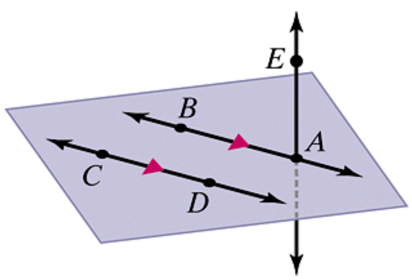
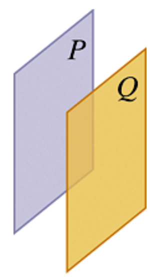
MAT 222

Chapter 3: Things To Know

Section 3.1 Lines and Angles

Objectives:	Vocabulary:
1. Identify Relationships Between Lines and Planes that Do Not Intersect. 2. Learn the Names of Angles Formed by Lines and a Transversal	• parallel lines • skew lines • parallel planes • parallel segments • transversal • interior angles • exterior angles • alternate interior angles • same-side interior angles • consecutive interior angles • corresponding angles • alternate exterior angles

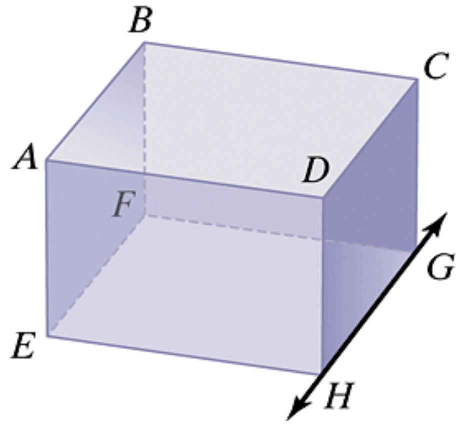




Definition	Examples/ How to Name It
______________________________ are coplanar lines that do not intersect. The symbol ‖ means ______________________.	
_________________________ are noncoplanar; they are not parallel and do not intersect.	
______________________________ are planes that do not intersect.	

Example Identifying Lines and Planes that do not Intersect

Recall that each segment in the figure shown is part of a line, as shown for $\overleftrightarrow{GH}$. Answer the questions based on the appearance of the figure.



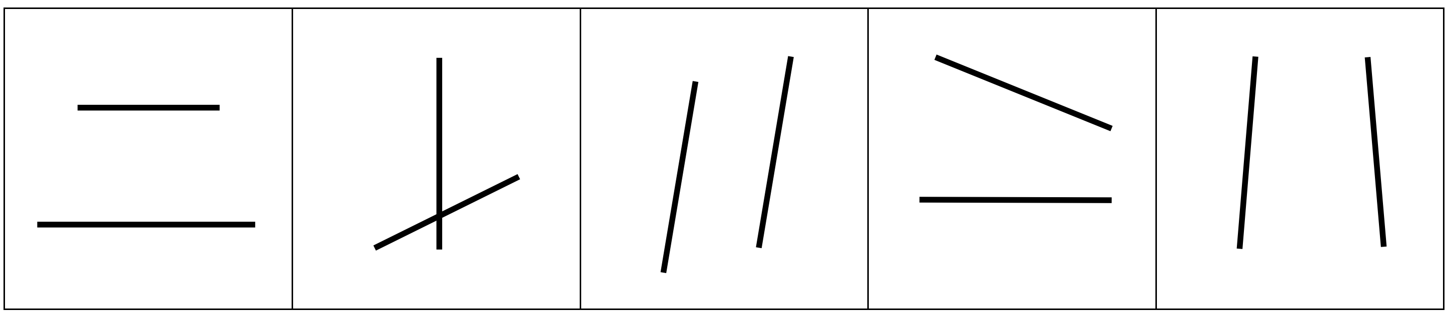
a. Which line(s) are parallel to $\overleftrightarrow{GH}$?

b. Which line(s) are skew to $\overleftrightarrow{GH}$ and also pass through point A?

c. Name any line(s) perpendicular to $\overleftrightarrow{GH}$.

