

## 7.4 - Parallel Lines and Transversals

### MATH ON THE JOB

Hal is a carpenter from Bathurst, NB. After graduating from high school he enrolled in the carpentry program at BayTech Institute of Trades and Technology, in Moncton. Shortly after graduating, he began working for his uncle's construction company, building and renovating houses primarily in northern New Brunswick.

Hal often works on wood-framed houses and buildings. The frames are made of studs (parallel, vertical pieces), and wall plates (pieces that are attached along the top and bottom of the studs). Frames are usually constructed on the ground or floor and then erected. The wall plates hold the studs in position.

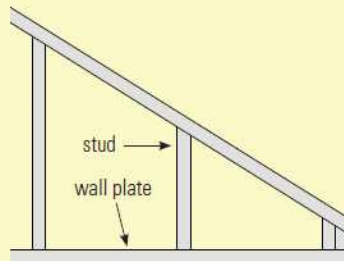
Part of Hal's job is to make sure that the studs are exactly perpendicular to the bottom wall plate and parallel to each other. To do this, he uses a measuring device such as a carpenter's square, which is used to measure and mark off  $90^\circ$  angles.

Hal is constructing a partial wall for the side of a staircase. The top of the wall follows the slope of the staircase. A partial diagram of the framing for the staircase is shown here.

- Decide upon a reasonable angle for the staircase. Staircase angles range between  $33^\circ$  and  $42^\circ$ .
- To make the studs parallel, what angle measure will Hal need to make between the studs and the bottom wall plate?
- To make the ends of the studs align with the top wall plate, what angle will Hal need to make between the studs and the top wall plate?



Carpenters use a variety of tools to do different jobs.



### SOLUTION

The average rise of a staircase is between  $33^\circ$  and  $42^\circ$ . The studs must be perpendicular ( $90^\circ$ ) to the bottom wall plate. If the student has drawn a top wall plate at a  $33^\circ$  angle to the horizontal, the left side of each stud must make a  $122^\circ$  angle with the top wall plate. The right side of each stud must make a  $58^\circ$  angle with the top wall plate.

# Notes - Geometry Theorems.doc

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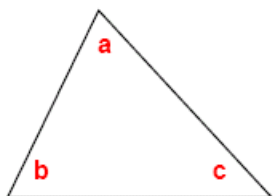
\*\*\* Now that the notes are taken care of...

let's do some examples to UNDERSTAND these **BIG** ideas!!!

## Geometry Theorems...

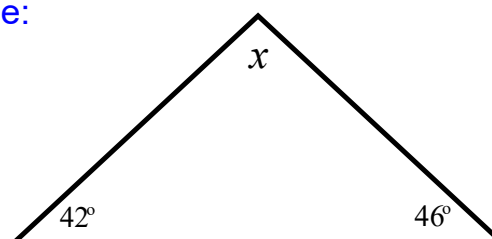
### Triangle Angle Sum Theorem:

The sum of the interior angles of any triangle is  $180^\circ$ .



$$a + b + c = 180^\circ$$

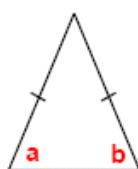
Example:



**Isosceles Triangle Theorem:**

In an isosceles triangle, the base angles are equal.

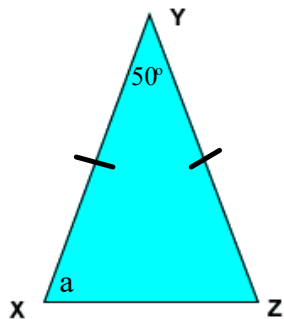
The two angles that are opposite to the equal sides.



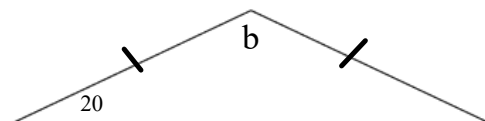
$a = b$

**EXAMPLES...**

1)



2)



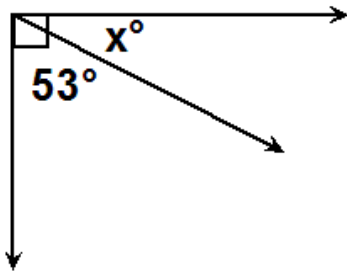
- **Complementary Angles:**

Two or more angles that have a sum of  $90^\circ$ .

Examples:

(1) What is the complement of a  $50^\circ$  angle?

