Parallel Lines & Transversals
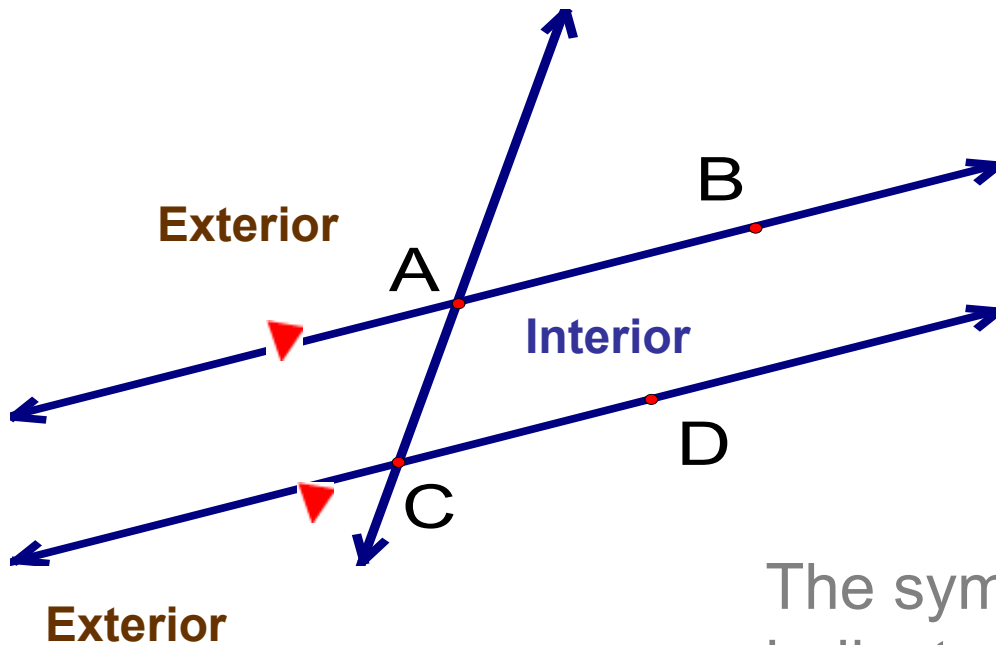
Geometry

Parallel Lines and Transversals

What would you call two lines which do not intersect?
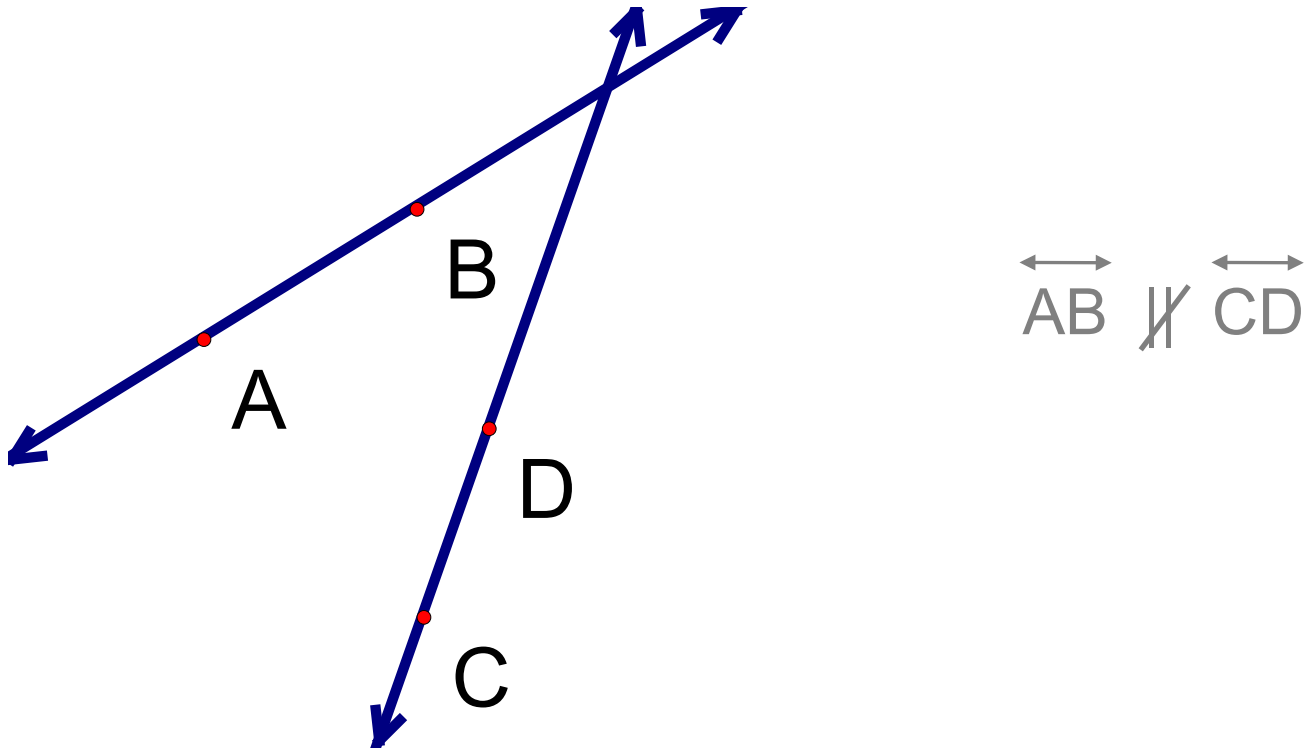
Parallel

