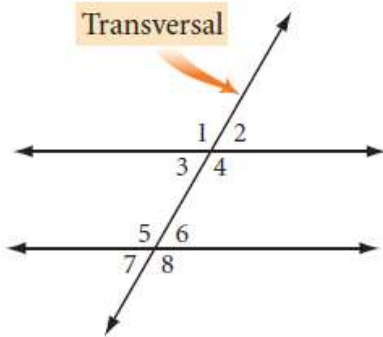
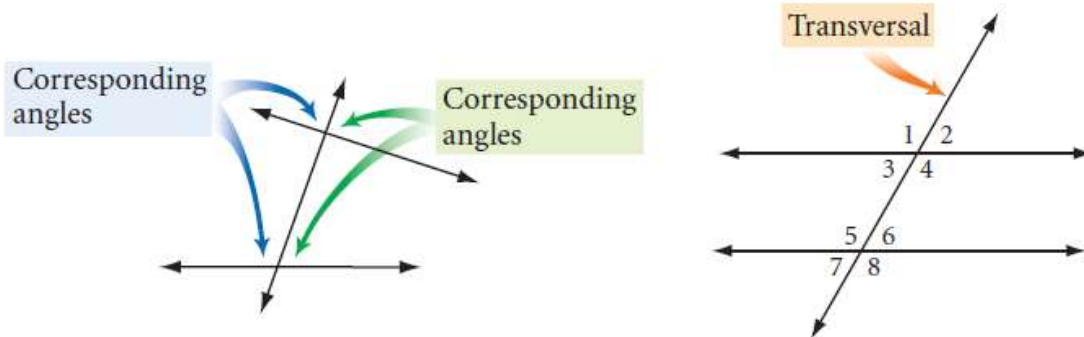


Lesson 2.6 – Special Angles on Parallel Lines

Transversal - A line intersecting two or more other lines in the plane is called a transversal.

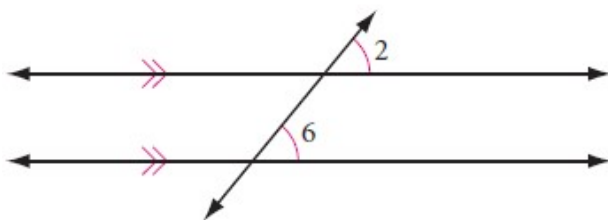


Corresponding Angles - Corresponding angles are angles that are in the same respective place on each of the lines cut by the transversal.



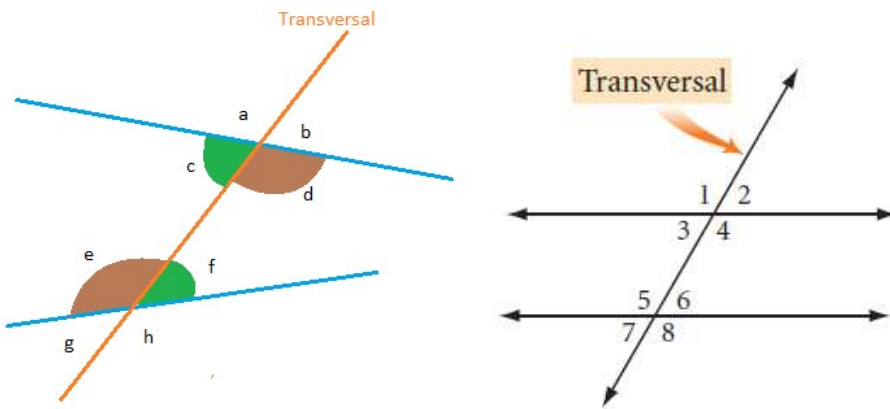
Pairs of Corresponding Angles: $\angle 1$ & $\angle 5$, $\angle 2$ & $\angle 6$, $\angle 3$ & $\angle 7$, $\angle 4$ & $\angle 8$

Corresponding Angles Conjecture (CA Conjecture) - If two parallel lines are cut by a transversal, then corresponding angles are congruent.