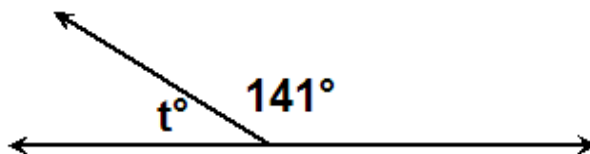
(2) Determine the measure of the missing angle.



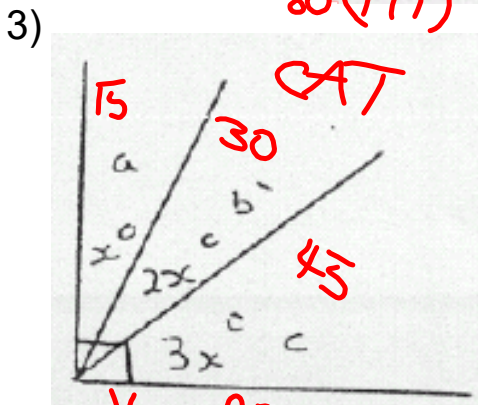
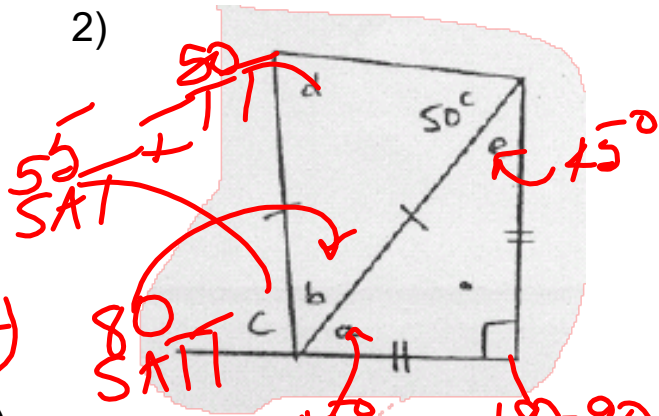
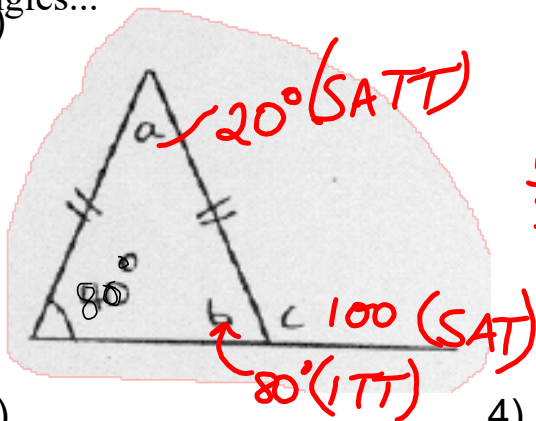
- **Supplementary Angles:**

Two or more angles that have a sum of  $180^\circ$ .

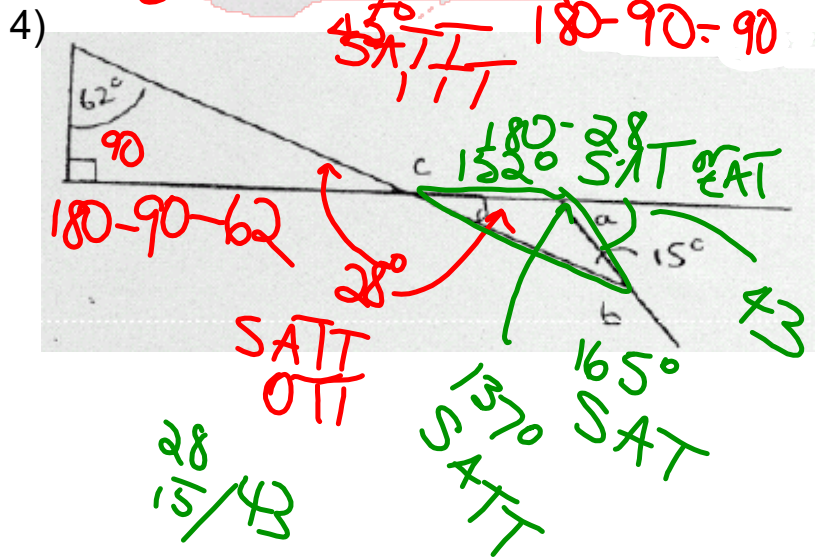
Examples:



