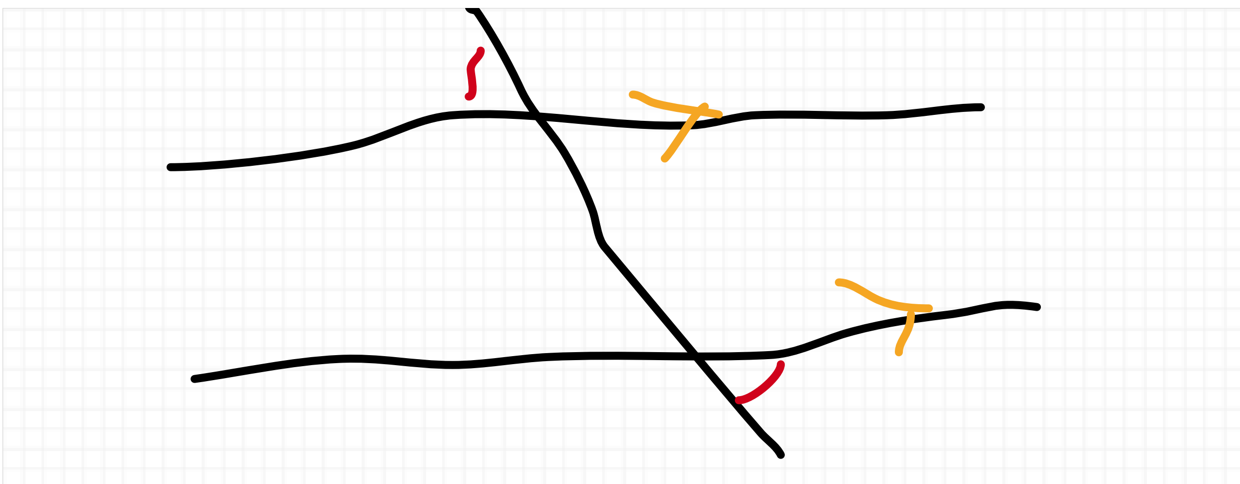


That is to say, the diagram above allows us to further infer the diagram below

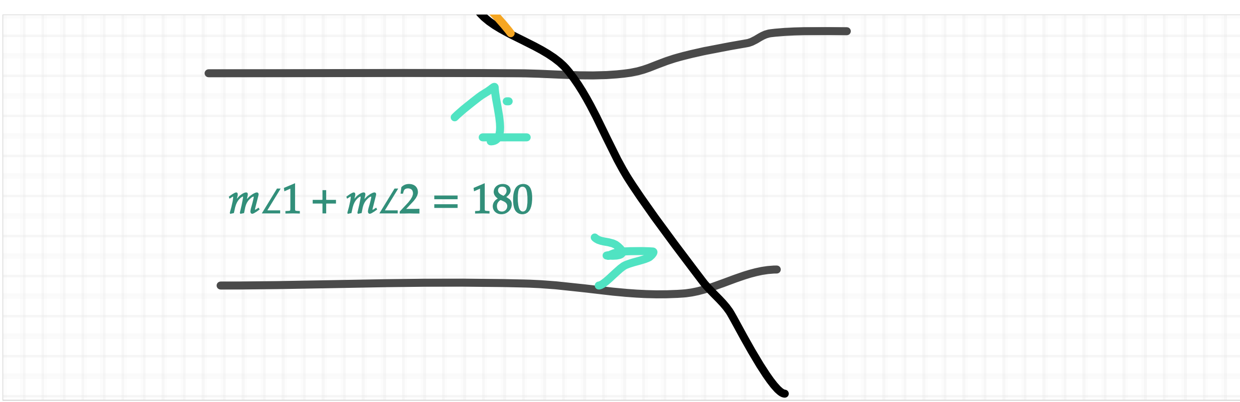


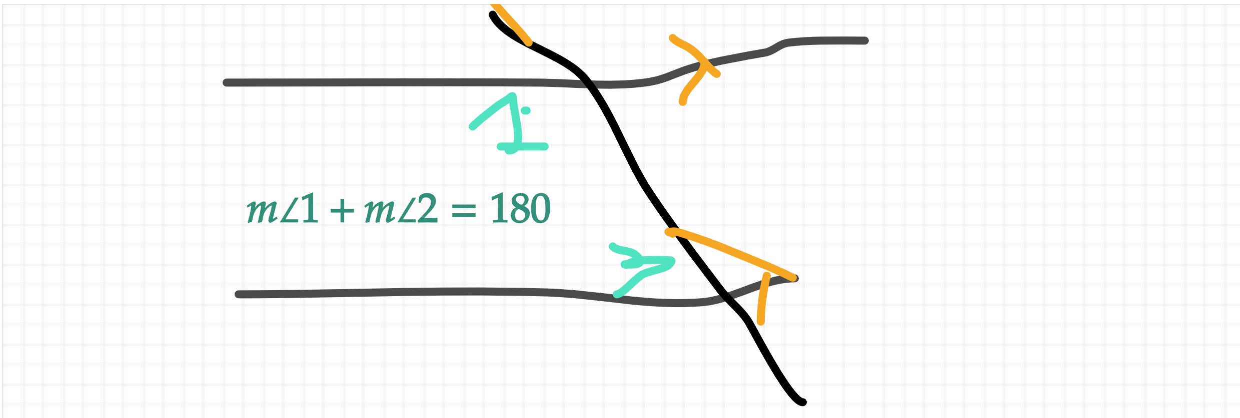
Theroem 2. Alternate Exterior angles converse. If the alternate exterior angles are congruent, then the lines are parallel, i.e. the