Exterior

Interior

A

B

C

D

Exterior

A solid arrow placed on two lines of a diagram indicate the lines are parallel.

The symbol ‖ is used to indicate parallel lines.

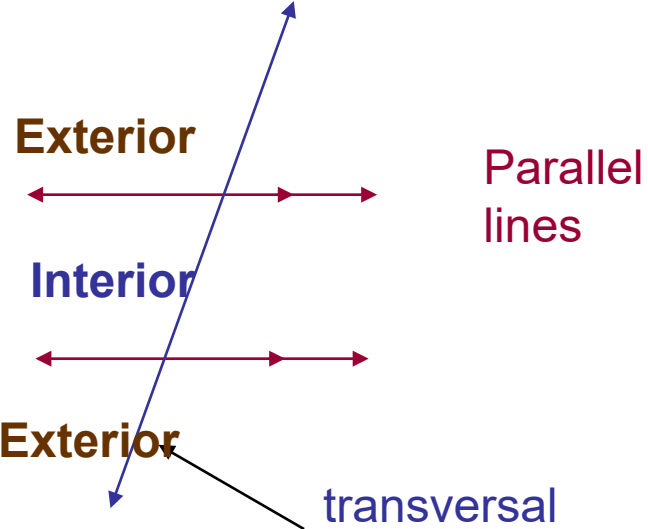$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$

Parallel Lines and Transversals

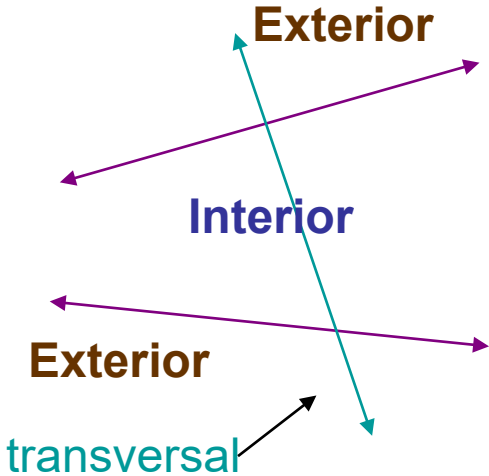A slash through the parallel symbol ∦ indicates the lines are **not** parallel.

$\overleftrightarrow{AB} \nparallel \overleftrightarrow{CD}$

Transversal

A line, ray, or segment that intersects 2 or more COPLANAR lines, rays, or segments.

