

# Geometry B Live Lesson Class

U1L4 – Parallel and Perpendicular Lines



# Agenda



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1. Review topics from Unit 1, Lesson 4.

2. Use the 2-column note system to take better notes in math class. Bring your math notebook and pen or pencil to each math LiveLesson class.

# 2-Column Notes Template



1. Announcements/To Do's
2. School-Wide Learner Outcomes
3. LL Objectives
4. Vocabulary words
5. Problems
6. Summary (End of class)

1. Write down important details.
2. What are you going to work on this week?
- 3.
4. Definitions (fill in as we go)
5. Steps to solving problems
6. 1 or 2 sentences about the LL class.

# Reminders and To – Do's



## Information

1. Complete 1 math lesson per day.
2. Check your WebMail every day
3. Be prepared to spend 4 - 6 hours per day on schoolwork.
4. Remind your Learning Coach to take daily attendance

## What to do

1. Go to your Planner in Connexus to find the math lesson for the day
2. Go to Connexus to find WebMail
3. Complete lessons for the day from your Planner. Do not get behind on lessons.
4. Have your Learning Coach log into Connexus daily.

# Reminders and To – Do's



## Information

5. Go to the Message Board first for information about our math class.

6. Contact Mr. Elizondo for math questions.

Remember: You need at least 2 phone calls with Mr. Elizondo per semester.

## What to do

6. Call (559) 549 - 3244 and leave a voicemail if call is not answered.

Make an appointment at:  
<https://elizondo.youcanbook.me>

Send a WebMail

# California Common Core State Standards



- HSG-CO.A.1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
- HSG-CO.C.9: Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
- HSG-CO.D.12: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
- HSG-GPE.B.4: Use coordinates to prove simple geometric theorems algebraically.
- HSG-GPE.B.7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
- HSN-Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

# U1L4 – Objectives

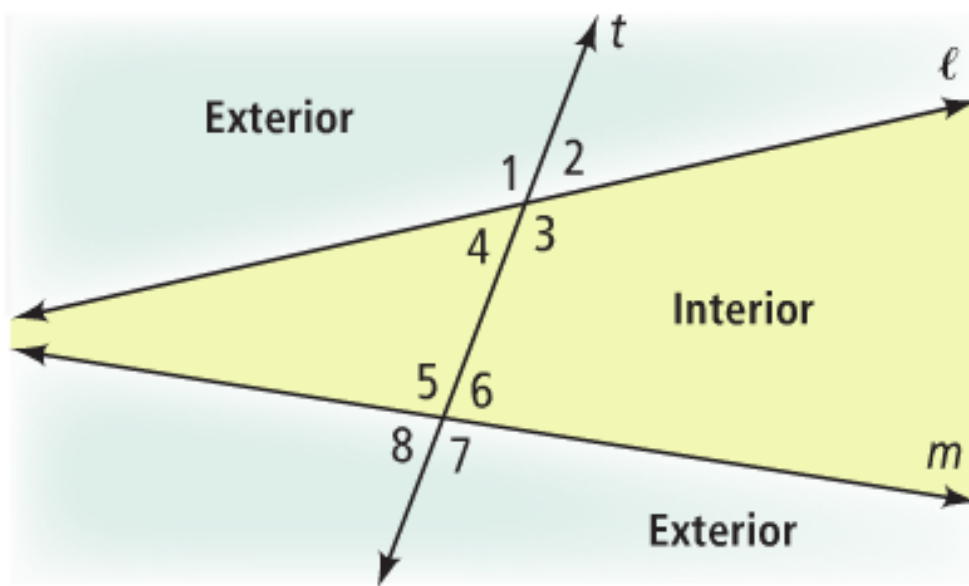


- Identify relationships between figures in space.
- Identify angles formed by two lines and a transversal.
- Prove theorems about parallel lines
- Use properties of parallel lines to find angle measures
- Determine whether two lines are parallel
- Write a flow proof to prove lines are parallel
- Relate parallel and perpendicular lines
- Use parallel lines to prove a theorem about triangles
- Find measures of angles of triangles
- Construct parallel and perpendicular lines
- Construct special quadrilaterals and a regular polygon inscribed in a circle

# U1L4 – Key Words



- A **transversal** is a line that intersects two or more coplanar lines at distinct points. The diagram below shows the eight angles formed by a transversal  $t$  and two lines  $l$  and  $m$ .