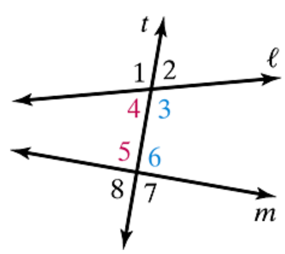
d. Name any plane(s) parallel to plane $CDHG$.

Example Circle the parallel segments in figures below.



Fill in the table with examples of the following vocabulary words from the figure to the right.

	# of examples	Example(s)
transversal	1	
alternate-interior angles	2 pairs	
same-side interior angles	2 pairs	
corresponding angles	4 pairs	
alternate-exterior angles	2 pairs	
same-side exterior angles	2 pairs	



Example Classifying an Angle Pair

The photo shows the Hearst Building in New York City. The new tower (showing many triangles) was completed in 2006. Fill in the blank.

a. 1 and 5 are ______________________________ angles.

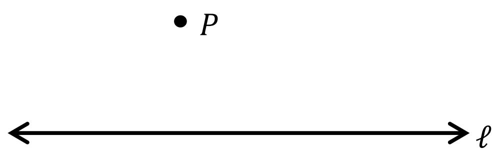
b. 2 and 7 are ______________________________ angles.

Section 3.2 Proving Lines are Parallel

Objectives:	Vocabulary:
• Use Theorems to Prove that Two Lines are Parallel. • Use Algebra for Find the Measures of Angles Needed so that Lines are Parallel.	• flow proof

We'll start this section with some postulates and theorems, including a real **VIP** (very important postulate). Take some notes about the various postulates/theorems in the boxes below.

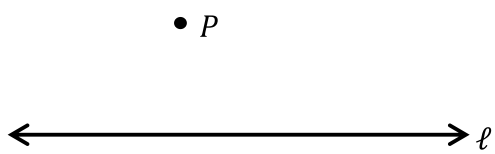
The Parallel Postulate



If..

then…

The Perpendicular Postulate



If..

then…

Theorem Two Lines Perpendicular to a Third Line

If..

then…

Theorem Alternate Interior Angles

If..

then…

Theorem Corresponding Angles

If..

then…

Theorem Same Side Interior Angles

If..

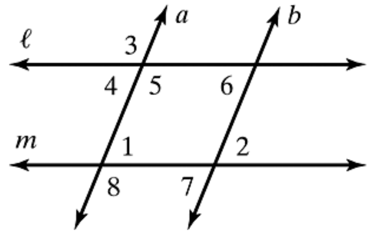
then…

Theorem Alternate Interior Angles

If..

then…

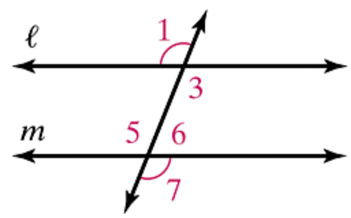
Example Identifying Parallel Lines
Which lines are parallel if $\angle 1 \cong \angle 7$? Justify your answer.



Note: We **CANNOT** say that $\ell \parallel m$ based on the info given, even though it appears that these lines might be parallel. We simply don't have any information about line ℓ.

In the PowerPoint, the Alternate Exterior Angles Theorem is proven using a style called a **flow proof**. This is another nice format for proofs to come in, but, like we said in Section 2.7, all of the proofs we'll use this semester will be in table format. It will therefore be a good exercise for you to translate the flow proof into a table proof format. *The following is a good representation of what test questions could look like—fill in the blank style proofs.*

Example Writing a **Table Proof** of the Alternate Exterior Angles Theorem

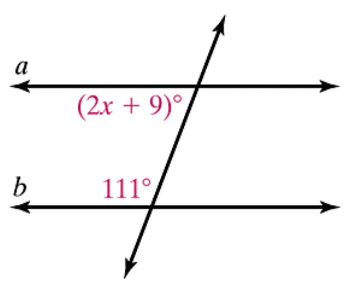


Given: $\angle 1 \cong \angle 7$

Prove: $\ell \parallel m$

Statements	Reasons
1. $\angle 1 \cong \angle 7$	
	2. Vertical angles are congruent.
	3. Substitution/Transitive Property
4. $\ell \parallel m$	

Example Using Algebra to Prove Lines are Parallel
What is the value of x that makes $a \parallel b$?



