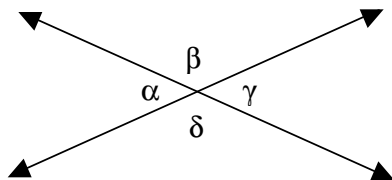


## Lesson 6 Supplementary and Complementary Angles

# Sample Teacher Manual Page

### Greek Letters

Figure 1

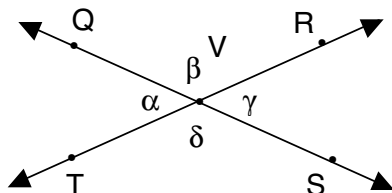


$\alpha$  = alpha  
 $\beta$  = beta  
 $\gamma$  = gamma  
 $\delta$  = delta

**Adjacent Angles** Angles that share a common side and have the same origin are called adjacent angles. They are side by side. In Figure 1,  $\alpha$  is adjacent to  $\beta$  and  $\delta$ . It is not adjacent to  $\gamma$ . In figure 1 there are four pairs of adjacent angles,  $\alpha$  and  $\beta$ ,  $\beta$  and  $\gamma$ ,  $\gamma$  and  $\delta$ ,  $\delta$  and  $\alpha$ .

In Figure 2 we added points so we can name the rays that form the angles. The common side shared by adjacent angles  $\angle\alpha$  and  $\angle\beta$ , is  $\vec{VQ}$ .

Figure 2



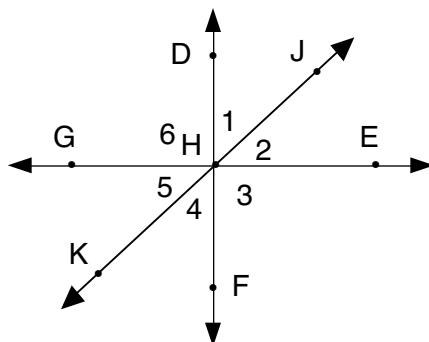
Given:  $\overleftrightarrow{RT} \cap \overleftrightarrow{QS} = V$

**Vertical Angles** Notice that  $\angle\gamma$  is opposite  $\angle\alpha$ . Angles that share a common origin and are opposite each other, are called vertical angles. They have the same measure and are congruent.  $\angle\beta$  and  $\angle\delta$  are also vertical angles.

If  $m\angle\beta$  is  $115^\circ$ , then  $m\angle\delta$  is also  $115^\circ$ . If this is true, then do we have enough information to find the  $m\angle\alpha$ ? We know from the information given in Figure 2 that  $\overleftrightarrow{RT}$  and  $\overleftrightarrow{QS}$  are lines. Therefore,  $\angle RVT$  is a straight angle and has a measure of  $180^\circ$ . If  $\angle RVQ$  ( $\angle\beta$ ) is  $115^\circ$ , then  $\angle QVT$  ( $\angle\alpha$ ) must be  $180^\circ - 115^\circ$  or  $65^\circ$ . Since  $\angle RVS$  ( $\angle\gamma$ ) is a vertical angle to  $\angle QVT$ , then it also is  $65^\circ$ .

**Supplementary Angles** Two angles, like  $\angle\alpha$  and  $\angle\beta$ , whose measures add up to  $180^\circ$ , or that make a straight angle (or straight line) are said to be supplementary. In our example they were adjacent to each other, but they don't have to be adjacent to be classified as supplementary angles.

Figure 3



All drawings are in the same plane unless otherwise noted.

