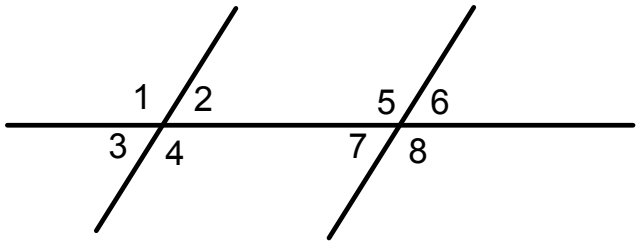
Theorem 17: Equal corresponding angles mean that lines are parallel.
Corollary 1: Equal alternate interior angles mean that lines are parallel.
Corollary 2: Supplementary interior angles on the same side of a transversal mean that lines are parallel.
Corollary 3: In a plane, two lines perpendicular to a third line are parallel.

The Parallel Postulate – Through a point not on a line, there is exactly one line parallel to the given line.
Theorem 18: In a plane, two lines parallel to a third line are parallel to each other.

## 6.4– Parallel Lines and Angles

Theorem 19: Parallel lines form equal corresponding angles.




corresponding pairs:
∠3 & ∠7
∠2 & ∠6
∠1 & ∠5
∠4 & ∠8

Corollary 1: Parallel lines form equal alternate interior angles. ∠4 & ∠5, ∠2 & ∠7

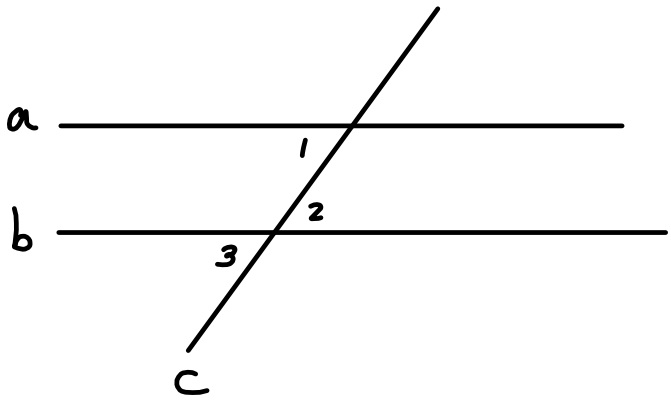
Corollary 2: Parallel lines form supplementary interior angles on the same side of a transversal. ∠2 & ∠5 ; ∠4 & ∠7

Corollary 3: In a plane, a line perpendicular to one of two parallel lines is also perpendicular to the other.

## Proof of Cor 1

Given : $a \parallel b$

Prove : $\angle 1 = \angle 2$



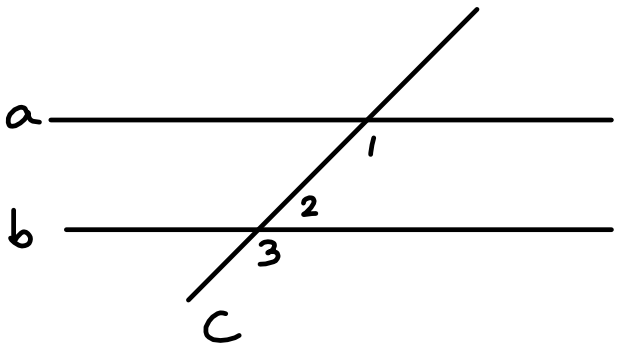

**Proof**

| Statements: | Reasons: |
|---|---|
| 1. $a \parallel b$ | Given |
| 2. $\angle 1 = \angle 3$ | Parallel lines form equal corresponding angles |
| 3. $\angle 3 = \angle 2$ | Vertical angles are equal |
| 4. $\angle 1 = \angle 2$ | Substitution |

## Proof of Cor 2

Given: $a \parallel b$

Prove: $\angle 1$ & $\angle 2$ are supplementary



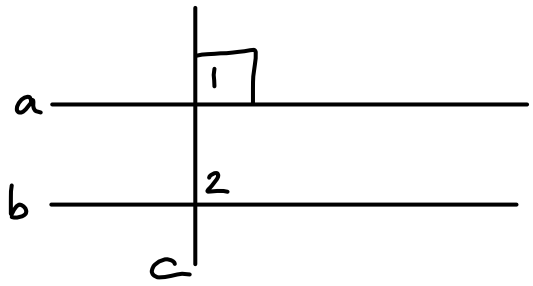

**Proof:**

| Statements | Reasons |
|---|---|
| 1. $a \parallel b$ | Given |
| 2. $\angle 1 = \angle 3$ | Parallel lines form equal corresponding angles |
| 3. $\angle 3$ and $\angle 2$ are supplementary | Angles in a linear pair are supplementary |
| 4. $\angle 1$ and $\angle 2$ are supplementary | Substitution |