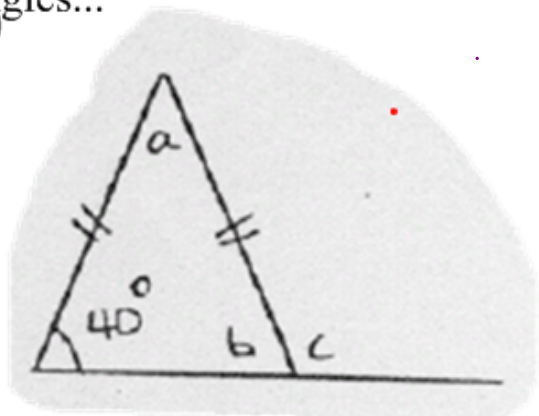
EXERCISE: Use geometry theorems to determine the measure of missing angles...



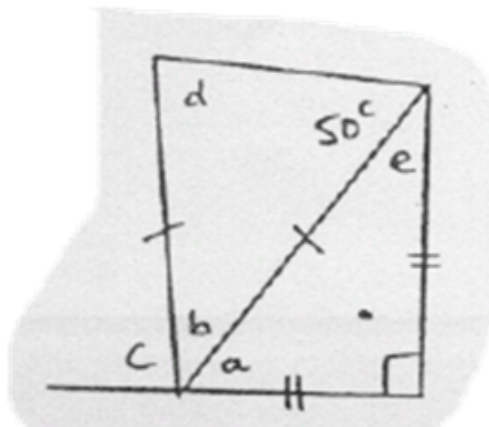
$$\frac{6x}{6} = \frac{90}{6} \quad x = 15$$



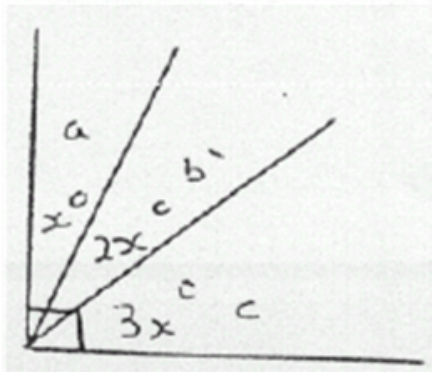
Figures...



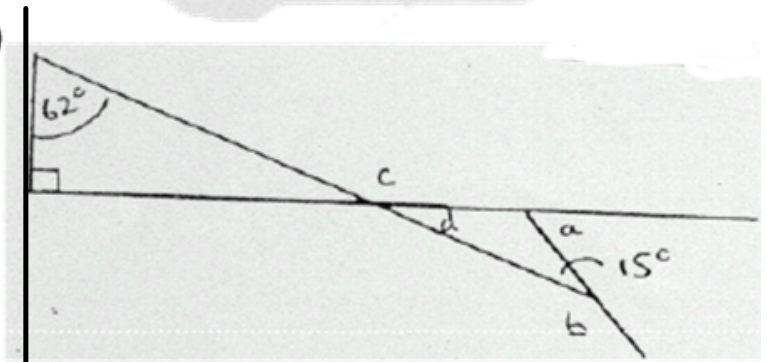
2)



3)



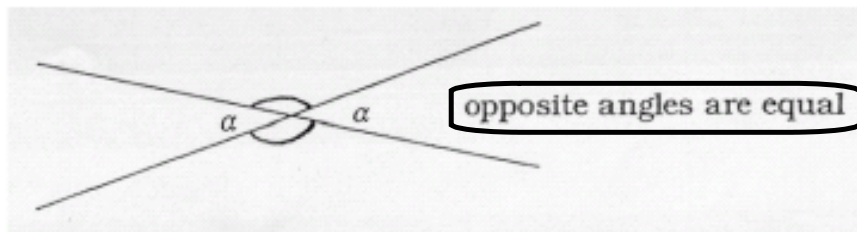
4)





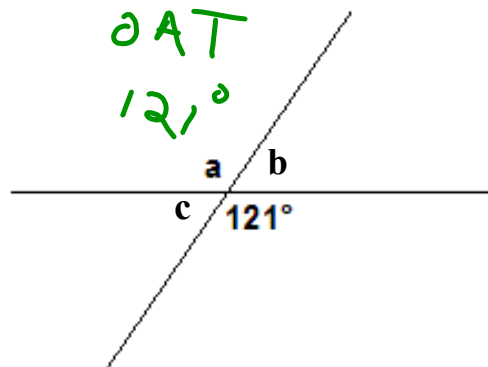
## Opposite Angle Theorem... Vertically

When 2 straight lines cross, 2 pairs of opposite angles are formed. Opposite angles are equal in size