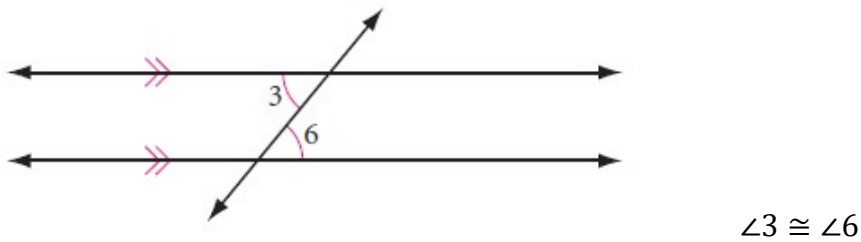
$$\angle 2 \cong \angle 6$$

Alternate Interior Angles - Alternate interior angles fall between the two lines cut by the transversal, and on opposite sides of the transversal.

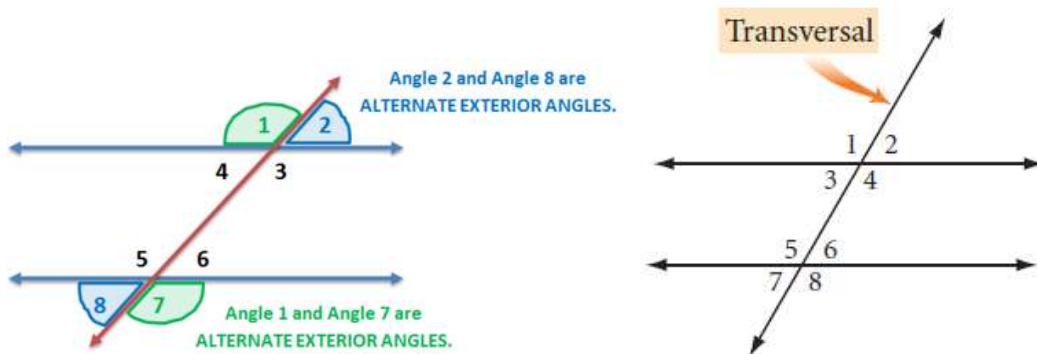


Pairs of Alternate Interior Angles: $\angle 3$ & $\angle 6$, $\angle 4$ & $\angle 5$

Alternate Interior Angle Conjecture (AIA Conjecture) - If two parallel lines are cut by a transversal, then alternate interior angles are congruent.

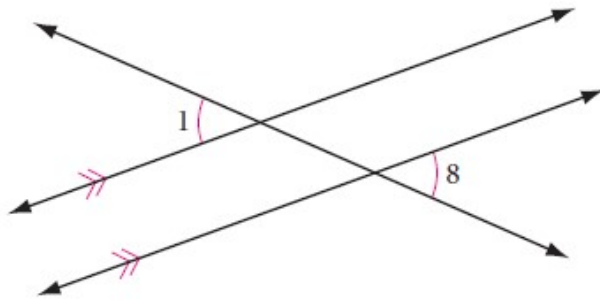


Alternate Exterior Angles - Alternate exterior angles fall outside of the two lines cut by the transversal and on opposite sides of the transversal.



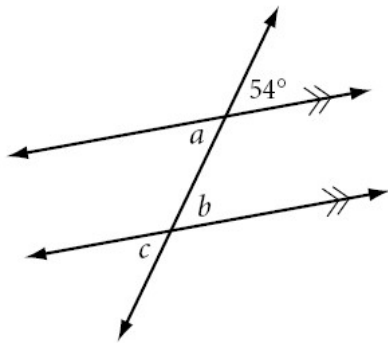
Pairs of Alternate Exterior Angles: $\angle 1$ & $\angle 8$, $\angle 2$ & $\angle 7$

Alternate Exterior Angles Conjecture (AEA Conjecture) - If two parallel lines are cut by a transversal, then alternate exterior angles are congruent.



$$\angle 1 \cong \angle 8$$

Example 1: Find each lettered angle measure using conjectures.

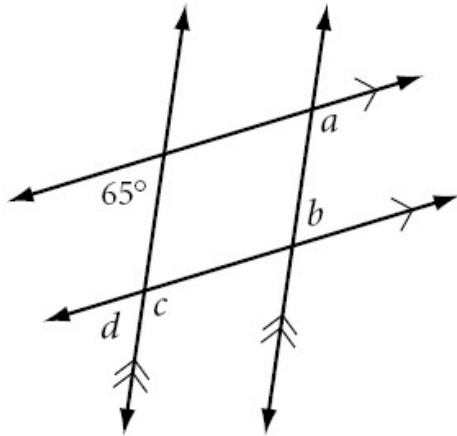


$a = 54^\circ$ a and the 54° angle are vertical angles and are congruent.