Exterior

Interior

Exterior

Parallel lines

transversal

Non-Parallel lines

Exterior

Interior

Exterior

transversal
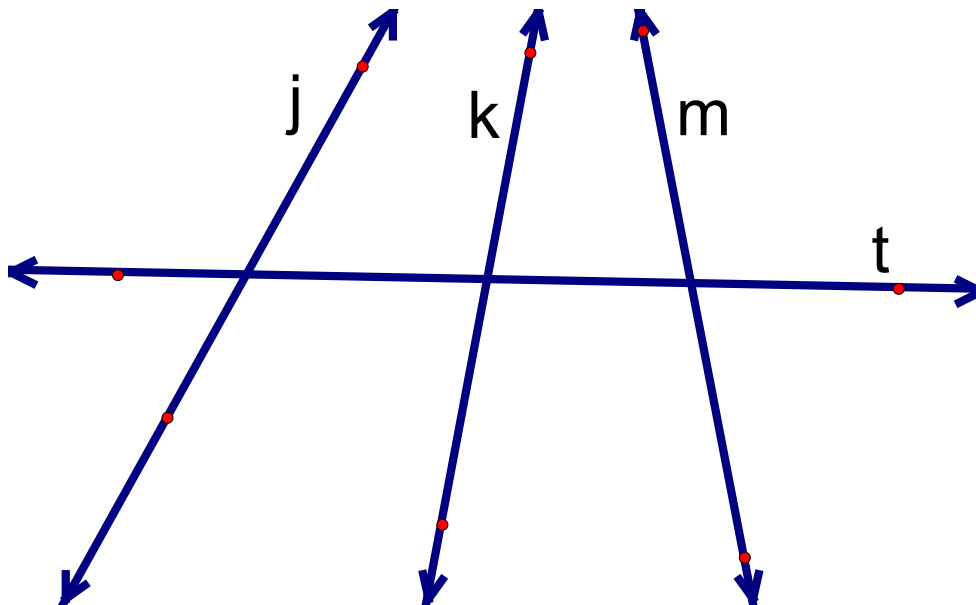
Parallel Lines and Transversals

Transversal -

A transversal is a line which intersects two or more lines in a plane. The intersected lines do not have to be parallel.

Lines j, k, and m are intersected by line t. Therefore, line t is a **transversal** of lines j, k, and m.
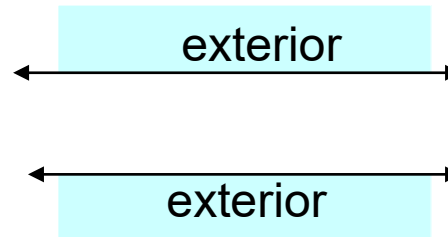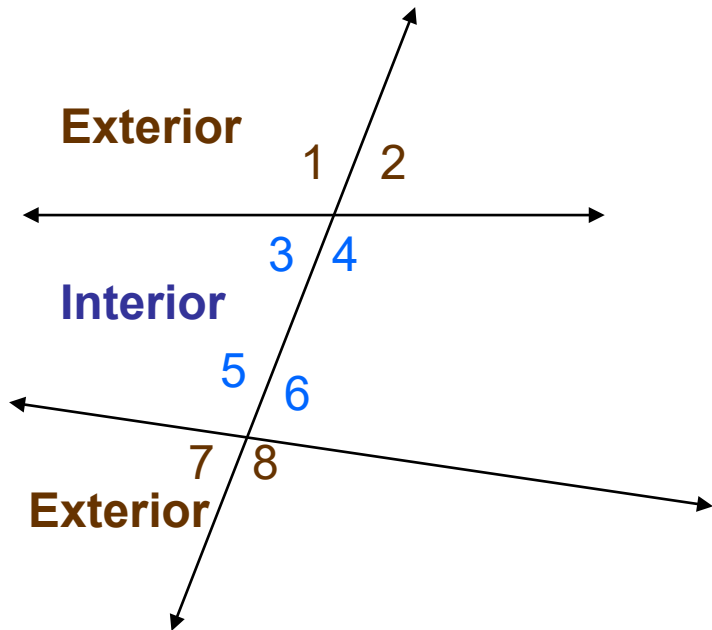
INTERIOR –The space INSIDE the 2 lines

