Name: ________________

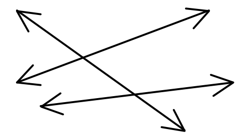
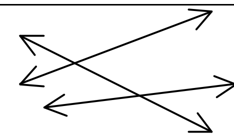
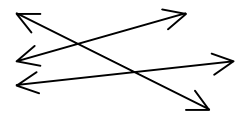
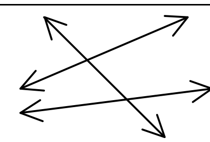
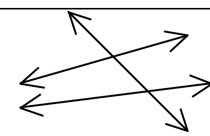
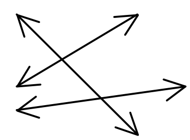
Chapter 3:
Parallel and Perpendicular Lines

Guided Notes

Geometry
Fall Semester

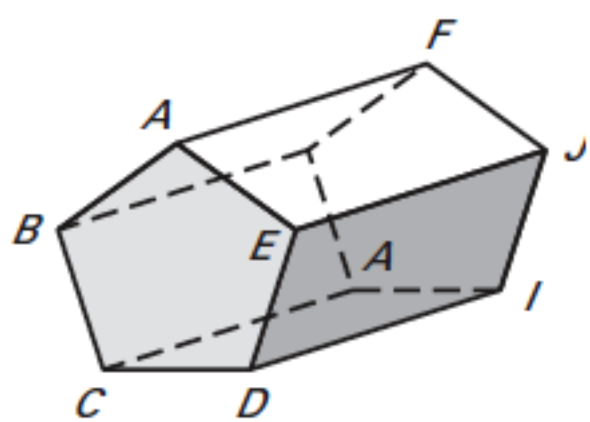
3.1 Identify Pairs of Lines and Angles

Term	Definition	Example
parallel lines (// or ||)		
skew lines		
parallel planes		
Postulate 13 Parallel Postulate	If there is a line and a point not on the line, then there is exactly one line through the point parallel to the given line.	
Postulate 14 Perpendicular Postulate	If there is a line and a point not on the line, then there is exactly one line through the point perpendicular to the given line.	
Transversal	The lines the transversal intersects do not need to be parallel; the transversal can also be a ray or line segment.	

Angles formed by Transversals		
exterior angles		
interior angles		
corresponding angles		
alternate interior angles		
alternate exterior angles		
consecutive interior angles (same-side interior angles)		

Examples:

1. Think of each segment in the figure as part of a line. Which line(s) or plane(s) in the figure appear to fit the description?



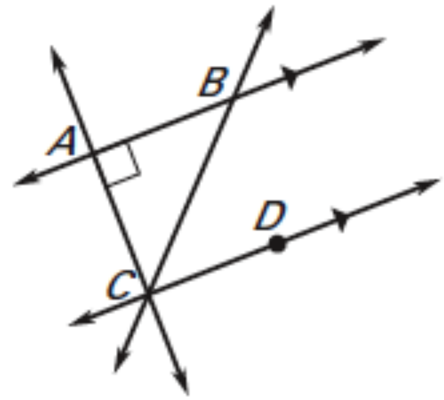
a) Line(s) parallel to $\overleftrightarrow{AF}$ and containing point E.

b) Line(s) skew to $\overleftrightarrow{AF}$ and containing point E.

c) Line(s) perpendicular to $\overleftrightarrow{AF}$ and containing point E.

d) Plane(s) parallel to plane FGH and containing point E.

2. Use the diagram at the right to answer each question.

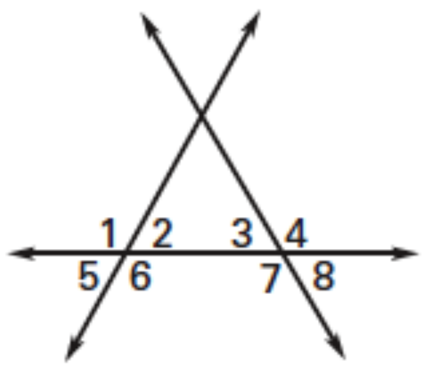


a) Name a pair of parallel lines.

b) Name a pair of perpendicular lines.

c) Is $\overleftrightarrow{AB} \perp \overleftrightarrow{BC}$?