# U1L4 – Key Words



take note

## Key Concept Angle Pairs Formed by Transversals

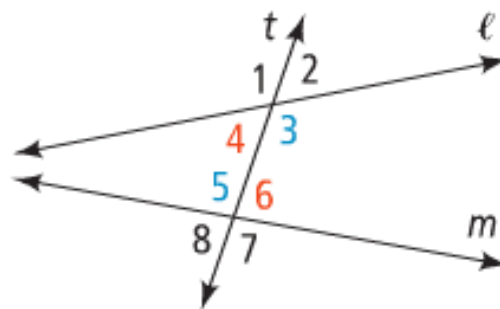
### Definition

**Alternate interior angles** are nonadjacent interior angles that lie on opposite sides of the transversal.

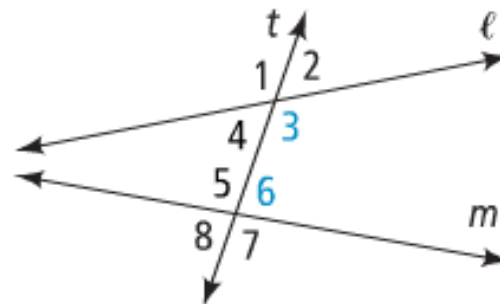
**Same-side interior angles** are interior angles that lie on the same side of the transversal.

### Example

$\angle 4$  and  $\angle 6$   
 $\angle 3$  and  $\angle 5$



$\angle 4$  and  $\angle 5$   
 $\angle 3$  and  $\angle 6$



# U1L4 – Key Words



## Corresponding angles

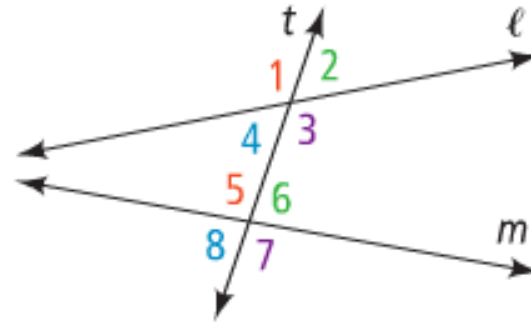
lie on the same side of the transversal  $t$  and in corresponding positions.

$\angle 1$  and  $\angle 5$

$\angle 4$  and  $\angle 8$

$\angle 2$  and  $\angle 6$

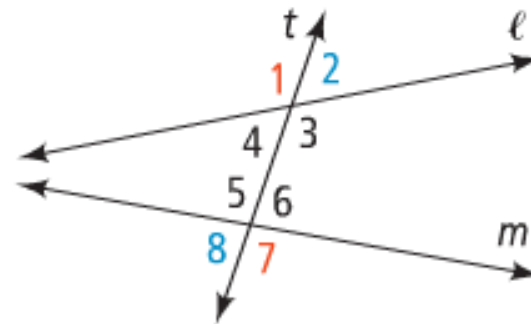
$\angle 3$  and  $\angle 7$



**Alternate exterior angles** are nonadjacent exterior angles that lie on opposite sides of the transversal.

$\angle 1$  and  $\angle 7$

$\angle 2$  and  $\angle 8$



# U1L4 – Concept Corner, Postulates and Theorems



Take note

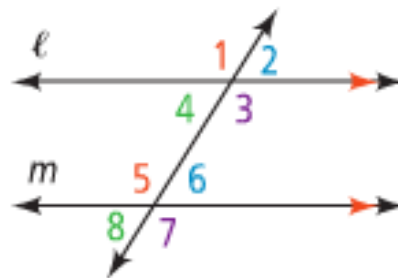
## Postulate 3-1 Corresponding Angles Postulate

### Postulate

If a transversal intersects two parallel lines, then corresponding angles are congruent.

If ...

$$\ell \parallel m$$



Then ...

$$\angle 1 \cong \angle 5$$

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

$$\angle 3 \cong \angle 7$$

$$\angle 4 \cong \angle 8$$

# U1L4 – Concept Corner, Postulates and Theorems

take note

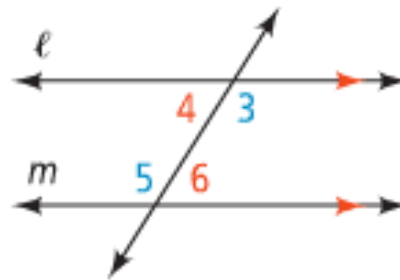
## Theorem 3-1 Alternate Interior Angles Theorem

### Theorem

If a transversal intersects two parallel lines, then alternate interior angles are congruent.