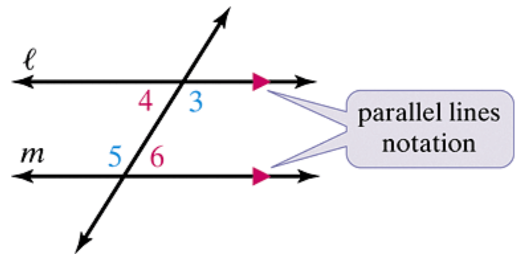
Section 3.3 Parallel Lines and Angles Formed by Transversals

Objectives:	Vocabulary:
1. Prove and Use Theorems About Parallel Lines Cut by a Transversal. 2. Use Algebra to Find Measures of Angles Formed by Parallel Lines Cut by a Transversal.	• No new vocabulary

Theorem Alternate Interior Angles Converse

If..

then…



Remember!

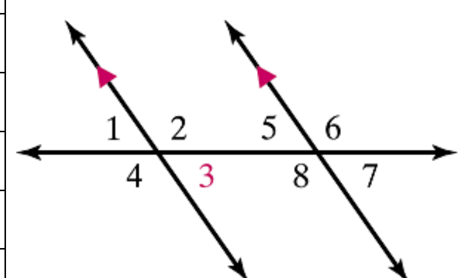
Statement + Converse = Biconditional

So we have that lines are parallel if alternate interior angles are congruent, *and vice versa.*

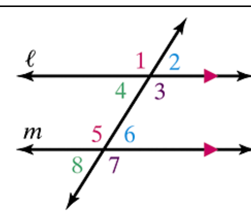
Example Finding Angle Measures

Using the figure shown and given that $m\angle 3 = 55°$, find the measure of each angle. Tell what theorem or postulate you used.

Angle	Measure	Justification
$\angle 1$		
$\angle 2$		
$\angle 3$	55°	Given
$\angle 4$		
$\angle 5$		
$\angle 6$		
$\angle 7$		
$\angle 8$		



Theorems Converses of Angle Pair Theorems

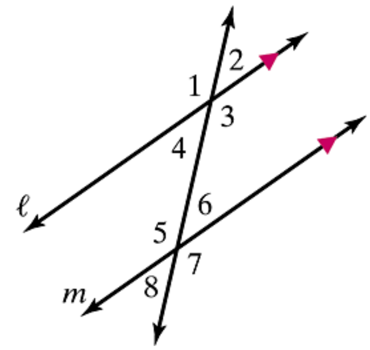


If $\ell \parallel m$, then… ______________________________ (Corresponding Angles)

______________________________ (Same-Side Interior)

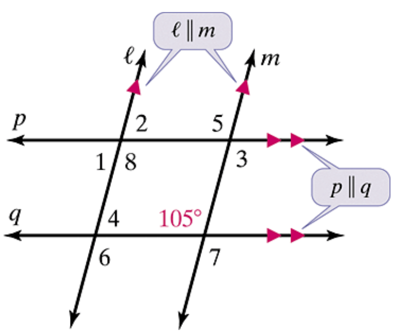
______________________________ (Alternate Exterior)

Example Finding Angle Measures
Given the figure shown and $m\angle 4 = 42°$, find the measures of the other angles.

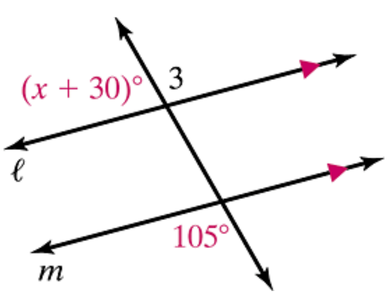


Your justification might not be EXACTLY "Alternate Interior Angles Converse." For example, you could justify your answer by stating "$m\angle 6 = 42°$ because $\angle 6$ and $\angle 4$ are alternate interior angles and $\ell \parallel m$."

Example Finding Angle Measures
Using the figure shown, what are the measures of angle 3 and angle 4? Which theorem justifies each answer?



