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 Geometry

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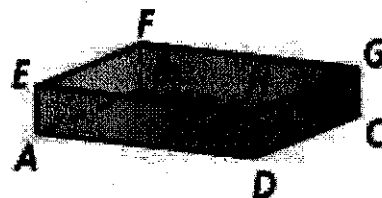
## Unit 3: Parallel and Perpendicular Lines Study Guide

**LT#1: Identify relationships between figures in space.**

Name one pair of each of the segments or planes. Lines and planes that appear to be parallel are parallel.

1. parallel segments

$$\overline{EH} \parallel \overline{FG} \parallel \overline{AD} \parallel \overline{BC} \quad \overline{EF} \parallel \overline{HG} \parallel \overline{AB} \parallel \overline{DC}$$



2. skew segments

$\overline{EA}$  skew to  $\overline{HG}$ ,  $\overline{FG}$ ,  $\overline{BC}$ ,  $\overline{DC}$   
 $\overline{AD}$  skew to  $\overline{GC}$ ,  $\overline{FB}$ ,  $\overline{HG}$ ,  $\overline{EF}$  and more!

3. parallel planes

$$EFGH \parallel ABCD, \quad EFBA \parallel HGCD, \quad EHDA \parallel FGCB$$

**LT#2: Identify angles formed by two lines and a transversal.**

Identify all numbered angle pairs that form the given type of angle pair. Then name the two lines and transversal that form each pair.

4. alternate interior angles

$\angle 3$  and  $\angle 6$  lines  $c$  and  $d$ , transversal  $e$

$\angle 2$  and  $\angle 7$  lines  $a$  and  $b$ , transversal  $d$

5. same-side interior angles

$\angle 5$  and  $\angle 8$  lines  $a$  and  $b$ , transversal  $c$

6. corresponding angles

$\angle 5$  and  $\angle 2$  lines  $c$  and  $d$ , transversal  $e$

$\angle 1$  and  $\angle 4$  lines  $c$  and  $d$ , transversal  $b$

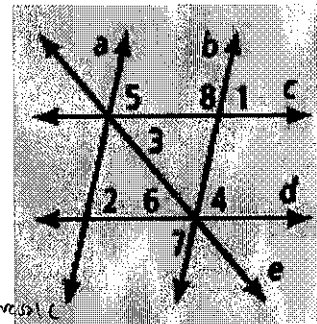
7. alternate exterior angles

$\angle 1$  and  $\angle 7$  lines  $c$  and  $d$ , transversal  $b$

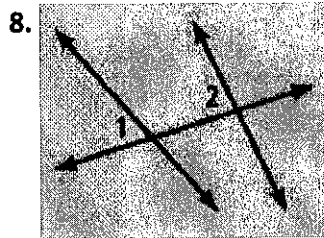
$\angle 5$  and  $\angle 1$  lines  $a$  and  $b$ , transversal  $c$

$\angle 8$  and  $\angle 7$  lines  $c$  and  $d$ , transversal  $b$

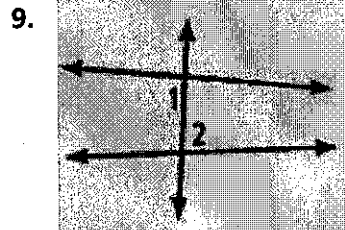
$\angle 2$  and  $\angle 4$  lines  $a$  and  $b$ , transversal  $d$



Classify the angle pair formed by  $\angle 1$  and  $\angle 2$ .



corresponding angles



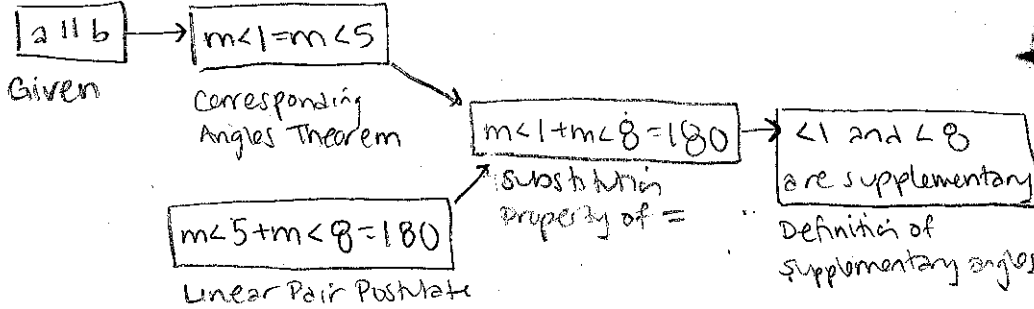
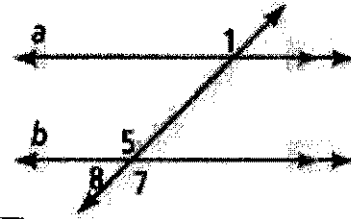
alternate interior angles

**LT#3: Prove theorems about parallel lines.**

Write a two-column, paragraph, or flow chart proof.