If ...

$$\ell \parallel m$$



Then ...

$$\angle 4 \cong \angle 6$$

$$\angle 3 \cong \angle 5$$

# U1L4 – Concept Corner, Postulates and Theorems

take note

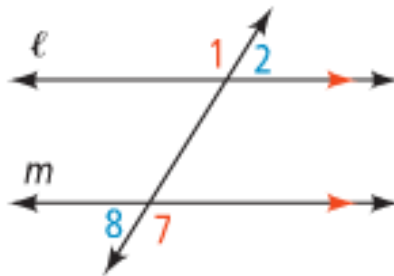
## Theorem 3-3 Alternate Exterior Angles Theorem

### Theorem

If a transversal intersects two parallel lines, then alternate exterior angles are congruent.

If ...

$$\ell \parallel m$$



Then ...

$$\angle 1 \cong \angle 7$$

$$\angle 2 \cong \angle 8$$

# U1L4 – Concept Corner, Postulates and Theorems



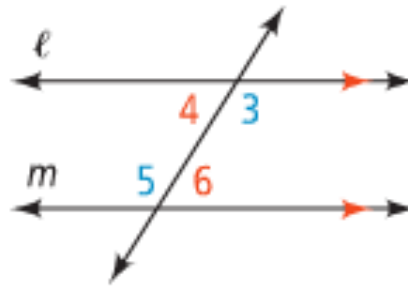
## Theorem 3-2 Same-Side Interior Angles Theorem

### Theorem

If a transversal intersects two parallel lines, then same-side interior angles are supplementary.

If ...

$$\ell \parallel m$$



Then ...

$$m\angle 4 + m\angle 5 = 180$$

$$m\angle 3 + m\angle 6 = 180$$

# U1L4 – Concept Corner, Postulates and Theorems



take note

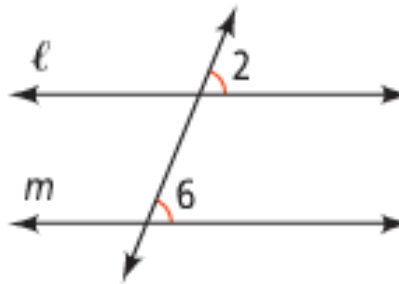
## Postulate 3-2 Converse of the Corresponding Angles Postulate

### Postulate

If two lines and a transversal form corresponding angles that are congruent, then the lines are parallel.

If ...

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



Then ...

$$l \parallel m$$

# U1L4 – Concept Corner, Postulates and Theorems

take note

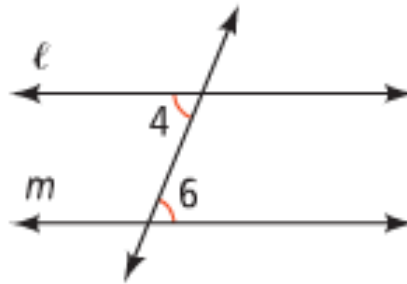
## Theorem 3-4 Converse of the Alternate Interior Angles Theorem

### Theorem

If two lines and a transversal form alternate interior angles that are congruent, then the two lines are parallel.

If ...

$$\angle 4 \cong \angle 6$$



Then ...

$$l \parallel m$$



# U1L4 – Concept Corner, Postulates and Theorems

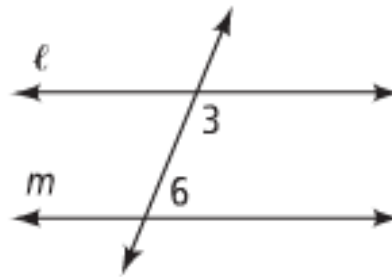
## Theorem 3-5 Converse of the Same-Side Interior Angles Theorem

### Theorem

If two lines and a transversal form same-side interior angles that are supplementary, then the two lines are parallel.