first diagram below allows us to further infer the second diagram below



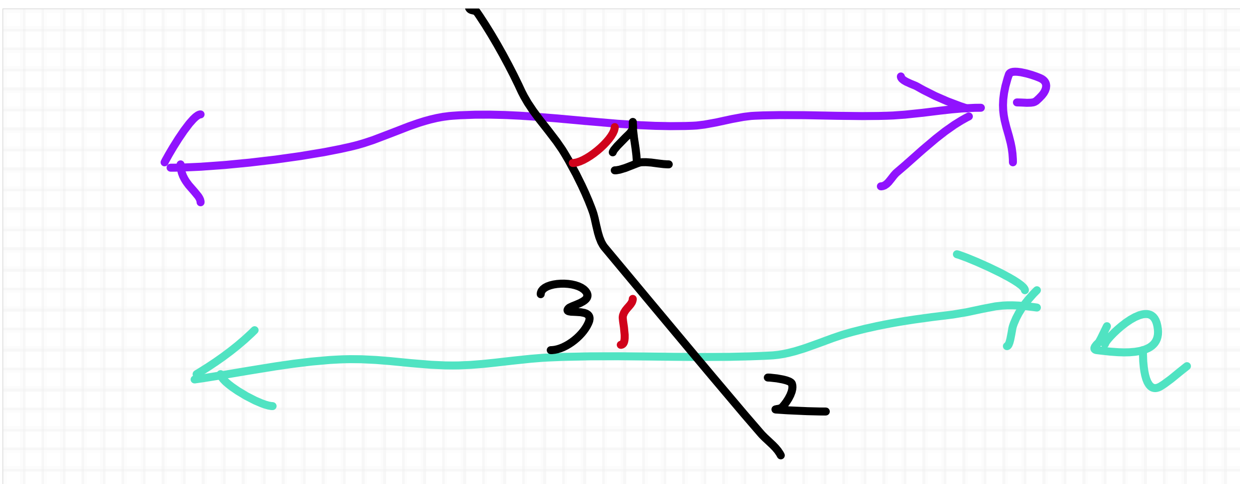


Theorem 3. Consecutive Interior Angles Theorem. If the consecutive interior angles are supplementary, then the lines are paralllel, i.e., assuming the first diagram below allows us to infer the second diagrm below.