3. From the diagram, identify all pairs of . . .



a) corresponding angles ____

b) alternate interior angles ______________________________________

c) alternate exterior angles ______________________________________

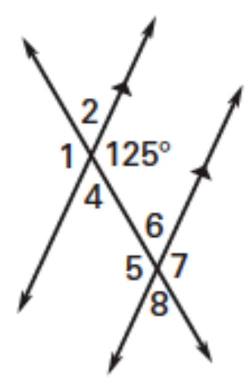
d) consecutive (same-side) interior angles ___________________________

3.2 Use Parallel Lines and Transversals

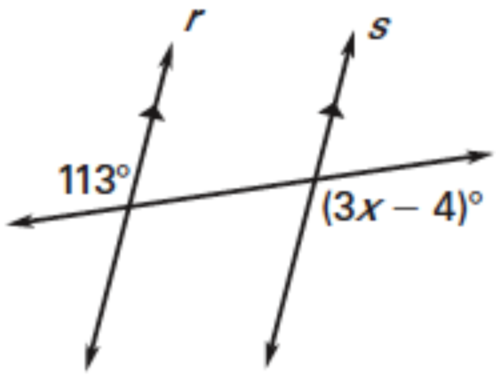
Term	Definition	Example
Postulate 15 Corresponding Angles Postulate	If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent.	
Theorem 3.1 Alternate Interior Angles Theorem	If two parallel lines are cut by a transversal, then the pairs of alternate interior angles are congruent.	
Theorem 3.2 Alternate Exterior Angles Theorem	If two parallel lines are cut by a transversal, then the pairs of alternate exterior angles are congruent.	
Theorem 3.3 Consecutive Interior Angles Theorem	If two parallel lines are cut by a transversal, then the pairs of same side interior angles are supplementary.	

Examples:

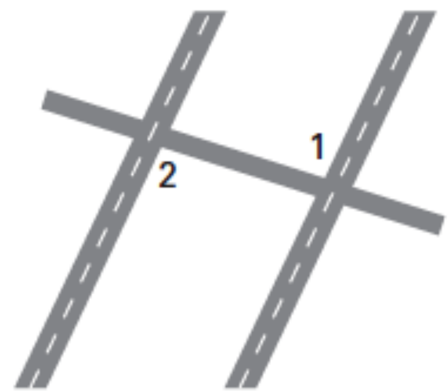
1. **Given the diagram at right, which numbered angles have a measure of $125°$?**



2. Find the value of x.



3. A taxiway is being constructed that intersects two parallel runways at an airport. You know that $m\angle 2 = 98°$. What is $m\angle 1$? How do you know?