interior

EXTERIOR –The space OUTSIDE the 2 lines

exterior

exterior

Special Angle Relationships

Exterior

Interior

Exterior

1 2

3 4

5 6

7 8

Interior Angles

<3 & <6 are Alternate Interior angles

<4 & <5 are Alternate Interior angles

<3 & <5 are Same Side Interior angles

<4 & <6 are Same Side Interior angles

Exterior Angles

<1 & <8 are Alternate Exterior angles

<2 & <7 are Alternate Exterior angles

<1 & <7 are Same Side Exterior angles

<2 & <8 are Same Side Exterior angles

Special Angle Relationships
WHEN THE LINES ARE PARALLEL

Exterior

1 2

3 4

Interior

5 6

7 8
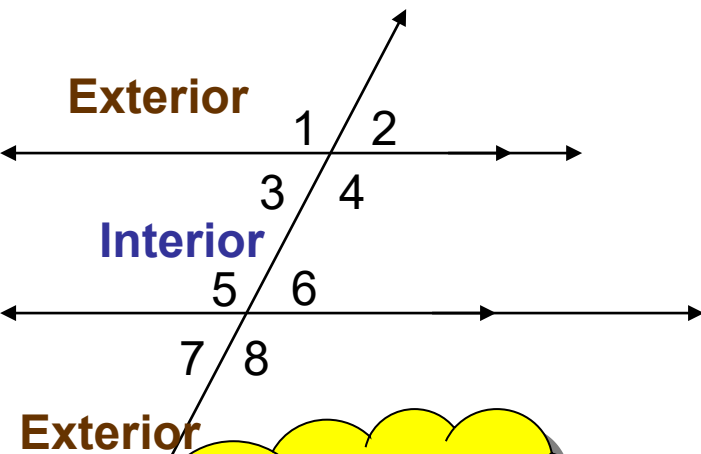
Exterior

If the lines are not parallel, these angle relationships DO NOT EXIST.

♥ *Alternate Interior Angles are CONGRUENT*
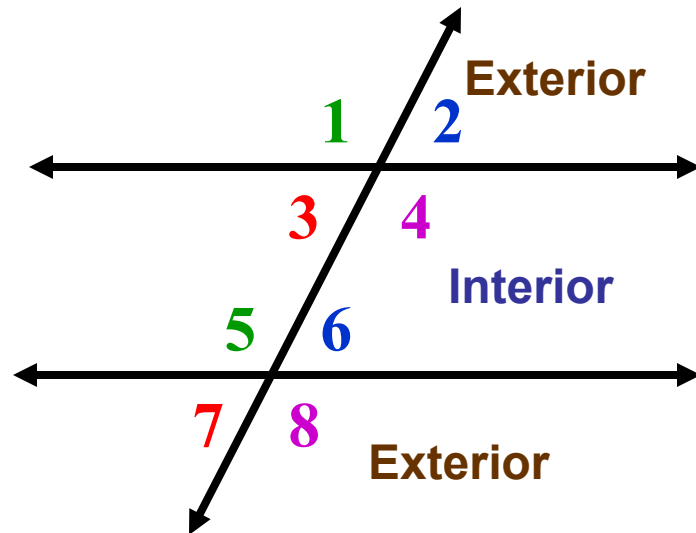
♥ *Alternate Exterior Angles are CONGRUENT*

♥ *Same Side Interior Angles are SUPPLEMENTARY*

♥ *Same Side Exterior Angles are SUPPLEMENTARY*

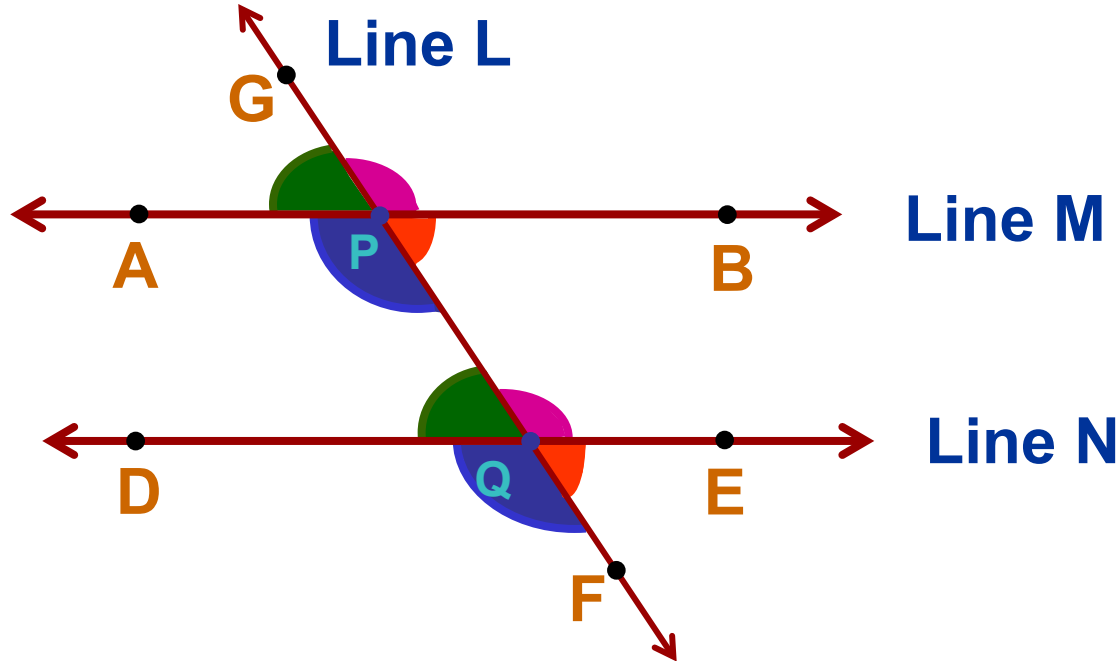# Corresponding Angles & Consecutive Angles