*Proof of Theorem 1.*Noting the diagram below



we shall prove that the lines p and q are parallel

Given Reason

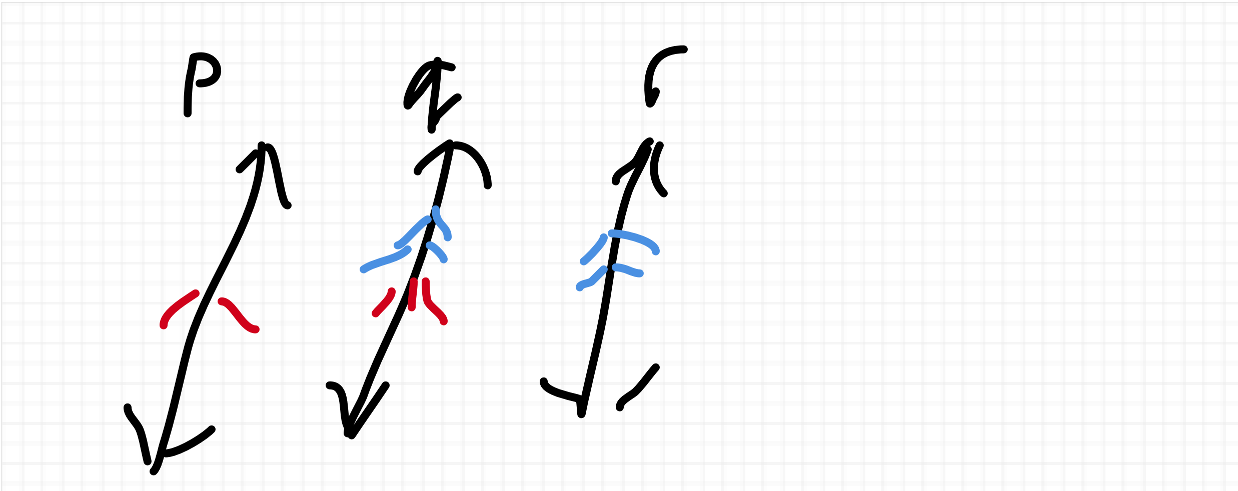
$\angle 1 \cong \angle 2$ given

$\angle 2 \cong \angle 3$ Vertical angles theorem

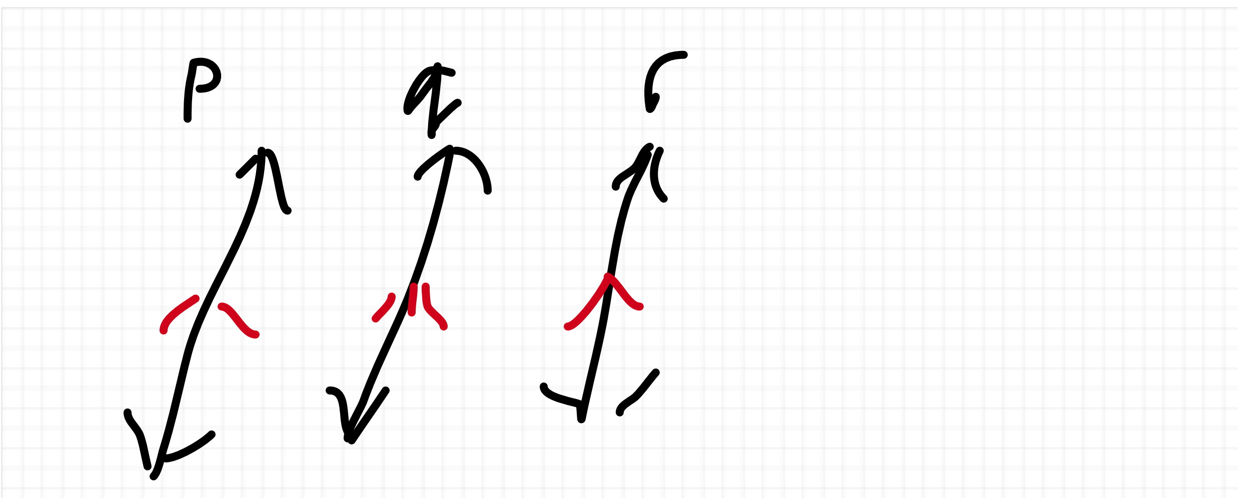
$\angle 1 \cong \angle 3$ Your favorite property.

$p || q$ Corresponding angles postulate (i.e., we have that $\angle 1$ and $\angle 4$ congruent, which implies the result), which tells us that the existance of congruent corresponding angles implies that the two lines are parallel.

Theorem 4. Your favorite property of parallel lines. If two lines are parallel,



i.e., we have $p||q$ and $q||r$, then $p||r$, and more generallly all three lines are parallel to each other (i.e., we have $q||p$, $r||q$, $r||p$)



Preview for Tomorrow

We'll prove the transitive property of parallel lines (and the more general conclusion) and do a "long" assignment.