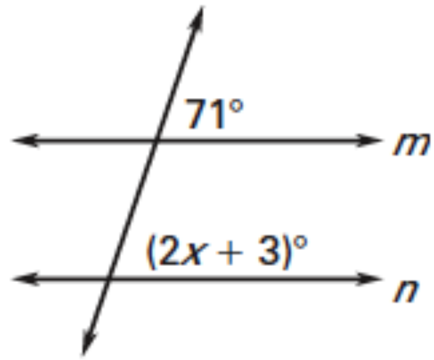


3.3 Prove Lines are Parallel

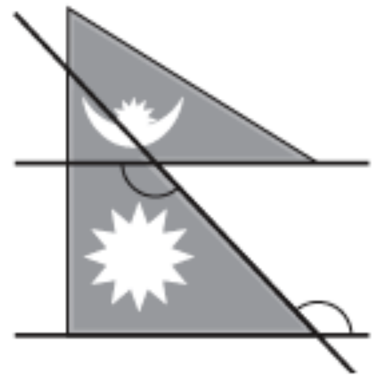
Term	Definition	Example
Postulate 16 Corresponding Angles Converse	If two lines are cut by a transversal so the corresponding angles are congruent, then the lines are parallel.	
Theorem 3.4 Alternate Interior Angles Converse	If two lines are cut by a transversal so the alternate interior angles are congruent, then the lines are parallel.	
Theorem 3.5 Alternate Exterior Angles Converse	If two lines are cut by a transversal so the alternate exterior angles are congruent, then the lines are parallel.	
Theorem 3.6 Consecutive Interior Angles Converse	If two lines are cut by a transversal so the consecutive interior angles are supplementary, then the lines are parallel.	
paragraph proof		
Theorem 3.7 Transitive Property of Parallel Lines	If two lines are parallel to the same line, then they are parallel to each other.	

Examples:

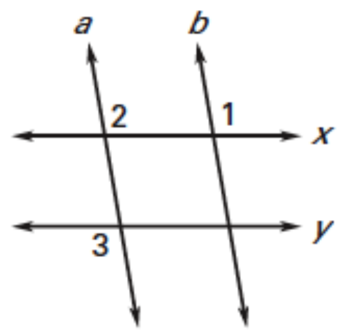
1. Find the value of x that makes $m \parallel n$.



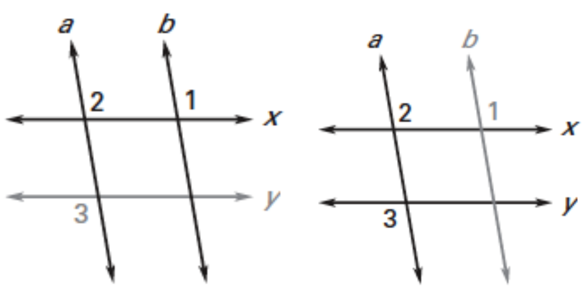
2. How can you tell whether the sides of the flag of Nepal are parallel?



3. Write a paragraph proof. In the figure, $a \parallel b$ and $\angle 1$ is congruent to $\angle 3$. Prove $x \parallel y$.

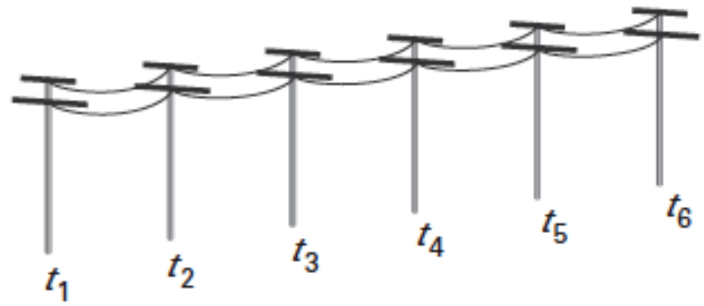


Plan:

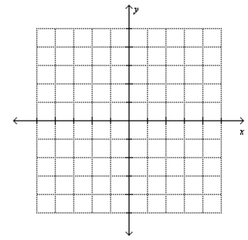
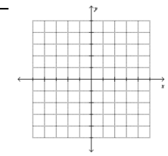
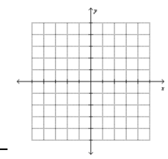
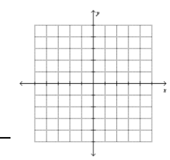
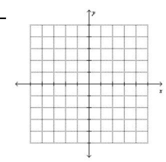
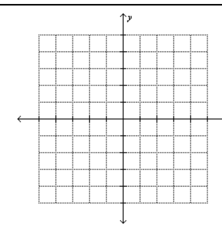
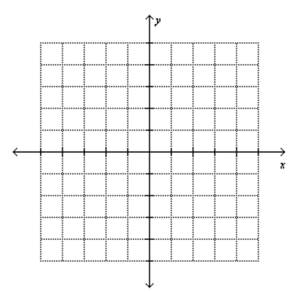


Proof:

4. Each utility pole shown is parallel to the pole immediately to its right. Use the Transitive Property of Parallel Lines to explain why the leftmost pole is parallel to the rightmost pole.