Example Using Algebra and Parallel Line Theorems to Find Angle Measures
Given the figure and $\ell \parallel m$, find the value of x.



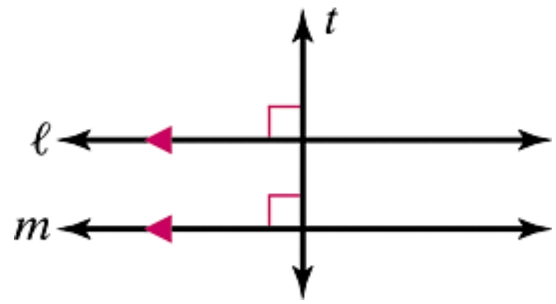
Section 3.4 Proving Theorems about Parallel and Perpendicular Lines

Objectives:	Vocabulary:
1. Use and Prove Theorems About Parallel and Perpendicular Lines. 2. Use Algebra to Find Measures of Angles Related to Perpendicular Lines.	• No New Vocabulary

Theorem Perpendicular Transversal Theorem
In a plane, let two parallel lines be cut by a transversal.

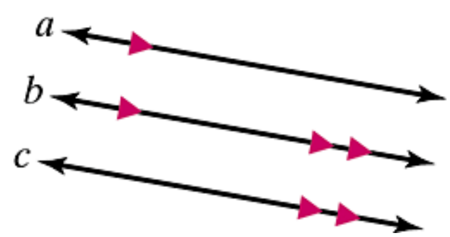
If the transversal is perpendicular to **ONE** of the parallel lines,

then…



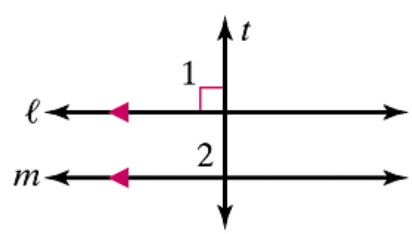
Theorem Two Lines Parallel to a Third Line
If two lines are parallel to the same line,

then…



Example Proving the Perpendicular Transversal Theorem

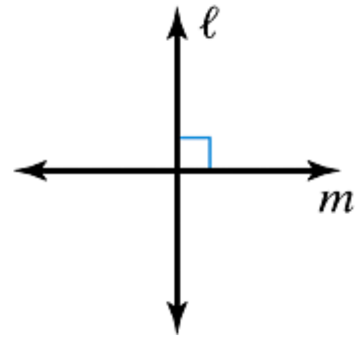
Given: In a plane, $\ell \parallel m$ and $t \perp \ell$
Prove: $t \perp m$



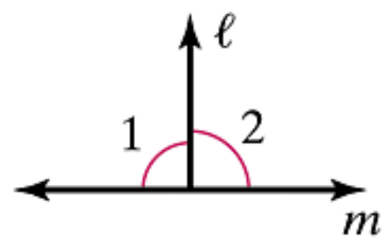
Statements	Reasons

Theorems About Perpendicular Lines

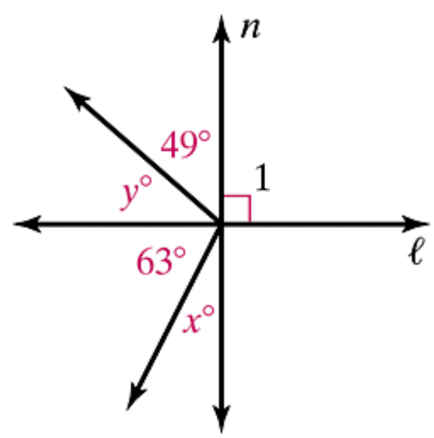
1. If two lines are perpendicular, then…



2. If two lines intersect to form a linear pair of congruent angles, then…



Example Finding Measures of Angles
Find the value of x.