10. Given:  $a \parallel b$

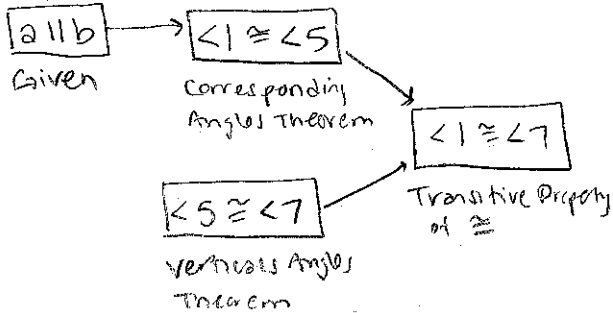
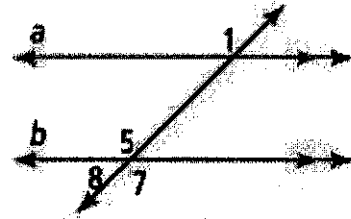
Prove:  $\angle 1$  and  $\angle 8$  are supplementary.



Note: proof could also use alternate exterior angles  $\angle 1$  and  $\angle 7$ .

11. Given:  $a \parallel b$

Prove:  $\angle 1 \cong \angle 7$

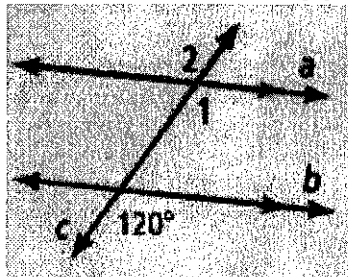


Note: proof could also use alternate exterior angles Theorem.

**LT#4: Use properties of parallel lines to find angle measures.**

Find  $m\angle 1$  and  $m\angle 2$ . Justify your answers.

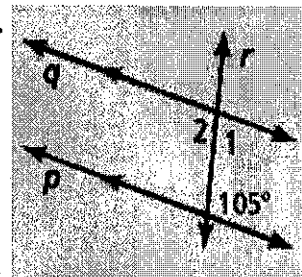
12.



$m\angle 1 = 120^\circ$

$m\angle 2 = 120^\circ$

13.



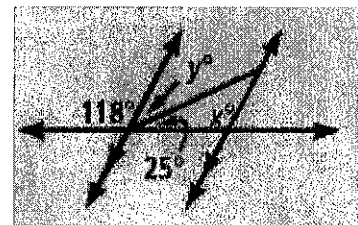
$m\angle 1 = 180 - 105 = 75^\circ$

$m\angle 2 = 105^\circ$

14. Find the values of  $x$  and  $y$  in the diagram below.

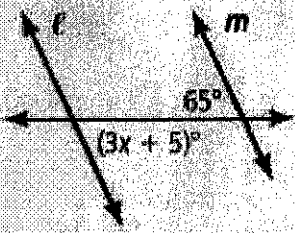
$x = 118^\circ$

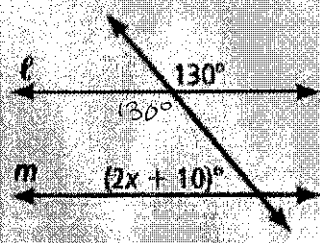
$y = 180^\circ - 118^\circ - 25^\circ = 37^\circ$



**LT#5: Determine whether two lines are parallel.**

Find the value of  $x$  for which  $l \parallel m$ .

15.   $3x + 5 = 65$   
 $3x = 60$   
 $x = 20$

16.   $2x + 10 + 130 = 180$   
 $2x + 140 = 180$   
 $2x = 40$   
 $x = 20$

Use the given information to decide which lines, if any, are parallel. Justify your conclusions.