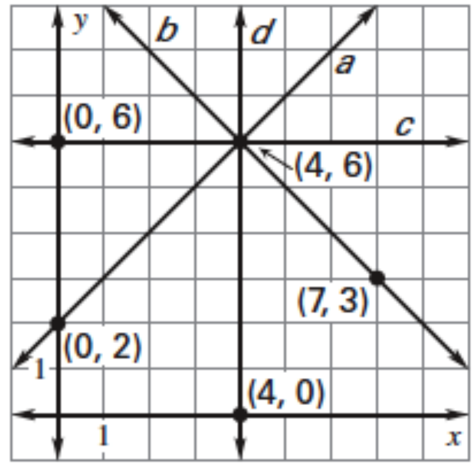


3.4 Find and Use Slopes of Lines

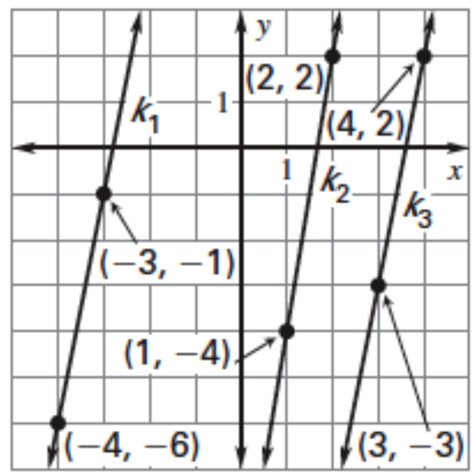
Term	Definition	Example
slope		
positive slope		
negative slope		
zero slope (slope of zero) (no slope)	A horizontal line.	
undefined slope	A vertical line.	
Postulate 17 Slopes of Parallel Lines	In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope. Any two vertical lines are parallel.	
Postulate 18 Slopes of Perpendicular Lines	In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is -1. The slopes of the two lines that are perpendicular are negative reciprocals of each other. Horizontal lines are perpendicular to vertical lines.	
"if and only if" form (iff)	The form used when both a conditional and its converse are true.	

Examples:

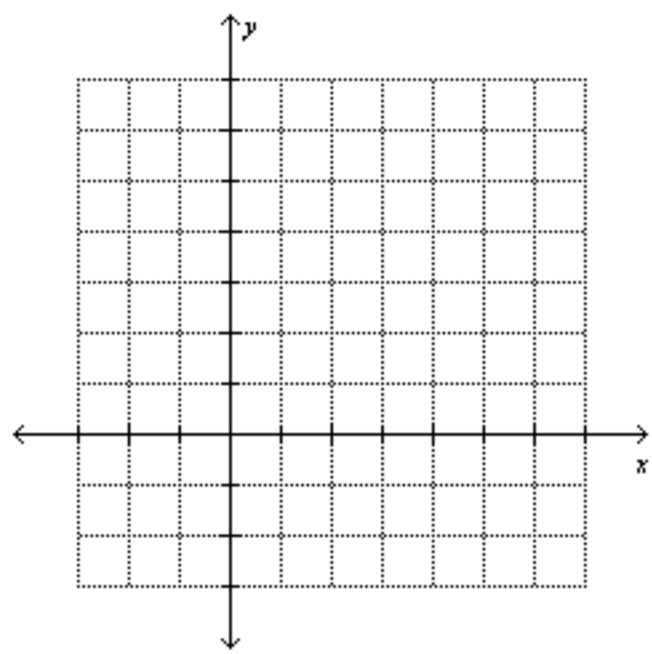
1. Find the slope of line a and line c.



