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## 2.7/2.8. Honors Geometry

DATE: 9/20

Target 1C. Prove theorems about lines and angles with statements based on the Law of Syllogism

### Transitive Property

- If  $\angle$ s  $\cong$  to the same or  $\cong \angle$ s, then they are  $\cong$  to each other.
- The same is true for segments.

*For instance:*

$$1) \text{ Given: } \begin{array}{l} \angle A \cong \angle B \\ \angle C \cong \angle B \end{array} \Rightarrow \underline{\angle A \cong \angle C} \checkmark$$

What can you conclude?

We can conclude  $\angle A \cong \angle C$ .

$$2) \text{ Given: } \begin{array}{l} \angle A \cong \angle B \\ \angle C \cong \angle B \\ \angle D \cong \angle F \\ \angle D \cong \angle C \end{array} \Rightarrow \begin{array}{l} \angle A \cong \angle C \\ \angle C \cong \angle F \end{array} \Rightarrow \underline{\angle A \cong \angle F} \checkmark$$

What can you conclude? We can conclude  $\angle A \cong \angle F$ .

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## Substitution

- The act of replacing a variable with a number, for example. Think about the process of solving an equation for  $x$  and then substituting the value you found for that variable.

***For instance:***

1) Given:  $\angle 1$  is comp to  $\angle 2$

$$\angle 1 \cong \angle 3$$

What can you conclude?

By "substituting"  $\angle 3$  for  $\angle 1$  in the first given statement, we can conclude  $\angle 3$  is comp to  $\angle 2$  ✓

## TI-Nspire Vertical Angles Activity

- Construct two intersecting lines. (*Go to Menu, Points & Lines*)
- Label the lines with the points as shown. (*Menu, Points & Lines, Actions, Text*)
- Measure  $\angle ABE$ ,  $\angle DBC$ ,  $\angle ABD$  and  $\angle CBE$  and label the diagram with the angle measure.

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### TI-Nspire Vertical Angles Activity

- Construct two intersecting lines. (Go to Menu, Points & Lines)
- Label the lines with the points as shown. (Menu, Points & Lines, Actions, Text)
- Measure  $\angle ABE$ ,  $\angle DBC$ ,  $\angle ABD$  and  $\angle CBE$  and label the diagram with the angle measure. (Menu, Measurement, Angle)

1) Grab one of the lines and move it from left to right.

What do you notice?

The  $\angle$  measures change

2) What do you notice about the measure of  $\angle ABE$  &  $\angle DBC$ ?

They have the same measure

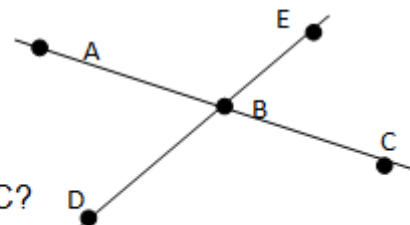
3) What do you notice about the measure of  $\angle ABD$  &  $\angle CBE$ ?

They have the same measure

4) Move one of the lines again. Is your answer to #2 and #3 still true? Explain.

Yes because  $\overleftrightarrow{AC}$  and  $\overleftrightarrow{DE}$  intersect to form vertical  $\cong \angle$ s

Conclusion: Vertical angles are  $\cong$



### Examples

If you haven't done this activity, please come before/after school...

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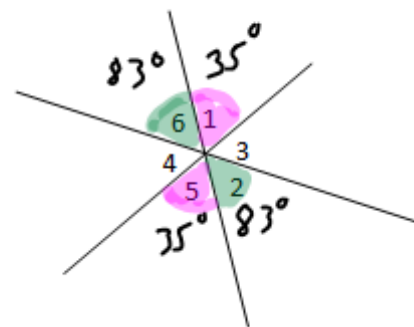
### Examples

- 1) Name all the pairs of vertical angles. Then find the  $m\angle 3$ ,  $m\angle 4$ ,  $m\angle 5$ , and  $m\angle 6$  given that  $\angle 1 = 35^\circ$  &  $\angle 2 = 83^\circ$ .