17.  $\angle 1 \cong \angle 9$

$l \parallel p$  Converse of the Corresponding Angles Theorem

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

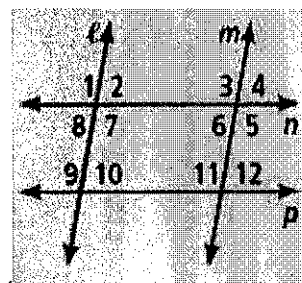
no conclusion

19.  $m\angle 2 + m\angle 3 = 180$

$l \parallel m$  Converse of the Same-Side Interior Angles Postulate

20.  $\angle 5 \cong \angle 11$

$l \parallel m$  Converse of the Corresponding Angles Theorem

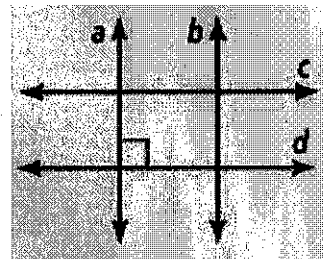


**LT#6: Relate parallel and perpendicular lines.**

Use the diagram at the right to complete each statement.

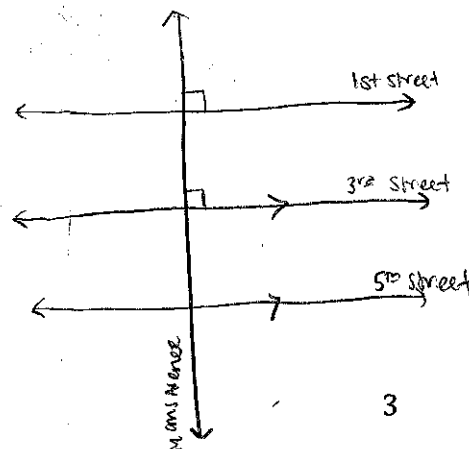
21. If  $b \perp c$  and  $b \perp d$ , then  $c \parallel d$ .

22. If  $c \parallel d$ , then  $b \perp c$ .



23. Morris Avenue intersects both 1<sup>st</sup> Street and 3<sup>rd</sup> Street at right angles. 3<sup>rd</sup> Street is parallel to 5<sup>th</sup> Street. How are 1<sup>st</sup> Street and 5<sup>th</sup> Street related? Explain.

1<sup>st</sup> Street  $\parallel$  3<sup>rd</sup> Street because they are both  $\perp$  to Morris Avenue, since 1<sup>st</sup> Street and 5<sup>th</sup> Street are both  $\parallel$  to 3<sup>rd</sup> Street, 1<sup>st</sup> Street and 5<sup>th</sup> Street are  $\parallel$  to each other

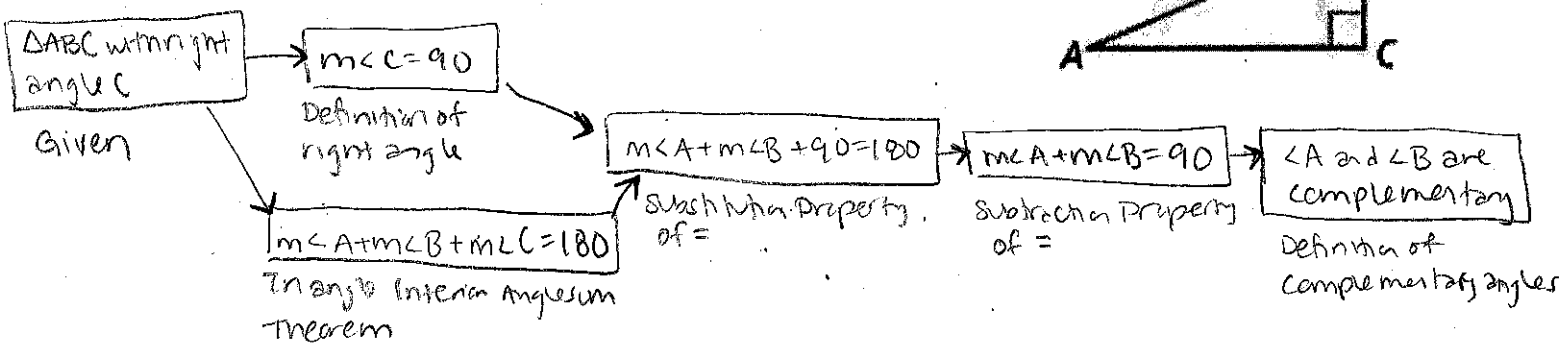
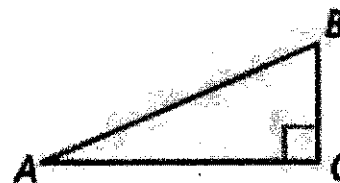


**LT#7: Use parallel lines to prove a theorem about triangles.**

Write a two-column, paragraph, or flow chart proof.