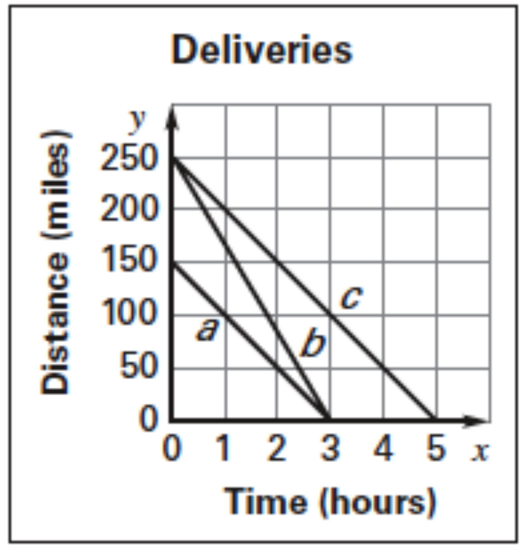
2. Find the slope of each line. Which lines are parallel?



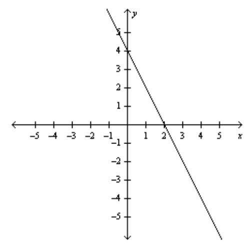
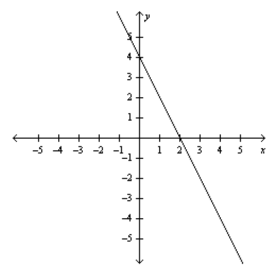
3. Line h passes through points (1,-2) and (5,6). Graph the line perpendicular to h that passes through the point (5,2).



4. Analyze the graph. A trucker made three deliveries. The graph shows the trucker's distance to the destination from the starting time to the arrival time for each delivery. Use the slopes of the lines to make a statement about the deliveries.

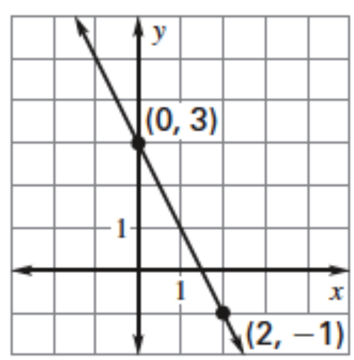


3.5 Write and Graph Equations of Lines

Term	Definition	Example
slope-intercept form		
standard form		
x-intercept		
y-intercept		

Examples:

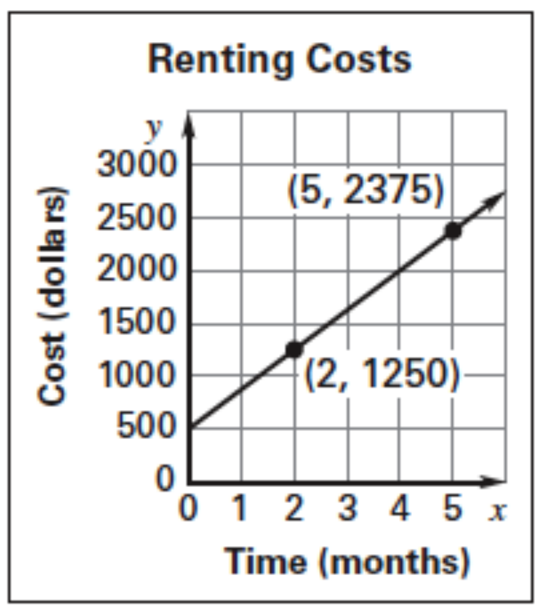
1. Write an equation of the line in slope-intercept form.



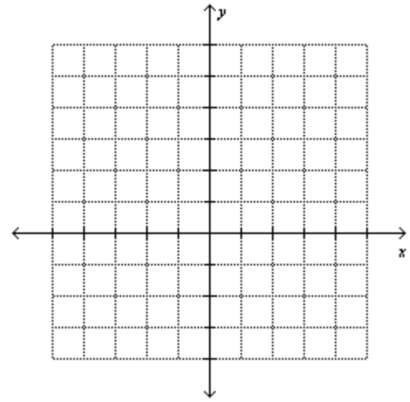
2. Write an equation of the line passing through the point (1,-1) that is parallel to the line with the equation $y = 2x - 1$.