Corresponding Angles: Two angles that occupy corresponding positions.

$$\angle\, 2 \cong \angle\, 6, \; \angle\, 1 \cong \angle\, 5, \; \angle\, 3 \cong \angle\, 7, \; \angle\, 4 \cong \angle\, 8$$

Corresponding Angles

When two parallel lines are cut by a **transversal**, pairs of **corresponding angles** are formed.

Line L

Line M

Line N

G

A

P

B

D

Q

E

F

$\angle GPB = \angle PQE$

$\angle GPA = \angle PQD$

$\angle BPQ = \angle EQF$

$\angle APQ = \angle DQF$

Four pairs of corresponding angles are formed.

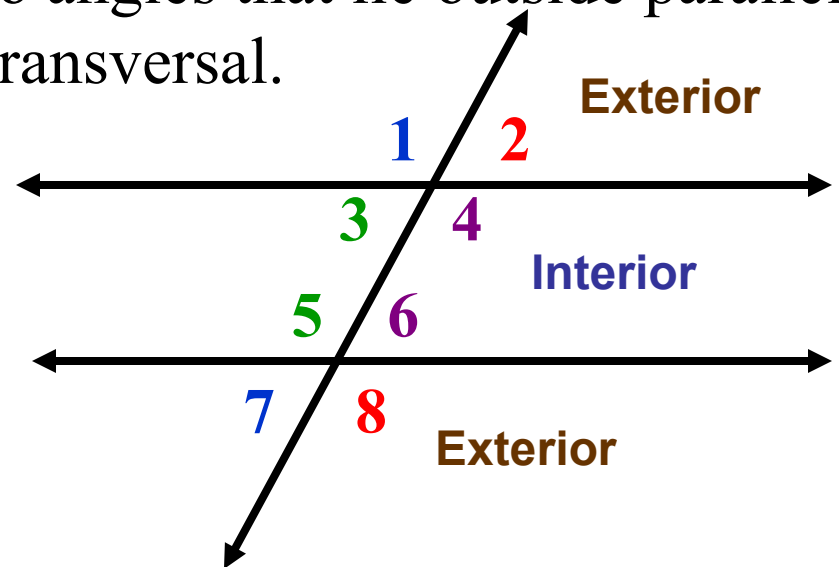Corresponding pairs of angles are **congruent**.

Same Side Interior/Exterior Angles

Same Side Interior Angles: Two angles that lie between parallel lines on the same sides of the transversal.