24. Given:  $\triangle ABC$  with right angle  $C$

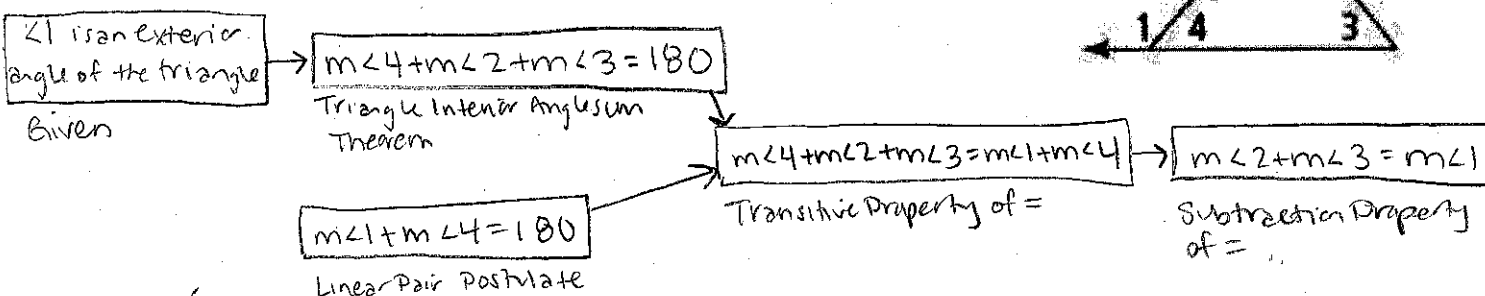
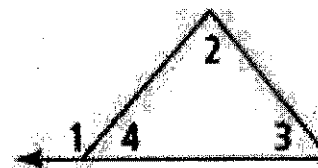
Prove:  $\angle A$  and  $\angle B$  are complementary.



25. Prove the Triangle Exterior Angles Theorem.

Given:  $\angle 1$  is an exterior angle of the triangle.

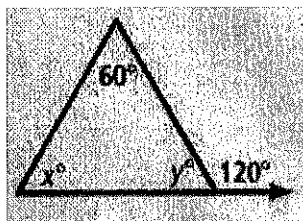
Prove:  $m\angle 1 = m\angle 2 + m\angle 3$



**LT#8: Find measures of angles of triangles.**

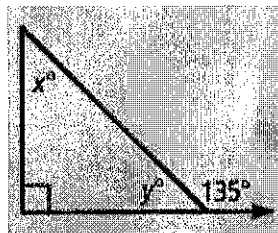
Find the values of the variables.

26.



$y = 180 - 120$   
 $y = 60^\circ$   
 $x + 60 + 60 = 180$   
 $x + 120 = 180$   
 $x = 60^\circ$

27.



$y = 180 - 135$   
 $y = 45^\circ$   
 $x + 90 + 45 = 180$   
 $x + 135 = 180$   
 $x = 45^\circ$

The measures of the three angles of a triangle are given. Find the value of  $x$ .

28.  $x, 2x, 3x$

$$x + 2x + 3x = 180$$

$$6x = 180$$

$$x = 30$$

29.  $x + 10, x - 20, x + 25$

$$x + 10 + x - 20 + x + 25 = 180$$

$$3x + 15 = 180$$

$$3x = 165$$

$$x = 55$$

30.  $20x + 10, 30x - 2, 7x + 1$

$$20x + 10 + 30x - 2 + 7x + 1 = 180$$

$$57x + 9 = 180$$

$$57x = 171$$

$$x = 3$$

**LT#9: Graph and write linear equations.**

Find the slope of the line passing through the points.