Proof of Cor 3

Given: $c \perp a$ & $a \parallel b$

Prove: $c \perp b$

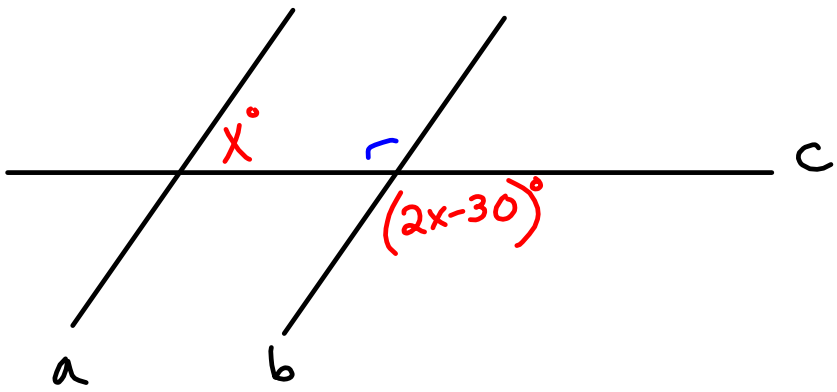



Proof:

| Statements | Reasons |
|---|---|
| 1. $c \perp a$ & $a \parallel b$ | Given |
| 2. $\angle 1 = \angle 2$ | Parallel lines form equal corresponding angles |
| 3. $\angle 1$ is a right angle | Perpendicular lines meet at right angles |
| 4. $\angle 2$ is a right angle | Substitution |
| 5. $c \perp b$ | Perpendicular lines meet at right angles |

SAT Problem

Given: a||b




45. Write an equation relating the measures of the two indicated angles.

$x + 2x - 30 = 180$

46. Find the measure of the acute angle.

$70°$

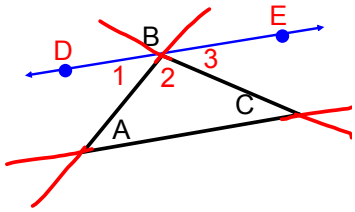
47. Find the measure of the obtuse angle.

$110°$

## 6.5– The Angles of a Triangle

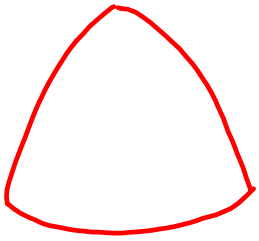
Theorem 20: The Angle Sum Theorem – The sum of the angles of a triangle is 180°.

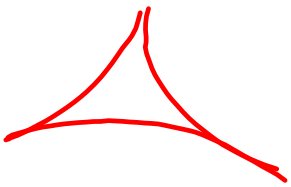
*Given:* ΔABC
*Prove:* ∠A+∠B+∠C=180°




*Proof:*

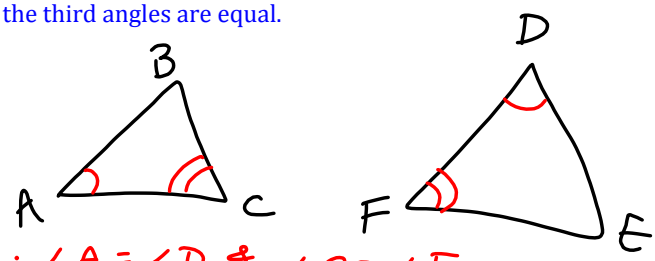
| Statements | Reasons |
|---|---|
| 1. ΔABC | Given |
| 2. Through point B, draw line DE\|\|AC | Parallel Postulate |
| 3. ∠1=∠A and ∠3=∠C | Parallel lines form equal alternate interior angles |
| 4. ∠1+∠2=∠DBC | Betweenness of Rays Theorem |
| 5. ∠DBC and ∠3 are supplementary | Angles in a linear pair are supplementary |
| 6. ∠DBC+∠3=180° | Supplementary ∠'s sum to 180° |
| 7. ∠1+∠2+∠3=180° | Substitution (#4 & #6) |
| 8. ∠A+∠B+∠C=180° | Substitution (#3 & #7) |





In non-Euclidean geometries,
the angles in a triangle do not necessarily sum to 180!
Crocheted hyperbolic planes violating the Parallel Postulate
courtesy http://theiff.org/oexhibits/oe1e.html

Corollary 1: If two angles of one triangle are equal to two angles of another triangle, the third angles are equal.