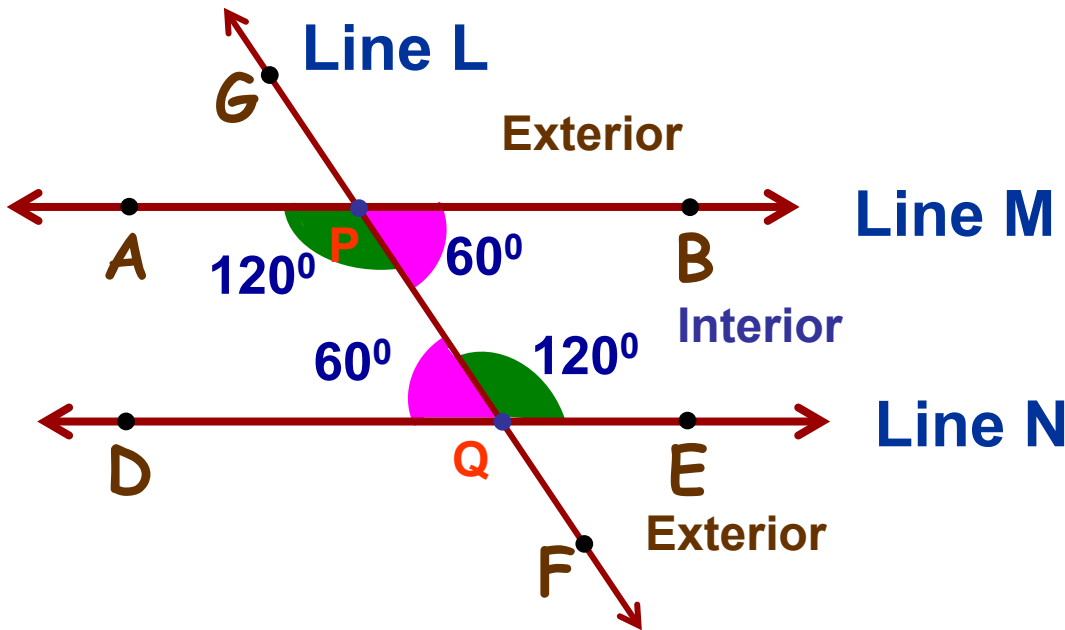$m\angle 3 + m\angle 5 = 180°, m\angle 4 + m\angle 6 = 180°$

Same Side Exterior Angles: Two angles that lie outside parallel lines on the same sides of the transversal.

$m\angle 1 + m\angle 7 = 180°, m\angle 2 + m\angle 8 = 180°$

Exterior

1 2

3 4

Interior

5 6

7 8

Exterior

Interior Angles

The angles that lie in the area between the two parallel lines that are cut by a transversal, are called **interior angles.**

Line L

G

Exterior

Line M

A

120^0

P

60^0

B

Interior

60^0

120^0

Line N

D

Q

E

Exterior

F

$$\angle BPQ + \angle EQP = 180^0$$

$$\angle APQ + \angle DQP = 180^0$$

The measures of interior angles in each pair add up to 180^0.

A pair of interior angles lie on the same side of the transversal.