31.  $(6, -2), (1, 3)$

$$m = \frac{\Delta y}{\Delta x} = \frac{3 - (-2)}{1 - 6} = \frac{5}{-5} = -1$$

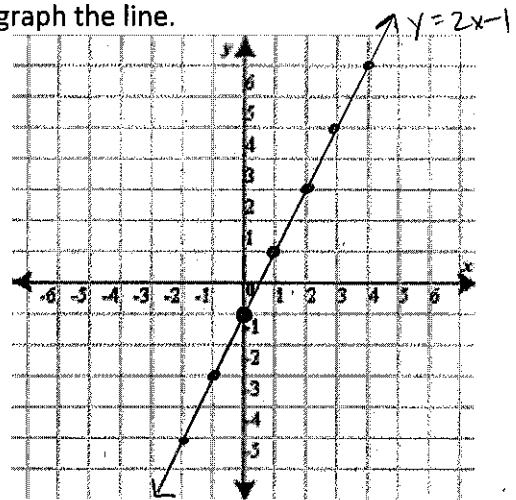
32.  $(-7, 2), (-7, -5)$

$$m = \frac{\Delta y}{\Delta x} = \frac{-5 - 2}{-7 - (-7)} = \frac{-7}{0} \text{ undefined}$$

33. Name the slope and y-intercept of  $y = 2x - 1$ . Then graph the line.

$$m = 2$$

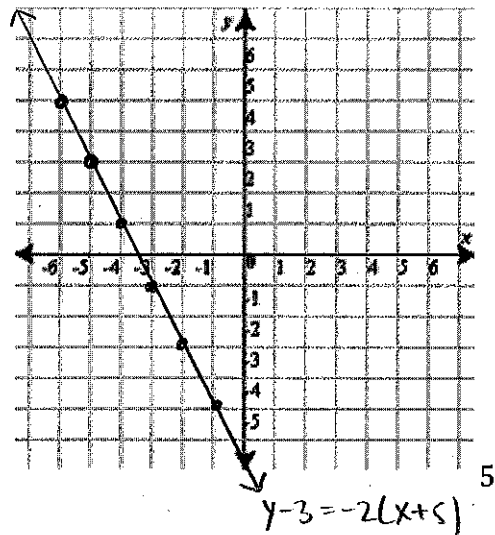
$$b = -1$$



34. Name the slope and point on  $y - 3 = -2(x + 5)$ . Then graph the line.

$$m = -2$$

$$\text{point} = (-5, 3)$$



Write an equation of the line.

35. slope  $-\frac{1}{2}$ , y-intercept 12

$$y = mx + b$$
$$y = -\frac{1}{2}x + 12$$

36. slope 3, passes through (1, -9)

$$y - y_1 = m(x - x_1)$$
$$y + 9 = 3(x - 1)$$

37. passes through (4, 2) and (3, -2)

$$m = \frac{\Delta y}{\Delta x} = \frac{-2 - 2}{3 - 4} = \frac{-4}{-1} = 4$$

$$y - y_1 = m(x - x_1)$$
$$y - 2 = 4(x - 4) \quad \checkmark \quad y + 2 = 4(x - 3)$$

**LT#10: Relate slope to parallel and perpendicular lines.**

Determine whether  $\overline{AB}$  and  $\overline{CD}$  are parallel, perpendicular, or neither.

38. A(-1, -4), B(2, 11), C(1, 1), D(4, 10)

$$m_{AB} = \frac{11 - (-4)}{2 - (-1)} = \frac{15}{3} = 5$$

$$m_{CD} = \frac{10 - 1}{4 - 1} = \frac{9}{3} = 3$$

neither

39. A(2, 8), B(-1, -2), C(3, 7), D(0, -3)

$$m_{AB} = \frac{-2 - 8}{-1 - 2} = \frac{-10}{-3} = \frac{10}{3}$$

$$m_{CD} = \frac{-3 - 7}{0 - 3} = \frac{-10}{-3} = \frac{10}{3}$$

parallel

40. A(-3, 3), B(0, 2), C(1, 3), D(-2, -6)

$$m_{AB} = \frac{2 - 3}{0 - (-3)} = \frac{-1}{3}$$

perpendicular

41. A(-1, 3), B(4, 8), C(-6, 0), D(2, 8)

$$m_{AB} = \frac{8 - 3}{4 - (-1)} = \frac{5}{5} = 1$$

$$m_{CD} = \frac{8 - 0}{2 - (-6)} = \frac{8}{8} = 1$$

parallel

42. Write an equation of the line parallel to  $y = 8x - 1$  that contains (-6, 2).

$$m = 8$$

$$y - 2 = 8(x + 6)$$

43. Write an equation of the line perpendicular to  $y = \frac{1}{6}x + 4$  that contains (3, -3).

$$m = 6$$

$$y + 3 = 6(x - 3)$$