If ...

$$m\angle 3 + m\angle 6 = 180$$



Then ...

$$l \parallel m$$

*You will prove Theorem 3-5 in Exercise 29.*

# U1L4 – Concept Corner, Postulates and Theorems

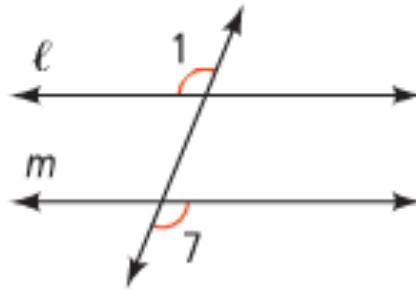
## Theorem 3-6 Converse of the Alternate Exterior Angles Theorem

### Theorem

If two lines and a transversal form alternate exterior angles that are congruent, then the two lines are parallel.

If ...

$$\angle 1 \cong \angle 7$$



Then ...

$$l \parallel m$$

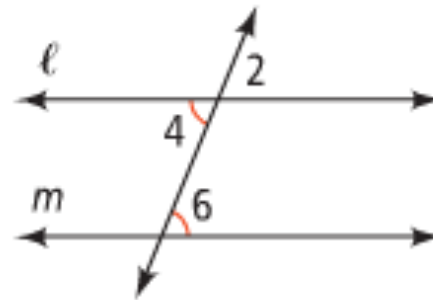
# U1L4 – Concept Corner, Proof of Theorem



## **Proof** Proof of Theorem 3-4: Converse of the Alternate Interior Angles Theorem

**Given:**  $\angle 4 \cong \angle 6$

**Prove:**  $\ell \parallel m$



$$\angle 4 \cong \angle 6$$

Given

$$\angle 2 \cong \angle 4$$

Vertical  $\angle$ s are  $\cong$ .

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

Transitive  
Property of  $\cong$

$$\ell \parallel m$$

If corresp.  $\angle$ s are  $\cong$ ,  
then the lines are  $\parallel$ .

# U1L4 – Concept Corner, Theorems



take note

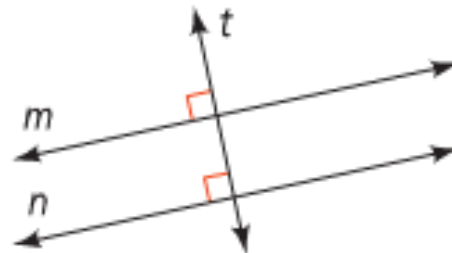
## Theorem 3-8

### Theorem

In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

If ...

$m \perp t$  and  $n \perp t$



Then ...

$m \parallel n$

## U1L4 – Concept Corner, Perpendicular Transversal Theorem



take note

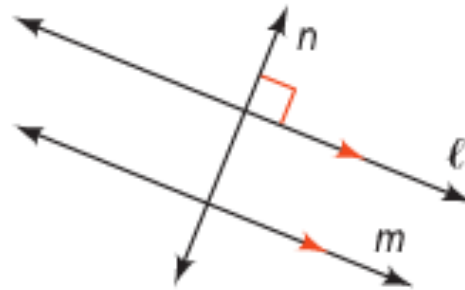
### Theorem 3-9 Perpendicular Transversal Theorem

#### Theorem

In a plane, if a line is perpendicular to one of two parallel lines, then it is also perpendicular to the other.

If ...

$n \perp \ell$  and  $\ell \parallel m$



Then ...

$n \perp m$

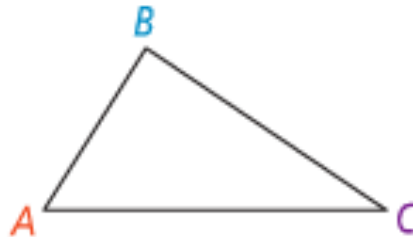
## U1L4 – Concept Corner, Triangle Angle-Sum Theorem



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### Theorem 3-10 Triangle Angle-Sum Theorem

The sum of the measures of the angles of a triangle is 180.



$$m\angle A + m\angle B + m\angle C = 180$$

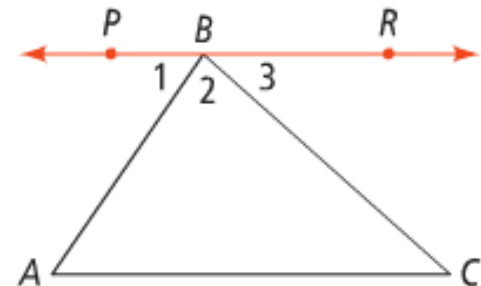
## U1L4 – Concept Corner, Proof of Triangle Angle-Sum Theorem