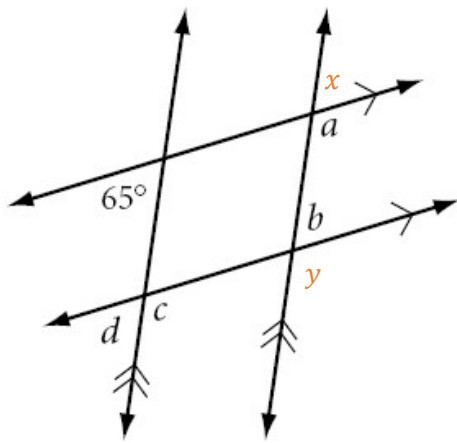
$b = 54^\circ$ b and the 54° angle are corresponding angles on parallel lines and are congruent.

$c = 54^\circ$ c and the 54° angle are alternate exterior angles on parallel lines and are congruent.

Example 2: Find each lettered angle measure using conjectures.



Let's label a couple of angles to make referring to them easier.



x and the 65° angle are alternate exterior angles on parallel lines and are congruent, so $x = 65^\circ$.

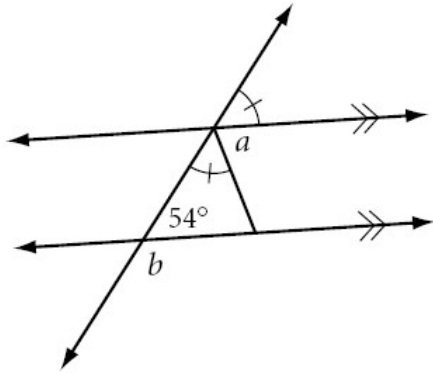
$a = 115^\circ$ a and x are a linear pair of angles.

$b = 65^\circ$ b and y are a linear pair of angles. y and a are corresponding angles on parallel lines and are congruent.

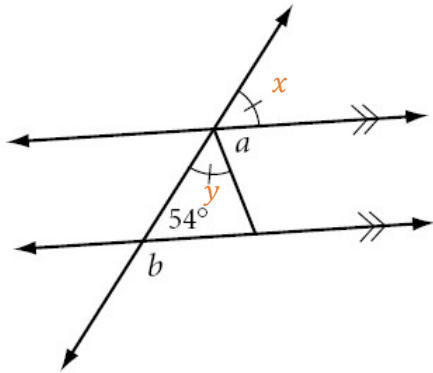
$c = 115^\circ$ c and y are corresponding angles on parallel lines and are congruent.

$d = 65^\circ$ d and b are alternate exterior angles on parallel lines and are congruent.

Example 3: Find each lettered angle measure using conjectures.



Let's label a couple of angles to make referring to them easier.



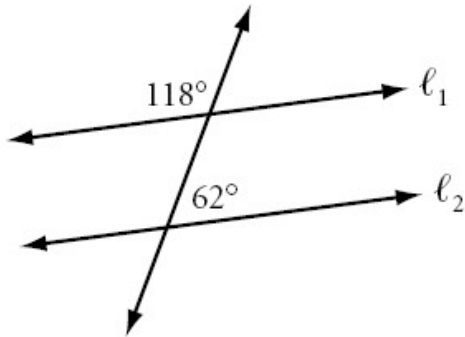
x and the 54° angle are corresponding angles on parallel lines and are congruent, so $x = 54^\circ$.

x and y are marked congruent, so $y = 54^\circ$.

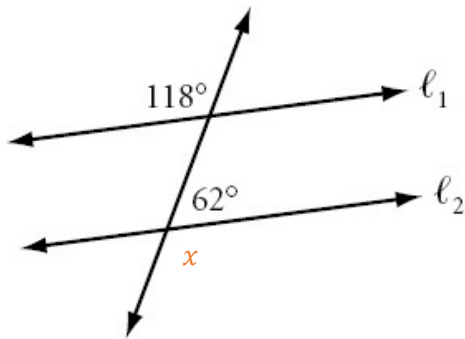
$a = 72^\circ$ a , x and y are supplementary so they add to 180° .

$b = 126^\circ$ b and the 54° angle are a linear pair of angles.

Example 4: Use conjectures to determine whether $\ell_1 \parallel \ell_2$ and explain why. If not enough information is given, write “cannot be determined.”