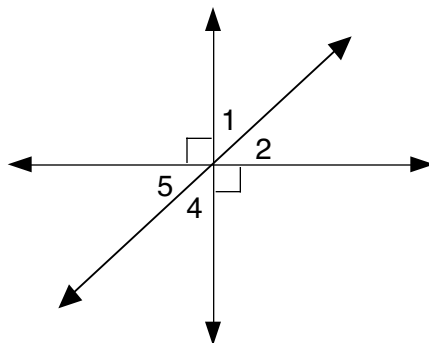
Given:  $\overleftrightarrow{DF}$ ,  $\overleftrightarrow{GH}$ , and  $\overleftrightarrow{KJ}$  all intersect at H.

$$\overleftrightarrow{DF} \perp \overleftrightarrow{GE}$$

**Complementary Angles** We can observe many relationships in Figure 3.  $\angle 1$  is adjacent to  $\angle 6$  and  $\angle 2$ .  $\angle 3$  and  $\angle 6$  are vertical angles, as are  $\angle 1$  and  $\angle 4$ .  $\angle 6$  and  $\angle 3$  are also right angles since  $\overleftrightarrow{DF} \perp \overleftrightarrow{GE}$ . The new concept is in  $\angle DHE$  and  $\angle GHF$ . Both of these are right angles because the lines are perpendicular. Therefore their measures are each  $90^\circ$ . Then  $m\angle 1 + m\angle 2 = 90^\circ$  and  $m\angle 4 + m\angle 5 = 90^\circ$ . Two angles whose measures add up to  $90^\circ$  are called complementary angles. Notice that from what we know about vertical angles,  $\angle 1$  and  $\angle 5$  are also complementary. Let's use some real measures to verify our conclusions.

Figure 4

(a simplified Fig. 3)



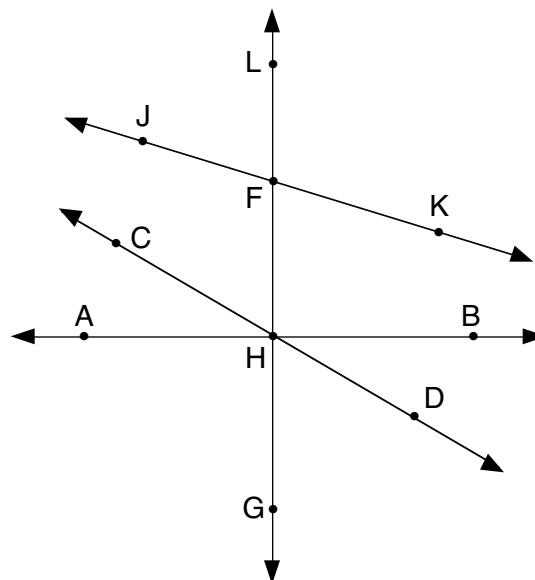
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In Figure 4, let's assume that  $m\angle 1 = 47^\circ$ . Then  $m\angle 2$  must be  $43^\circ$  since they add up to  $90^\circ$ . If  $m\angle 1 = 47^\circ$ , then  $m\angle 4$  must also be  $47^\circ$  since they are vertical angles, and  $m\angle 5$  must be  $43^\circ$ . So  $\angle 1$  and  $\angle 5$  are complementary, as are  $\angle 2$  and  $\angle 4$ . Remember that supplementary and complementary angles do not have to be adjacent to qualify.

It helps me not to get supplementary and complementary angles mixed up by thinking of the "s" in straight and the "s" in supplementary. The "c" in complementary may be like the "c" in corner. For those who use cassettes, a C-90 is a popular tape size.

Use the drawing to fill in the blanks.

- 1)  $\angle AHC$  is adjacent to  $\angle$ \_\_\_\_\_ and  $\angle$ \_\_\_\_\_.
- 2)  $\angle BHD$  is adjacent to  $\angle$ \_\_\_\_\_ and  $\angle$ \_\_\_\_\_.
- 3)  $\angle FHB$  and  $\angle$ \_\_\_\_\_ are vertical angles.
- 4)  $\angle FHC$  and  $\angle$ \_\_\_\_\_ are vertical angles.
- 5)  $\angle LFJ$  and  $\angle$ \_\_\_\_\_ are supplementary angles.
- 6)  $\angle FHC$  and  $\angle$ \_\_\_\_\_ are complementary angles.
- 7)  $\angle JFH$  and  $\angle$ \_\_\_\_\_ are supplementary angles.
- 8)  $\angle BHD$  and  $\angle$ \_\_\_\_\_ are complementary angles.
- 9) If the  $m\angle CHA = 40^\circ$ , then  $m\angle BHD =$  \_\_\_\_\_.
- 10) If the  $m\angle JFL = 65^\circ$ , then  $m\angle KFH =$  \_\_\_\_\_.
- 11) If the  $m\angle FHB = 90^\circ$ , then  $m\angle FHA =$  \_\_\_\_\_.
- 12) If the  $m\angle CHA = 40^\circ$ , then  $m\angle FHC =$  \_\_\_\_\_.
- 13) If the  $m\angle LFJ = 65^\circ$ , then  $m\angle LFK =$  \_\_\_\_\_.
- 14) If the  $m\angle FHB = 90^\circ$ , then  $m\angle AHG =$  \_\_\_\_\_.