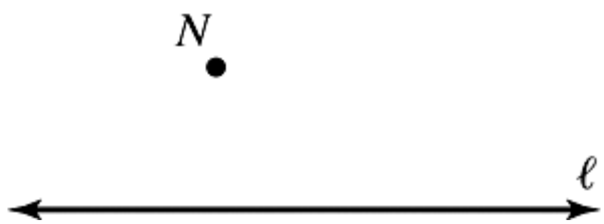
Section 3.5 Constructions—Parallel and Perpendicular Lines

Objectives:	Vocabulary:
1. Construct Parallel and Perpendicular Lines	• No New Vocabulary

Example Constructing Parallel Lines
Construct the line parallel to a given line and through a given point that is not on the line.

Given: Line ℓ and point N not on ℓ

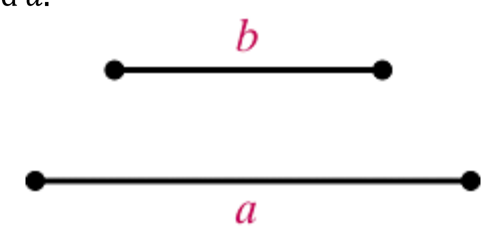
Construct: Line m through N with $m \parallel \ell$



Example Constructing a Special Quadrilateral
Construct a quadrilateral with one pair of parallel sides of lengths b and a.

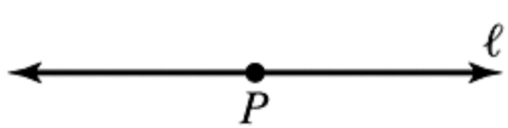
Given: Segments of lengths b and a.

Construct: Quadrilateral $ABYZ$ with $AZ = a, BY = b$, and $\overline{AZ} \parallel \overline{BY}$.



Example Constructing the Perpendicular at a Point on a Line
Construct the perpendicular to a given line at a given point on the line.

Given: Point P on line ℓ
Construct: $\overleftrightarrow{CP}$ with $\overleftrightarrow{CP} \perp \ell$



Section 3.6 Coordinate Geometry—The Slope of a Line

Objectives:

1. Find the Slope of a Line.
2. Interpret the Slope-Intercept Form in an Application.
3. Compare the Slopes of Parallel and Perpendicular Lines.

Vocabulary:

- slope
- vertical change
- horizontal change
- rate of change
- y-intercept point
- y-intercept
- slope-intercept form
- perpendicular lines

The slope of a line can be represented as a ratio in several different ways, including:

- as a ratio of vertical change to horizontal change:

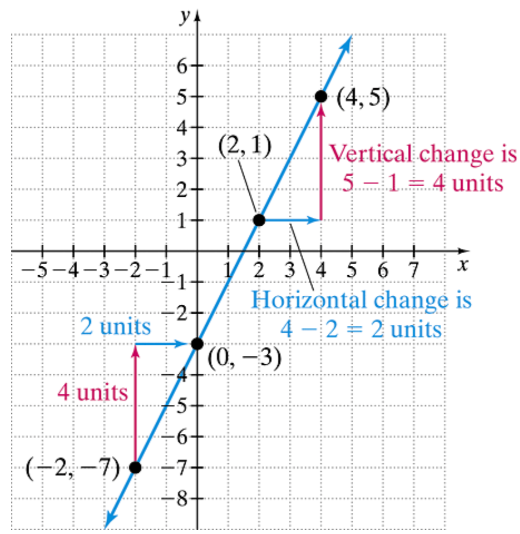
$$m = \frac{\text{change in} \quad (\qquad\qquad\qquad \text{change})}{\text{change in} \quad (\qquad\qquad\qquad \text{change})}$$

- as a ratio of rise to run:

$$m = \frac{\qquad\qquad}{}$$

- as a formula:

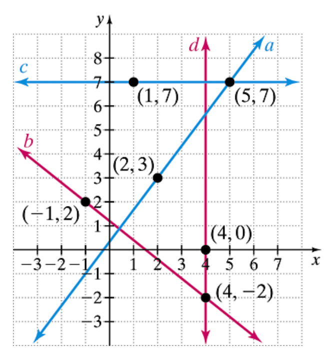
$$m = \frac{\qquad\qquad}{}$$



Example Finding Slopes of Lines

a. Find the slope line *b*.

b. Find the slope line *d*.