Previously...

Proved the alternate interior angle converse, along with discussing some more angle converse theorems. Then we discussed the transitive property of parallel lines.

Proofy Proving that Lines are Parallel (Cont.)

Theorem 5. Equivalence Retion of Parallel Lines. Lines being parallel to each other symmetric and transitive (but not reflexive :( )

Definition 6. A **binary relation** is a symbol that says something about two objects.

Example 7. Here are some binary relations:

Equality $=$ is a binary relation, since when we say something is equal to something, we say it about two numbers

The greater than or equal sign $\geq$ is another example of a binary relation, since it says something about two numbers.

The congruence sign $\cong$ is a binary relation, since they refer to two geometric objects.

The parallel and perpendicular signs $\perp$, || are binary relations, since they refer to two lines

Definition 8. An **equivalence relation** for any binary relation $\sim$ is one with three properties:

1. *symmetry* If $x \sim y$, then $y \sim x$

2. *transitive property*. If $x \sim y$ and $y \sim z$, then $x \sim z$.

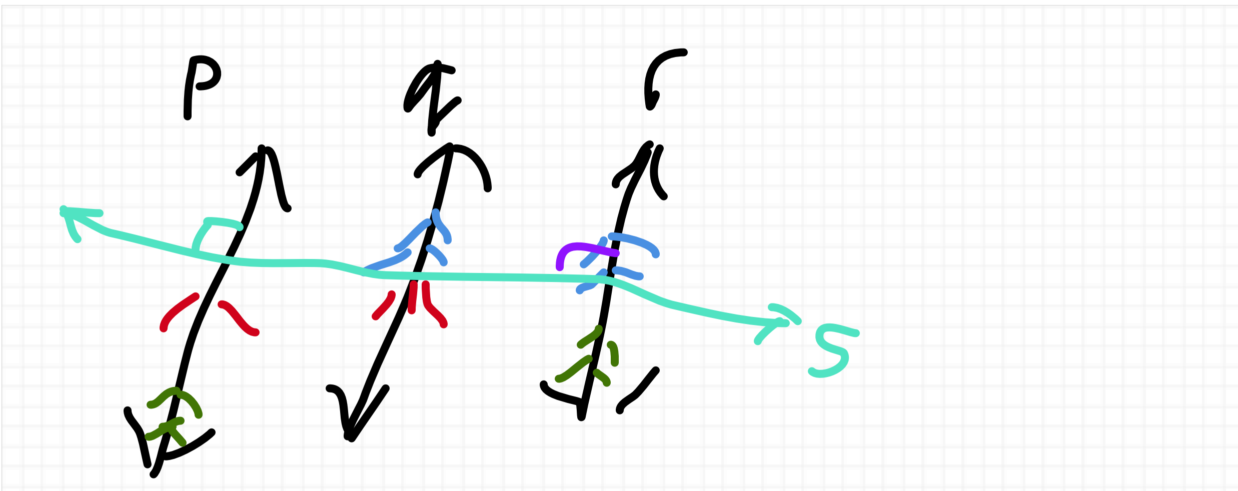
Example 9. $=$ and $\cong$ are equivalence relations, since it's pretty straightforward to see that they satisfy each of the three properties.

Proof of Theroem 5 (and Theorem 4).

symmetry. Suppose $p||q$. We want to show that $q||p$

Statement	Reason
$p||q$	Given
$q||p$	By definition

transitivity. Suppose $p||q$ and $q||r$.



Statement	**Reason**
$p||q$ and $q||r$	Given
There exists line s such that $p \perp s$	Perpendicular line postulate
$r \perp s$	Perpendicular transversal Theorem (proved as an exercise)
$p||r$	Corresponding angles converse postulate

QED

Tuesday Assignment

[Geometry Unit 3 Week 2 Tuesday Assignment]

Preview for Tomorrow

N/A

9/28

Teacher PD, no class today

9/29

Thursday Quiz

Geometry Unit 3 Week 2 Quiz

Next Time...

We'll start on section 3.6 of Larson, which is about proving that lines are perpendicular. It's like section 3.3 except for perpendicular lines.

9/30

Friday Assignment

Geometry Unit 3 Week 2 Friday Assignment