3. Write an equation of the line passing through the point (3,2) that is perpendicular to the line with the equation $y = -3x + 1$.

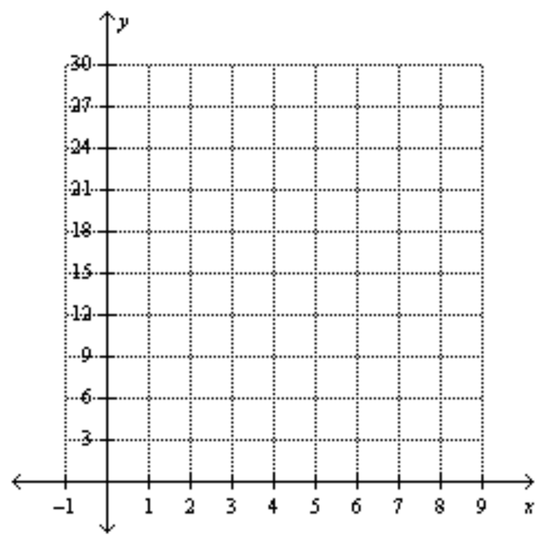
4. The graph at right models the total cost of renting an apartment. Write an equation of the line. Explain the meaning of the slope and the y-intercept of the line.



5. Graph $2x+3y=6$. The equation is in **STANDARD FORM**, so use the intercepts.



6. Solve a real world problem. You can buy a magazine at a store for \$3. You can subscribe yearly to the magazine for a flat fee of \$18. After how many magazines is the subscription a better buy?

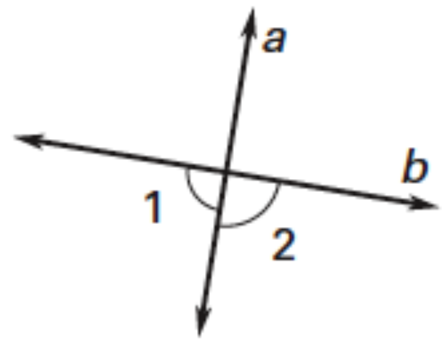


3.6 Prove Theorems about Perpendicular Lines

Term	Definition	Example
Theorem 3.8	If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.	
Theorem 3.9	If two lines are perpendicular, then they intersect to form four right angles.	
Theorem 3.10	If two sides of two adjacent acute angles are perpendicular, then the angles are complementary.	
Theorem 3.11 Perpendicular Transversal Theorem	If a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other.	
Theorem 3.12 Lines Perpendicular to a Transversal Theorem	In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.	
distance from a point to a line		
distance between two parallel lines		

Examples:

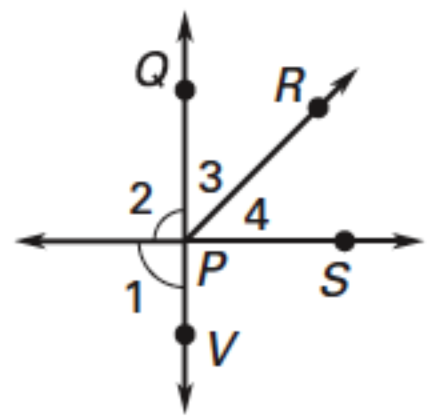
1. In the diagram at right, $\angle 1 \cong \angle 2$. What can you conclude about a and b ?



2. In the diagram at right, $\angle 1 \cong \angle 2$. Prove that $\angle 3$ and $\angle 4$ are complementary.

Given:

Prove:



Statements	Reasons
1. $\angle 1 \cong \angle 2$	1. ______________________
2. ______________________	2. $lin.pr.,\cong \angle s \rightarrow \perp$
3. $\angle 3$ and $\angle 4$ are complementary.	3. ______________________

3. Determine which lines, if any, are parallel in the diagram. Explain.