GEOMETRY HONORS
CHAPTER 3 Lessons 2
Green text (section 4.3)

date Notes

Objective:

To prove lines are parallel

Postulate: Write the converse of the postulate in the previous lesson.

If 2 lines are cut by a transversal, and a pair of same side interior angles are supplementary, then the lines are parallel.

Must prove theorems using the postulate.

Theorem:

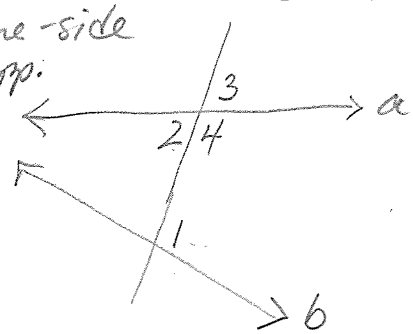
If 2 lines are cut by a transversal and alternate interior angles are congruent, then the lines are parallel.

Plan: show same-side int. ∡s supp.

Proof:

Given: ∡1 ≅ ∡2

Prove: a ∥ b



① ∡1 ≅ ∡2 → ② m∡1 = m∡2

③ ∡2 & ∡4 linear pair → ④ ∡2 suppl. ∡4 → ⑤ m∡2 + m∡4 = 180

② and ⑤ → ⑥ m∡1 + m∡4 = 180

⑥ → ⑦ ∡1 supp. ∡4 → ⑧ a ∥ b

① Given

② ≅ ∡s have = measures.

③ A linear pair are 2 ∡s that form a straight line

④ A linear pair are 2 ∡s supplementary

⑤ Suppl. ∡s are 2 ∡s total 180.

⑥ Substitution Prop.

⑦ Suppl. ∡s are 2 ∡s total 180

⑧ 2 lines w/ transv. & same side int. ∡s suppl. → 2 ∥ lines.

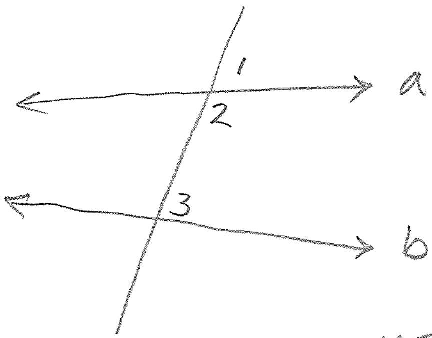
Theorem:

If 2 lines are cut by a transversal and corresponding angles are congruent, ~~then~~ then lines are parallel.

Proof:

Given: $\angle 1 \cong \angle 3$

Prove: $a \parallel b$



① $\angle 1 \cong \angle 3$ → ② $m\angle 1 = m\angle 3$

③ $\angle 1$ & $\angle 2$ linear pair → ④ $\angle 1$ suppl. $\angle 2$ → ⑤ $m\angle 1 + m\angle 2 = 180$

⑥ $m\angle 3 + m\angle 2 = 180$ → ⑦ $\angle 3$ & $\angle 2$ suppl. → ⑧ $a \parallel b$

① Given
② $\cong$ $\angle$s have = measures.
③ Linear pair are 2 $\angle$s that form straight line.
④ Linear pair are 2 $\angle$s supplementary.
⑤ Suppl. $\angle$s are 2 $\angle$s total 180.
⑥ Substitution Prop.
⑦ Suppl. $\angle$s are 2 $\angle$s that total 180.
⑧ 2 lines w/ trans. & same side int. $\angle$s suppl. → 2 $\parallel$ lines.

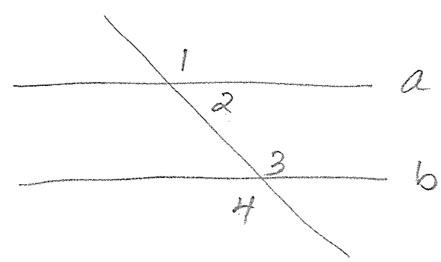
Theorem:

If 2 lines are cut by a transversal and alternate exterior angles are congruent, ~~then~~ then lines are parallel.

Proof:

Given: $\angle 1 \cong \angle 4$

Prove: $a \parallel b$



① $\angle 1 \cong \angle 4$ → ② $m\angle 1 = m\angle 4$

③ $\angle 1$ & $\angle 2$ linear pair → ④ $\angle 1$ Supp $\angle 2$ → ⑤ $m\angle 1 + m\angle 2 = 180$