The vertical  $\angle$ s are:

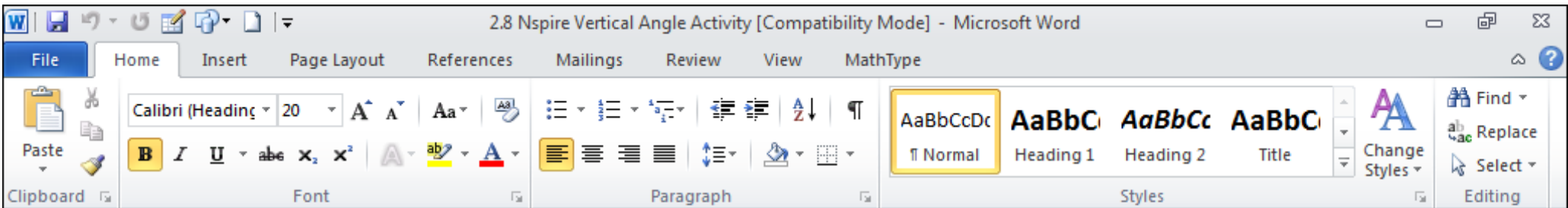
- $\angle 1$  and  $\angle 5$
- $\angle 2$  and  $\angle 6$
- $\angle 3$  and  $\angle 4$

$$\begin{aligned} m\angle 3 &= m\angle 4 = 180 - \angle 2 - \angle 5 \\ &= 180 - 83 - 35 \\ &= 62^\circ \end{aligned}$$



$$\begin{aligned} \therefore m\angle 5 &= 35 \text{ why?} \\ m\angle 6 &= 35 \text{ why?} \end{aligned}$$

2) Given:  $\angle 1 = 4x$



2) Given:  $\angle 1 = 4x$   
 $\angle 2 = x^2 - 5$

Can you find two possible solutions for the measure of  $\angle 3$ ?  
 Please justify your answer.

B/c vertical  $\angle$ s are  $\cong$ , we have the equation:

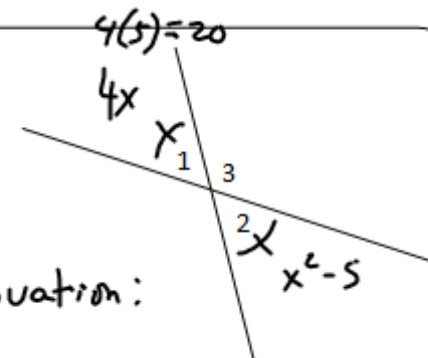
$$4x = x^2 - 5$$

$$\begin{array}{r} 4x = x^2 - 5 \\ -4x \quad -4x \\ \hline 0 = x^2 - 4x - 5 \\ 0 = (x - 5)(x + 1) \end{array}$$

$\begin{array}{c} -5 \\ \hline -5 \quad +1 \\ -4 \end{array}$ 
     
  $\begin{array}{c} -5 \\ \wedge \\ -5 \cdot 1 \end{array}$

$$\begin{array}{r} 0 = x - 5 \text{ or } 0 = x + 1 \\ +5 \quad +5 \quad \quad -1 \quad -1 \\ \hline 5 = x \quad \quad \quad -1 = x \end{array}$$

The zero is very important



Are two solutions for  $\angle 3$  poss.?  
 No b/c  $4(-1) = 4$ , a negative  $\angle$ .

So only solution is  
 $\angle 3 = 180 - 20 = 160^\circ$  ✓

3) Given:  $\angle 1$  supp to  $\angle 3$   
 Prove:  $\angle 2$  supp to  $\angle 3$



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3) Given:  $\angle 1$  supp to  $\angle 3$

Prove:  $\angle 2$  supp to  $\angle 3$

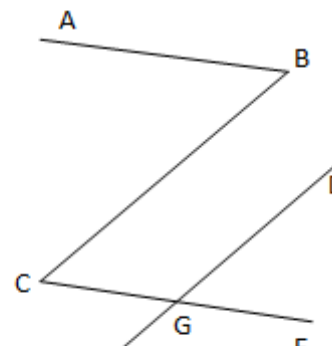


Statement	Reason
① $\angle 1$ <u>supp</u> $\angle 3$	① Given
② $\angle 1 \cong \angle 2$	② Vertical $\angle$ s are $\cong$
③ $\angle 2$ <u>supp</u> $\angle 3$	③ Substitution property (subst $\angle 2$ into $\angle 1$ of first given)

4) Given:  $\angle ABC \cong \angle BCG$

$\angle BCG \cong \angle DGE$

Prove:  $\angle ABC \cong \angle CGF$



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4) Given:  $\angle ABC \cong \angle BCG$

$\angle BCG \cong \angle DGE$

Prove:  $\angle ABC \cong \angle CGF$

statement	Reason
① $\angle ABC \cong \angle BCG$	① Given
② $\angle BCG \cong \angle DGE$	② Given
③ $\angle ABC \cong \angle DGE$	③ Transitive property.
④ $\angle CGF \cong \angle DGE$	④ Vertical $\angle$ s are $\cong$
⑤ $\angle ABC \cong \angle CGF$	⑤ Transitive property (again :))