Alternate Interior/Exterior Angles

- **Alternate Interior Angles:** Two angles that lie between parallel lines on opposite sides of the transversal (but not a linear pair).   ∠ 3 ≅ ∠ 6, ∠ 4 ≅ ∠ 5
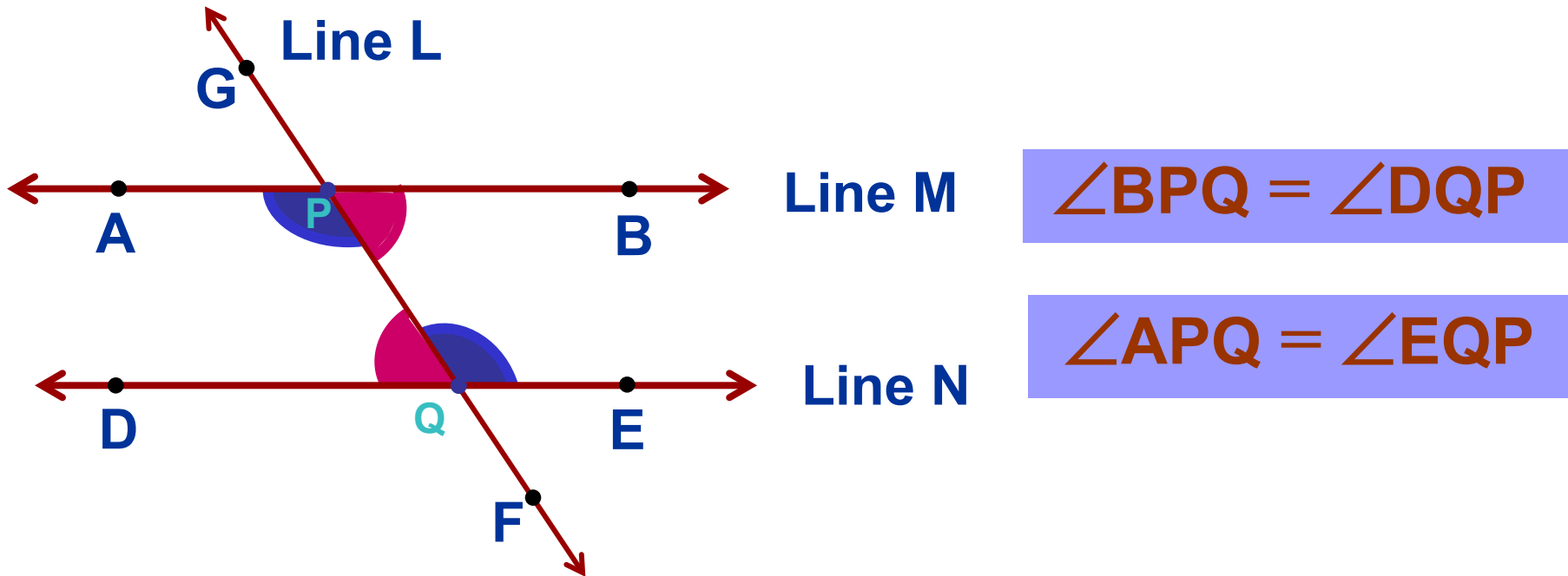
Alternate Exterior Angles: Two angles that lie outside parallel lines on opposite sides of the transversal.
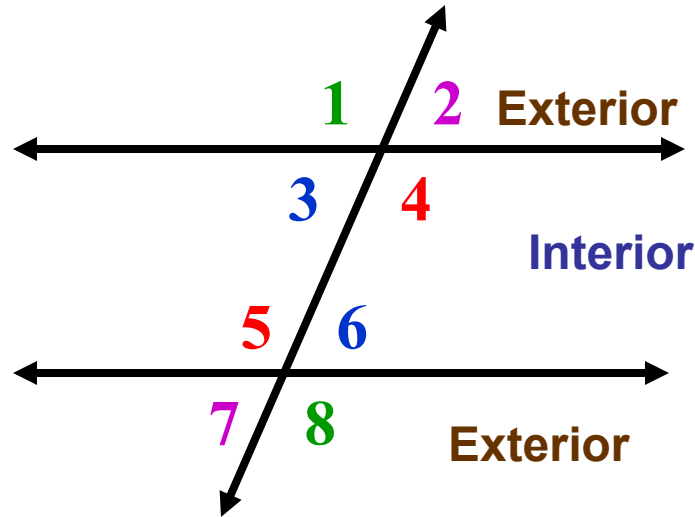
∠ 2 ≅ ∠ 7, ∠ 1 ≅ ∠ 8

Alternate Interior Angles

Alternate angles are formed on opposite sides of the transversal and at different intersecting points.

Line L

G

Line M

A

P

B

$\angle BPQ = \angle DQP$

Line N

D

Q

E

$\angle APQ = \angle EQP$

F

Two pairs of alternate angles are formed.

Pairs of alternate angles are **congruent**.

Let's Practice
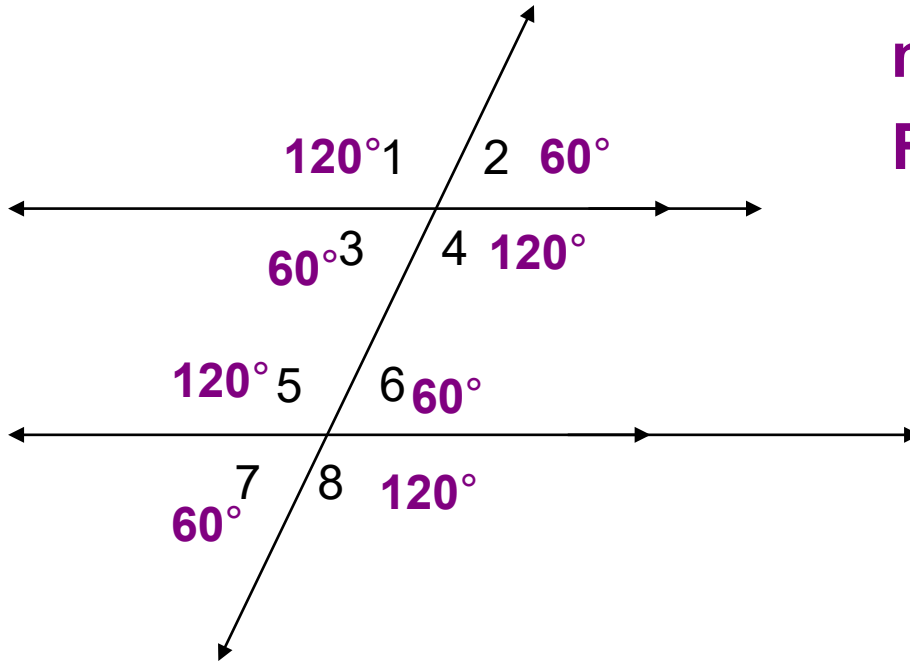
m<1=120°

Find all the remaining angle measures.