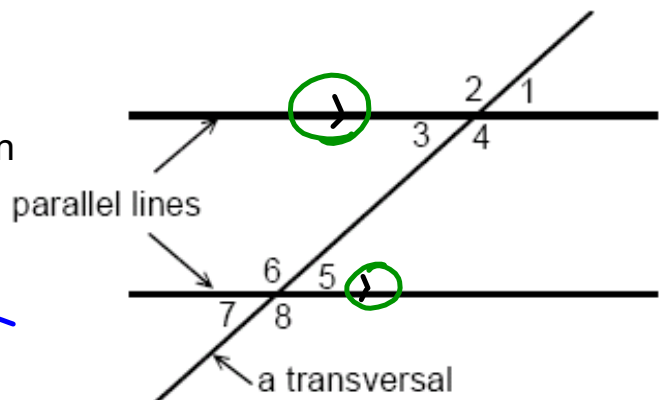
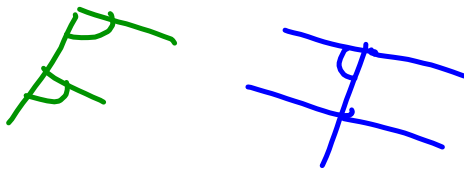
In geometry, angles or lines marked with the same symbol are the same size.

**Example:**



## Parallel Line Theorems

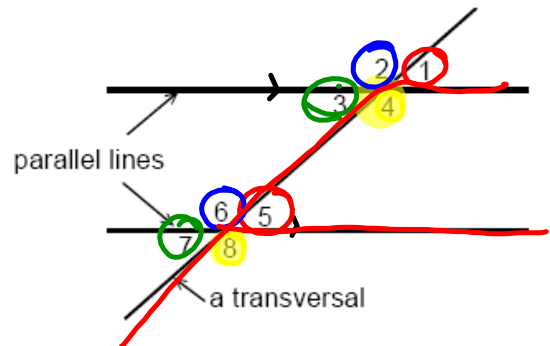
A transversal is a third line that crosses two or more lines, as shown in the illustration to the right.



Corresponding Angles:

CA

Pairs of angles on the same side of a transversal and the same side of the parallel lines

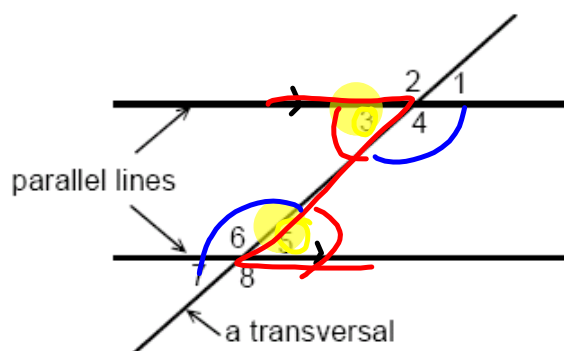


**CORRESPONDING ANGLES ARE EQUAL**

Alternate Interior Angles:

AIA

Pairs of angles on the opposite sides of a transversal and between the parallel lines

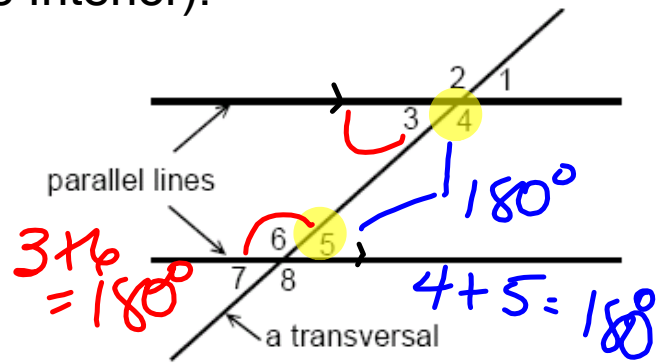


ALTERNATE INTERIOR ANGLES ARE EQUAL

Co-Interior Angles (Same-side Interior):