⑥ $m\angle 2 + m\angle 4 = 180$

⑦ $\angle 3 \cong \angle 4$ → ⑧ $m\angle 3 = m\angle 4$

→ ⑨ $m\angle 2 + m\angle 3 = 180$

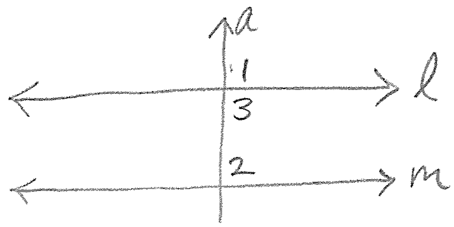
⑩ $\angle 2$ suppl. $\angle 3$ → ⑪ $a \parallel b$

① Given
② $\cong$ $\angle$s have = measures.
③ Linear pair are 2 $\angle$s that form straight line.
④ Linear pair are 2 suppl. $\angle$s.
⑤ Suppl. $\angle$s are 2 $\angle$s that total 180.
⑥ Substitution Prop.
⑦ Vertical $\angle$s $\cong$.
⑧ $\cong$ $\angle$s have = measures.
⑨ Substitution Prop.
⑩ Suppl. $\angle$s are 2 $\angle$s that total 180.
⑪ 2 lines w/ same side int. $\angle$s supp → 2 $\parallel$ lines

Theorem:

If a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other one also.

Given: $l \parallel m$
(Know) $a \perp l$



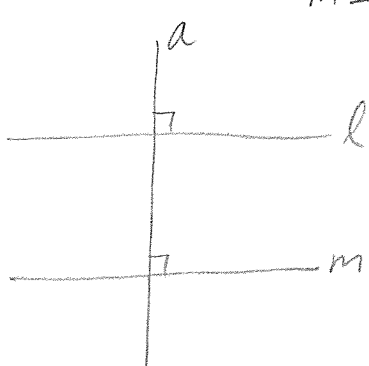
Conclude: $a \perp m$

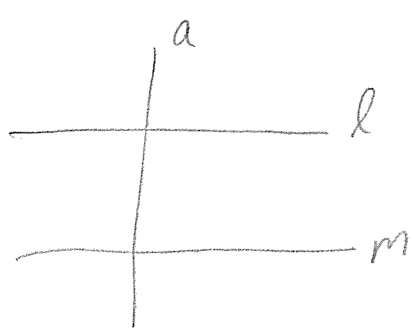
Theorem:

In a plane, two lines perpendicular to the same line are parallel.

Given $l \perp a$
$m \perp a$

Conclude: $l \parallel m$





The first two theorems useful for drawing lines in diagrams:

- Through a point outside a line, there is exactly one line parallel to the given line.

  Given

- Through a point outside a line, there is exactly one line perpendicular to the given line.

  Given

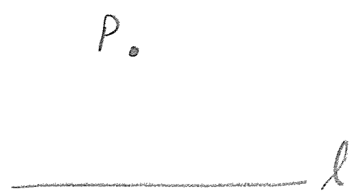
- Two lines parallel to a third line are parallel to each other.

  Given

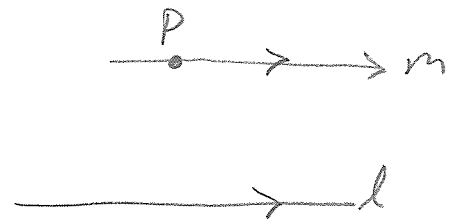
The two postulates are useful for drawing lines in diagrams:

- Parallel Postulate: (Thm in orange book)
  Through a point outside a line, there is exactly one line parallel to the given line.

Given

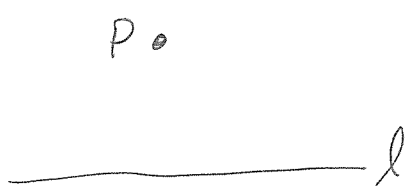


Conclude

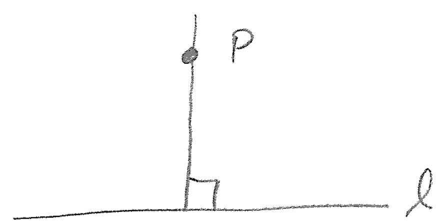


Thm
- Through a point outside a line, there is exactly one line perpendicular to the given line.

Given



Conclude



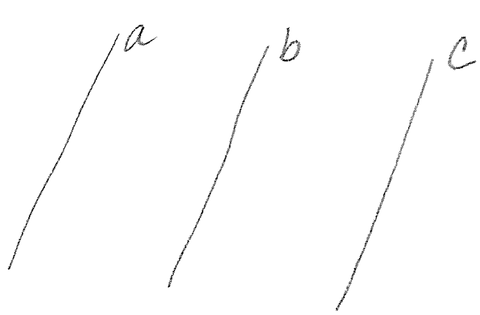
Thm
- Two lines parallel to a third line are parallel to each other.

Given

$a \parallel b$, $c \parallel b$

Conclude

$a \parallel c$



Homework:

Text: p. 163/ Read "Constructing Parallel Lines" section.
Do Example A and B on this page. Do the best you can.