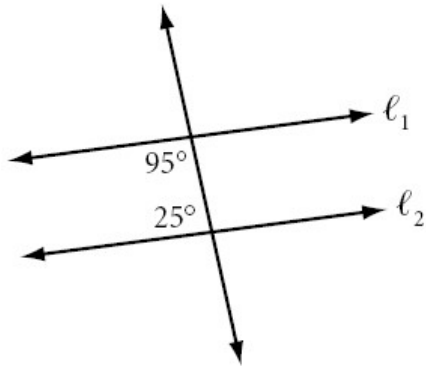


Let's label an angle to make references easier.

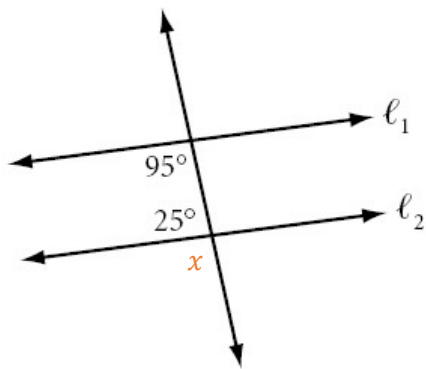


The 62° angle and x form a linear pair of angles and must add to 180° . That means that $x = 118^\circ$. If $\ell_1 \parallel \ell_2$, then the 118° angle and x should be alternate exterior angles on parallel lines and congruent. Since the 118° angle and x are congruent, then $\ell_1 \parallel \ell_2$.

Example 5: Use conjectures to determine whether $\ell_1 \parallel \ell_2$ and explain why. If not enough information is given, write “cannot be determined.”

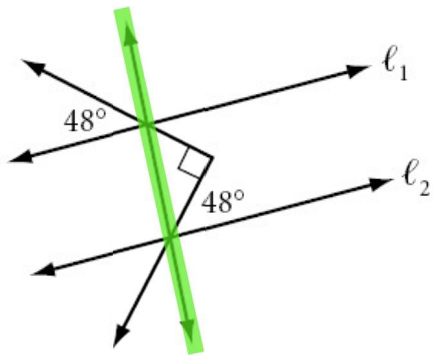
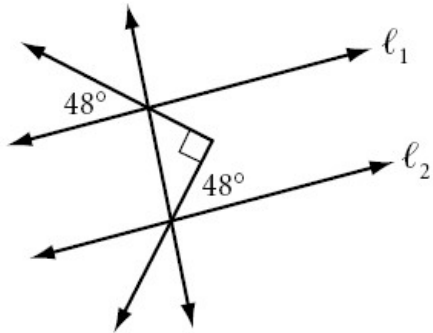


Let's label an angle to make references easier.



The 25° angle and x form a linear pair of angles and must add to 180° . That means that $x = 155^\circ$. If $\ell_1 \parallel \ell_2$, then the 95° angle and x should be corresponding angles on parallel lines and congruent. Since the 95° angle and x are not congruent, then $\ell_1 \nparallel \ell_2$ (the line through parallel mark, means “not”, so we are saying that the lines are not parallel).

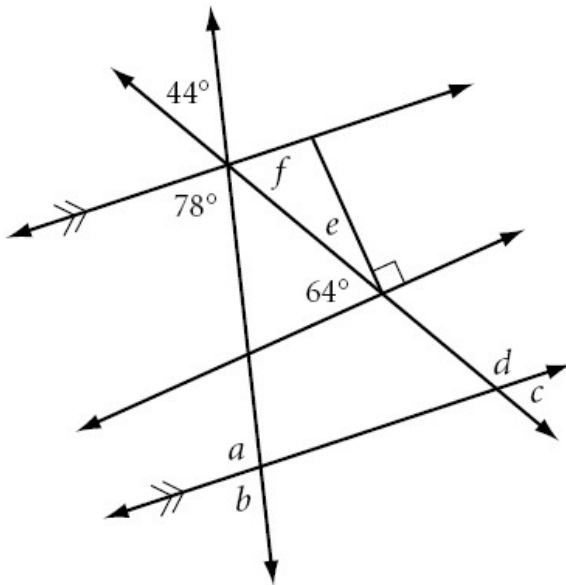
Example 6: Use conjectures to determine whether $\ell_1 \parallel \ell_2$ and explain why. If not enough information is given, write “cannot be determined.”