CIA

Pairs of angles on the same side of a transversal and between the parallel lines



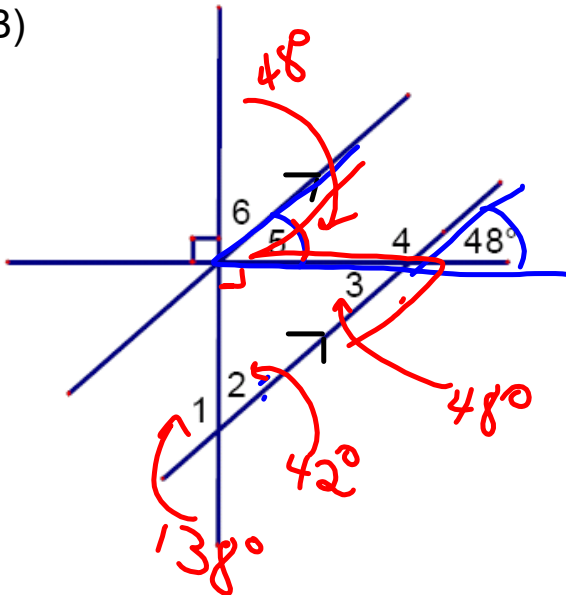
CO-INTERIOR ANGLES ARE SUPPLEMENTARY

$180^\circ$

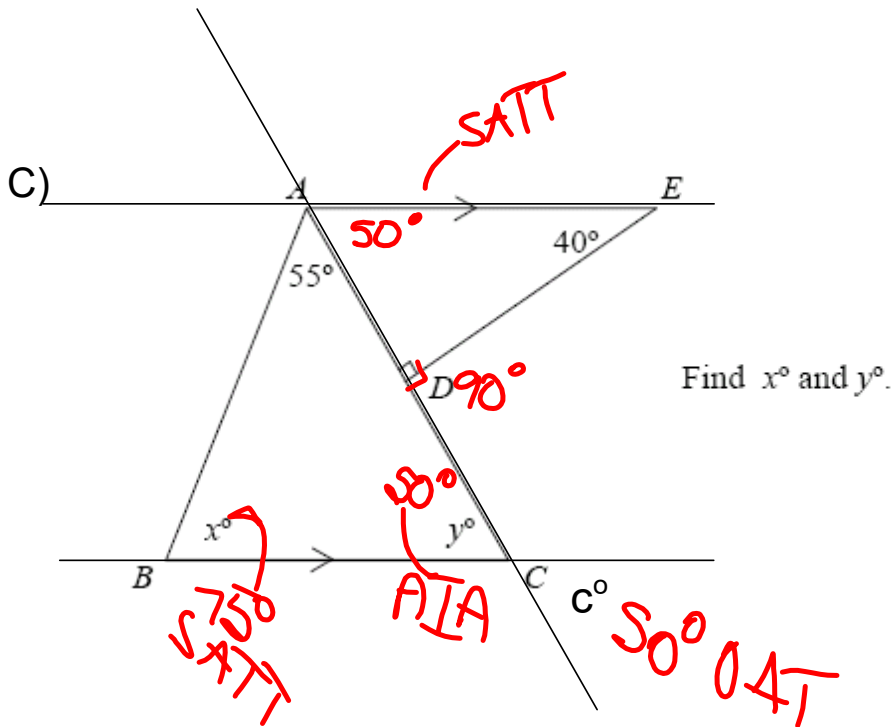
## EXERCISE: Practice...

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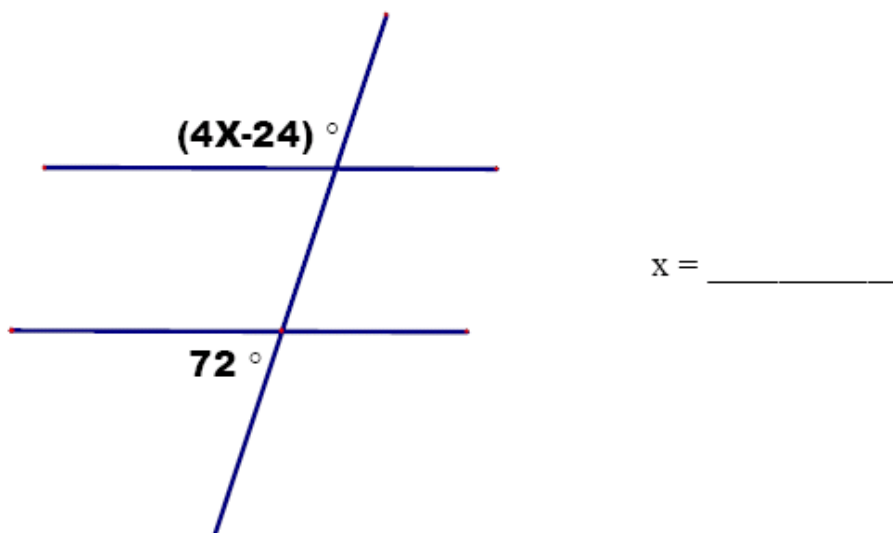
B)