### Proof of Theorem 3-10: Triangle Angle-Sum Theorem

**Given:**  $\triangle ABC$

**Prove:**  $m\angle A + m\angle 2 + m\angle C = 180$



#### Statements

- 1) Draw  $\overleftrightarrow{PR}$  through  $B$ , parallel to  $\overline{AC}$ .
- 2)  $\angle PBC$  and  $\angle 3$  are supplementary.
- 3)  $m\angle PBC + m\angle 3 = 180$
- 4)  $m\angle PBC = m\angle 1 + m\angle 2$
- 5)  $m\angle 1 + m\angle 2 + m\angle 3 = 180$
- 6)  $\angle 1 \cong \angle A$  and  $\angle 3 \cong \angle C$
- 7)  $m\angle 1 = m\angle A$  and  $m\angle 3 = m\angle C$
- 8)  $m\angle A + m\angle 2 + m\angle C = 180$

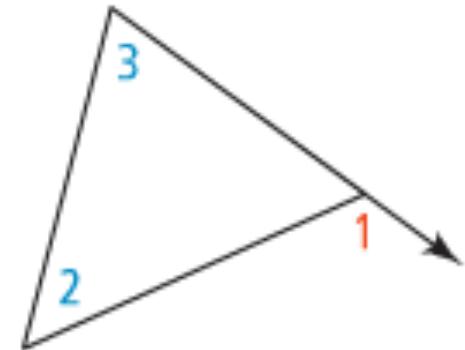
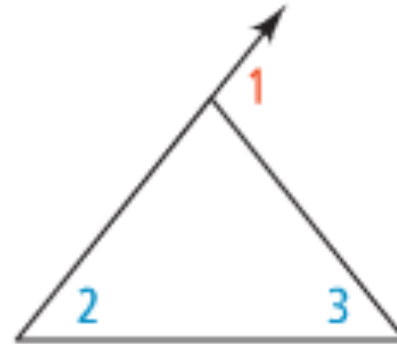
#### Reasons

- 1) Parallel Postulate
- 2)  $\sphericalangle$  that form a linear pair are suppl.
- 3) Definition of suppl.  $\sphericalangle$
- 4) Angle Addition Postulate
- 5) Substitution Property
- 6) If lines are  $\parallel$ , then alternate interior  $\sphericalangle$  are  $\cong$ .
- 7) Congruent  $\sphericalangle$  have equal measure.
- 8) Substitution Property

## U1L4 – Key Words



- An **exterior angle** of a polygon is an angle formed by a side and an extension of an adjacent side.
- For each exterior angle of a triangle, the two nonadjacent interior angles are its **remote interior angles**.





# U1L4 – Concept Corner, Triangle Exterior Angle Theorem

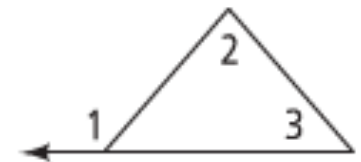


take note

## Theorem 3-11 Triangle Exterior Angle Theorem

The measure of each exterior angle of a triangle equals the sum of the measures of its two remote interior angles.