Given: $\angle A = \angle D$ & $\angle C = \angle F$

Prove: $\angle B = \angle E$

Proof:

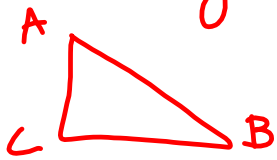
| Statements | Reasons: |
|---|---|
| 1. $\angle A = \angle D$ & $\angle C = \angle F$ | Given |
| 2. $\angle A + \angle B + \angle C = 180^\circ$ & $\angle D + \angle E + \angle F = 180^\circ$ | Triangle Sum Theorem |
| 3. $\angle A + \angle B + \angle C = \angle D + \angle E + \angle F$ | Substitution |
| 4. $\angle D + \angle B + \angle F = \angle D + \angle E + \angle F$ | Substitution (#1 & 3) |
| 5. $\angle B = \angle E$ | Subtraction |

Corollary 2: The acute angles of a right triangle are complementary.

Given: $\triangle ABC$, $\angle C$ is a right angle.

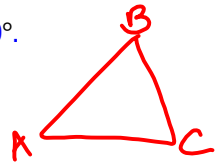
To show: $\angle A$ and $\angle B$ are complimentary

Proof:




| Statements | Reasons |
|---|---|
| 1. $\triangle ABC$, $\angle C$ is a right angle | Given |
| 2. $\angle C = 90^\circ$ | Right angles measure $90^\circ$. |
| 3. $\angle A + \angle B + \angle C = 180^\circ$ | Triangle Sum Theorem |
| 4. $\angle A + \angle B + 90^\circ = 180^\circ$ | Substitution (# 2 & 3) |
| 5. $\angle A + \angle B = 90^\circ$ | Subtraction |
| 6. $\angle A$ & $\angle B$ are complimentary | Complementary $\angle$'s sum to $90^\circ$ |

Corollary 3: Each angle of an equilateral triangle is 60°.




Given: $\triangle ABC$ is equilateral

To show: $\angle A = 60°$, $\angle B = 60°$, & $\angle C = 60°$

Proof:

| Statements | Reasons |
|---|---|
| 1. $\triangle ABC$ is equilateral | Given |
| 2. $\triangle ABC$ is equiangular | Equilateral $\triangle$'s are Equiangular |
| 3. $\angle A = \angle B = \angle C$ | all the $\angle$s in an equiangular $\triangle$ are equal |
| 4. $\angle A + \angle B + \angle C = 180°$ | Triangle Sum Theorem |
| 5. $\angle A + \angle A + \angle A = 180°$<br>$3\angle A = 180°$ | Substitution (& simplification) |
| 6. $\angle A = 60°$ | Division |
| 7. $\angle B = 60°$ & $\angle C = 60°$ | Substitution |

Theorem 20: An exterior angle of a triangle is equal to the sum of the remote interior angles.

HW #1 (submitted Friday, 11/7)
- Ch 1 Review Problems pp. 36-38
- Start working on Geometry badge on Khan Academy

HW #2 (submitted Friday, 11/14)
- Ch 2 Review Problems pp. 71-74
- Ch 3 Review Problems pp. 124-128
- Khan Academy exercises:"Introduction to Euclidean geometry," "Angles and intersecting lines"

HW #3 (submitted Friday, 11/21)
- Ch 4 Review Problems pp.176-180
- Khan Academy exercises: "Congruence"

**HW #4 (due Friday, 12/5)**
- Read Ch 5 & Ch 6
- **Ch 5 Review Problems pp. 206-209**
- Start working on Ch 6 Review Problems (not due until Fri. 12/12)
- Work toward mastery of practiced Khan Academy exercises in "Introduction to Euclidean Geometry," "Angles and Intersecting Lines," and "Congruence"

## Quiz #2 - NOW!