120°1   2 **60°**

60°3   4 **120°**

120°5   6**60°**

7   8 **120°**

60°

Another practice problem

40°

60°

180-(40+60)= 80°

80°

40°

60°

100°

80°

60°

120°

80°

100°

120°

60°
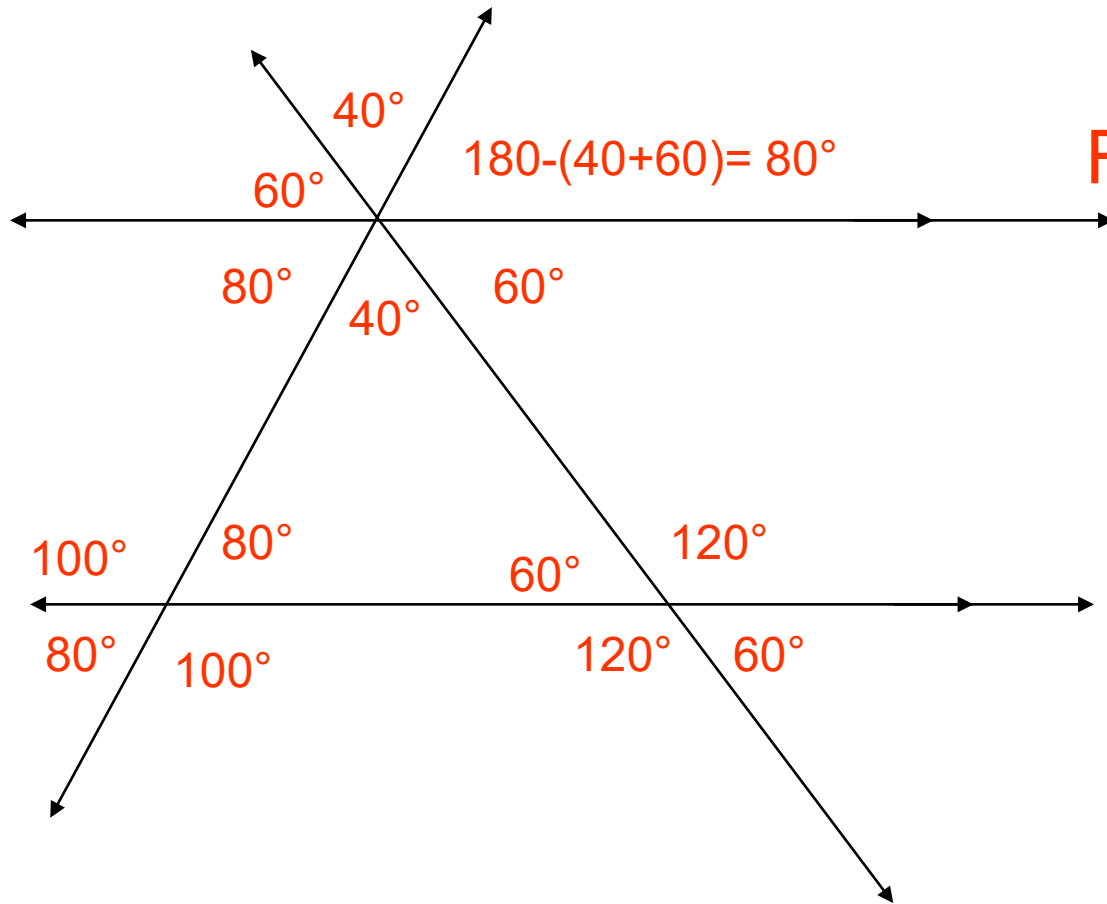
Find all the missing angle measures, and name the postulate or theorem that gives us permission to make our statements.