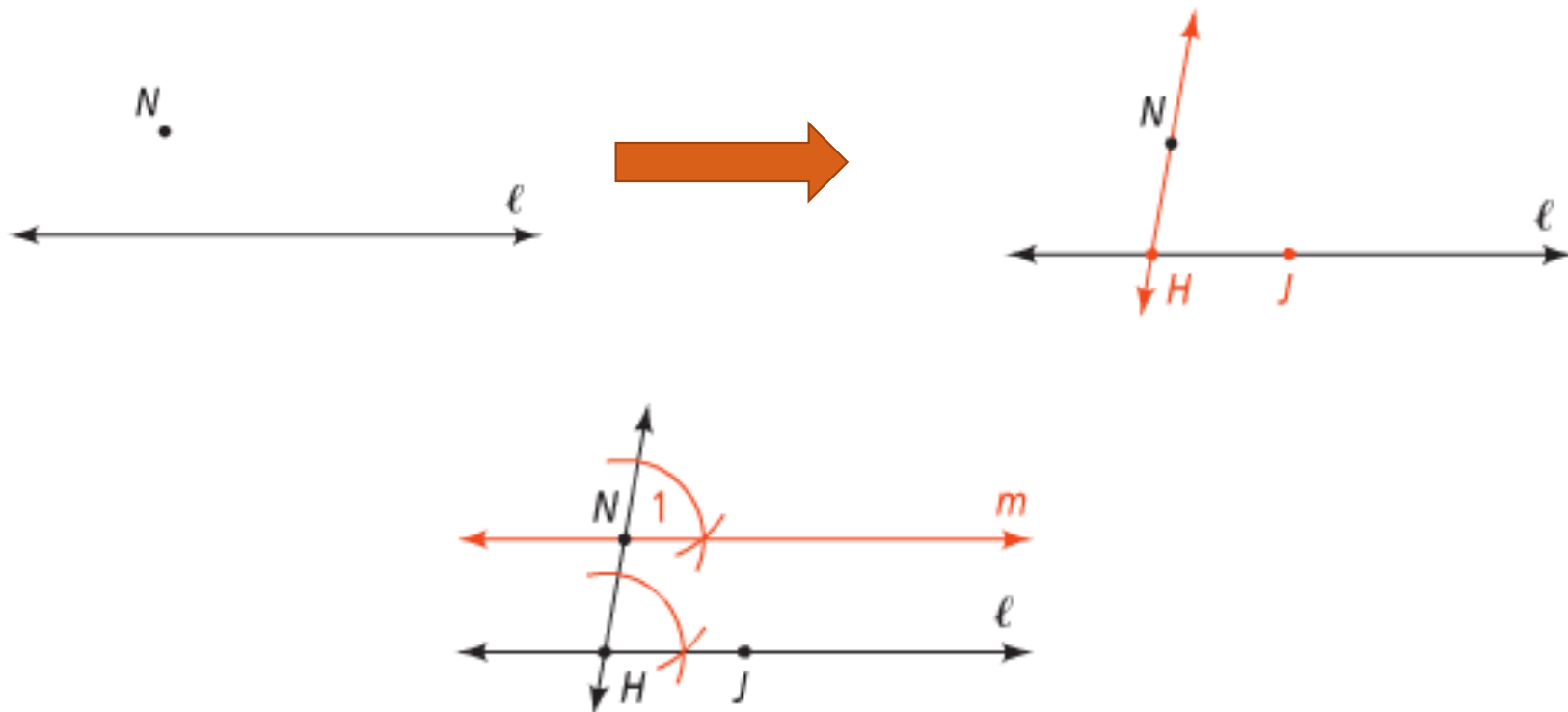
$$m\angle 1 = m\angle 2 + m\angle 3$$



## U1L4— Practice Problems, Constructing Parallel and Perpendicular Lines



Misty is doing a construction for her Geometry course. Look at the steps of the construction below. What is she trying to construct?

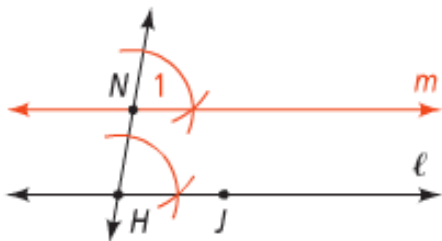


## U1L4 – Practice Problems, Constructing Parallel and Perpendicular Lines

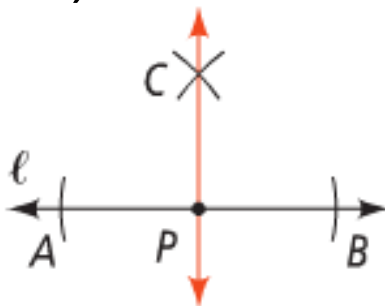


Peter is trying to construct the perpendicular to a given line at a given point not on the line. What should his construction look like at the end?

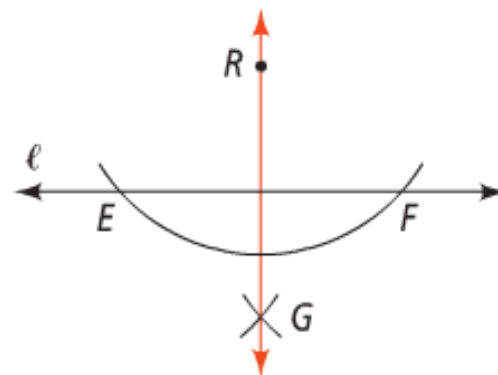
A)



B)



C)



# Questions?

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- You can also make an appointment at <https://elizondo.youcanbook.me>
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