Interpreting Slope

Slope Value	Positive	Negative	Zero	Undefined
Example Graph				
Description (words)				

Forms of Linear Equations

- Slope-Intercept Form

- Point-Slope Form

Example Finding Information about a Line from its Equation
Find the slope and the y-intercept point of the line $3x - 4y = 4$.

Example Predicting Future Prices
The adult one-day pass price for Disney World is given by $y = 3.2x + 48$ where x is the number of years since 2000.

a. Use this equation to predict the ticket priced for the year 2020.

b. What does the slope of this equation mean?

c. What does the y-intercept point of this equation mean?

Parallel Lines

Two nonvertical lines are parallel if…

Perpendicular Lines

Two nonvertical lines are perpendicular if…

Example
Are the following pairs of lines parallel, perpendicular, or neither?

a. $3x + 7y = 4$
$6x + 14y = 7$

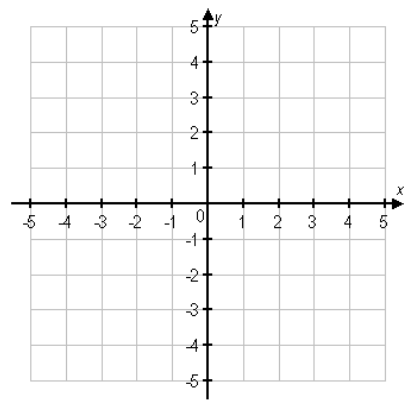
b. $-x + 3y = 2$
$2x + 6y = 5$

<u>Section 3.7 Coordinate Geometry—Equations of Lines</u>

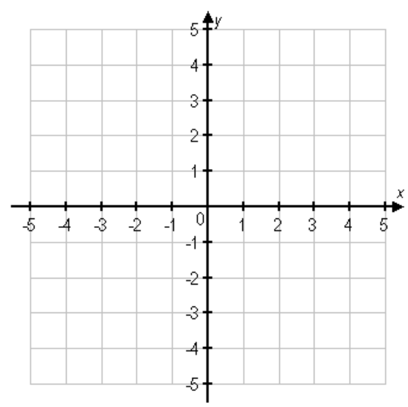
Objectives:	Vocabulary:
1. Use the Slope-Intercept Form. 2. Use the Point-Slope Form. 3. Write Equations of Vertical and Horizontal Lines. 4. Find Equations of Parallel and Perpendicular Lines.	• point-slope form • standard form • vertical line • horizontal line

> Note: In this class, we will use Slope-Intercept and Point-Slope form almost exclusively. You need not memorize Standard form. Anywhere in the PowerPoints you see "Write the equation in standard form," write it in slope-intercept instead.

Example Find an equation and graph the line.
Write an equation of the line with y-intercept point $(0, -3)$ and slope of ¼.



Example Graph $2x + 3y = 12$



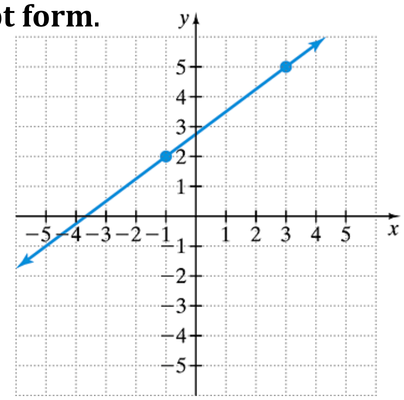
Example Equation of a Line
Find an equation of the line with slope -3 containing the point $(1, -5)$. Write the equation in slope-intercept form, $y = mx + b$.

Example Equation of a Line

Find an equation of the line through points (4,0) and (−4,5). Write the equation in slope-intercept form, $y = mx + b$.

Example Equation of a Line

Write the equation of the line graphed. Write the equation in **slope-intercept form.**



Example Equation of a Line

Find an equation of a horizontal line containing the point (2,3).

Example Equation of a Line

Find an equation of the line containing the point (2,3) with undefined slope.

Example Find an equation of the line containing the point (4,4) and (a) parallel to (b) perpendicular to the line $2x + 3y = -6$. Write the equation in **slope-intercept form**.

(a) parallel to

(b) perpendicular to