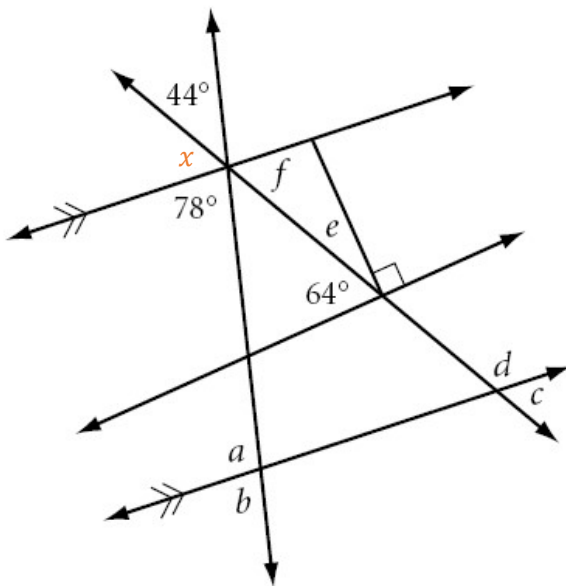
The only line that passes through both ℓ_1 and ℓ_2 is the highlighted line. Since we have no information about any of the angles formed by this line and ℓ_1 or ℓ_2 , there is not enough information.

Cannot be determined.

Example 7: Find each lettered angle measure using conjectures.



Let's label an angle to make references easier.



x , the 44° angle, and the 78° angle are supplementary angles so $x = 58^\circ$.

$a = 102^\circ$ a and b are a linear pair of angles, so solve for b first.

$b = 78^\circ$ b and the 78° angle are corresponding angles on parallel lines and are congruent.

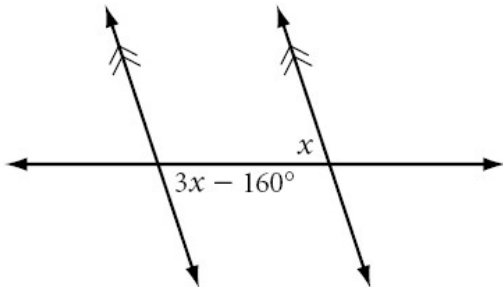
$c = 58^\circ$ c and x are alternate exterior angles on parallel lines and are congruent.

$d = 122^\circ$ c and d are a linear pair of angles.

$e = 26^\circ$ e , the 90° angle, and the 64° angle are supplementary angles.

$f = 58^\circ$ f and x are vertical angles.

Example 8: Find the value of x .



The two angles marked x and $3x - 160^\circ$ are alternate interior angles on congruent lines and must be congruent. Since they are congruent, we can set the angles equal to each other and solve.

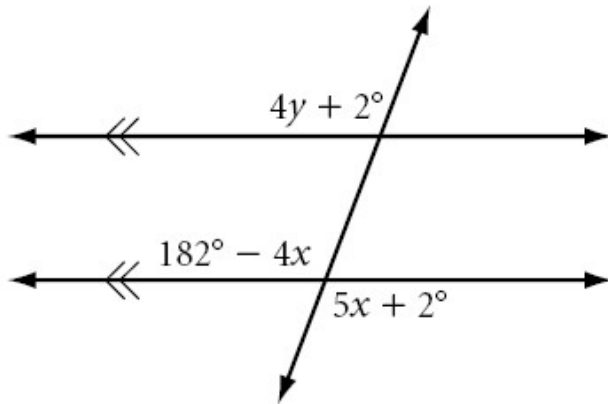
$$x = 3x - 160$$

$$-2x = -160$$

$$x = 80$$

$$x = 80^\circ$$

Example 9: Find the values of x and y .



We should start by comparing angles that have like variables, so let's start with the angles that have an x .

The two angles marked $182^\circ - 4x$ and $5x + 2^\circ$ are vertical angles and must be congruent. Since they are congruent, we can set the angles equal to each other and solve.

$$182 - 4x = 5x + 2$$

$$182 = 9x + 2$$

$$180 = 9x$$

$$20 = x$$

$$x = 20^\circ$$

The two angles marked $182^\circ - 4x$ and $4y + 2^\circ$ are corresponding angles on parallel lines and must be congruent. Since they are congruent, we can set the angles equal to each other and solve.

$$182 - 4x = 4y + 2$$

We also know that $x = 20^\circ$, so we can replace x with 20.

$$182 - 4(20) = 4y + 2$$

$$182 - 80 = 4y + 2$$

$$102 = 4y + 2$$

$$100 = 4y$$

$$25 = y$$

$$y = 25^\circ$$