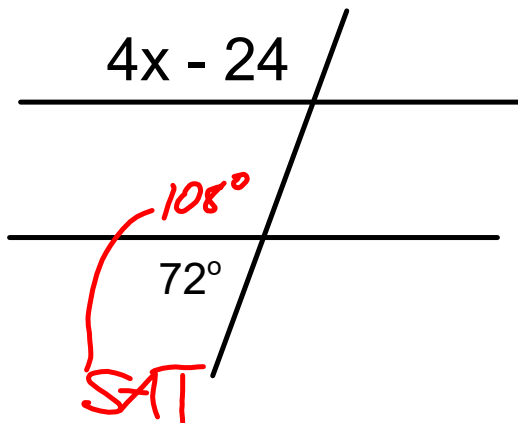


1.  $m\angle 1 = \underline{138^\circ \text{ SAT}}$
2.  $m\angle 2 = \underline{42 \text{ SAT/OAT}}$
3.  $m\angle 3 = \underline{48^\circ \text{ OAT CIA}}$
4.  $m\angle 4 = \underline{132^\circ \text{ SAT/SAT or}}$
5.  $m\angle 5 = \underline{48^\circ \text{ CA/AIA}}$
6.  $m\angle 6 = \underline{42 \text{ CAT}}$



D)





$x = \underline{\hspace{2cm}}$

$$\begin{aligned}4x - 24 &= 108 \text{ (CA)} \\4x - \cancel{24} &= 108 + 24 \\4x &= 132 \\ \frac{4x}{4} &= \frac{132}{4} \\x &= 33\end{aligned}$$

# QUIZ TIME... Use a ruler and compass!

When finished... HW: Complete the following...

## Worksheet - Angle Properties.pdf

Find the missing values

2. Find the values of  $x$  and  $y$ :

a) b) c)

3. Find the values of  $w, x, y,$  and  $z$ :

a) b) c)

d) e) f)

Exercises 7 - 6

A 1. Find the value of  $x$ :

a) b) c)

d) e) f)

g) h) i)

State all the facts you can about each figure:

a) b) c)

Side  $BC$  of  $\triangle ABC$  is extended to  $D$ . If  $BC = AC$ , prove that  $\angle ACD = 2\angle A$ .

$\angle A = \angle B$  (Isosceles Triangle Theorem)  
 $\angle A + \angle B = \angle ACD$  (Exterior Angle Theorem)  
 Therefore,  $\angle ACD = 2\angle A$

Find the values of  $x$  and  $y$ :

a) b) c)

d) e) f)



## Solutions from the HOMEWORK...Questions???

 [Worksheet Solutions - Angle Properties.pdf](#)

# PRACTICE TIME...

 Worksheet - Parallel Lines and Transversals.pdf

 **Worksheet Solutions - Parallel Lines and Transversals.pdf**

# IN-CLASS ASSIGNMENT TIME!!!

 [In-Class Assignment - Parallel Lines and Transversals.pdf](#)

## Parallel Lines???

What you should have found by measuring the angles above is that when two lines are parallel and intersected by a transversal:

- The measures of corresponding angles, alternate interior angles, and alternate exterior angles will be equal. (If such angles do not have equal measures, then the lines are not parallel.)
- Interior and exterior angles on the same side of a transversal will be supplementary. (If they are not, then the lines are not parallel.)

# HOMEWORK...

p. 314: #1 - 7

 **7.4 - Build Your Skills Detailed Solutions.pdf**



## Attachments

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Notes - Geometry Theorems.doc

Worksheet - Angle Properties.pdf

Worksheet Solutions - Angle Properties.pdf

Worksheet - Parallel Lines and Transversals.pdf

Worksheet Solutions - Parallel Lines and Transversals.pdf

In-Class Assignment - Parallel Lines and Transversals.pdf

7.4 - Build Your Skills Detailed Solutions.pdf