Given:  $\overleftrightarrow{AB}$ ,  $\overleftrightarrow{CD}$ ,  $\overleftrightarrow{LG}$  and  $\overleftrightarrow{JK}$   
are straight lines.  
 $m\angle FHB = 90^\circ$ .

The drawing is a sketch and not necessarily to scale. Don't make any assumptions about the lines and angles other than what is actually given.

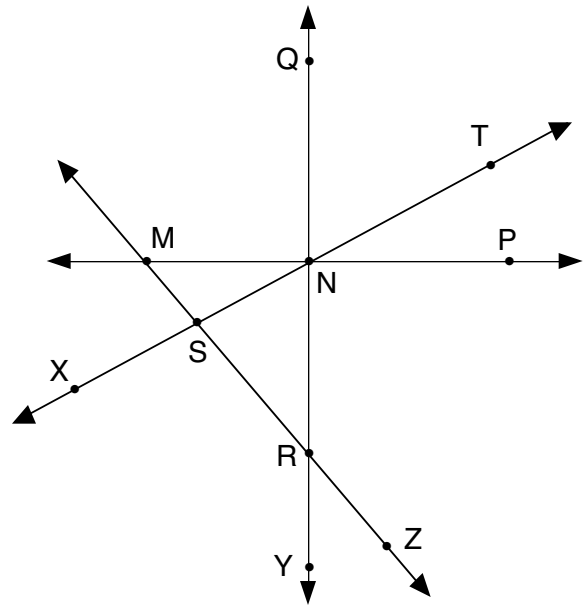
**Sample  
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Match each term to the best answer.

- |                          |                                 |
|--------------------------|---------------------------------|
| 15) $\beta$              | a) share a common ray           |
| 16) adjacent angles      | b) alpha                        |
| 17) supplementary angles | c) always have the same measure |
| 18) $\alpha$             | d) add up to $90^\circ$         |
| 19) complementary angles | e) add up to $180^\circ$        |
| 20) vertical angles      | f) beta                         |

Use the drawing to fill in the blanks.

- 1)  $\angle MNS$  is adjacent to  $\angle$ \_\_\_\_\_ and  $\angle$ \_\_\_\_\_.
- 2)  $\angle QNT$  is adjacent to  $\angle$ \_\_\_\_\_ and  $\angle$ \_\_\_\_\_.
- 3)  $\angle SRN$  and  $\angle$ \_\_\_\_\_ are vertical angles.
- 4)  $\angle MNS$  and  $\angle$ \_\_\_\_\_ are vertical angles.
- 5)  $\angle QNP$  and  $\angle$ \_\_\_\_\_ are supplementary angles.
- 6)  $\angle QNT$  and  $\angle$ \_\_\_\_\_ are complementary angles.
- 7)  $\angle NRZ$  and  $\angle$ \_\_\_\_\_ are supplementary angles.
- 8)  $\angle MNS$  and  $\angle$ \_\_\_\_\_ are complementary angles.
- 9) If the  $m\angle MNS = 35^\circ$ , then  $m\angle SNR =$  \_\_\_\_\_.
- 10) If the  $m\angle MNS = 35^\circ$ , then  $m\angle TNP =$  \_\_\_\_\_.
- 11) If the  $m\angle QNP = 90^\circ$ , then  $m\angle PNR =$  \_\_\_\_\_.
- 12) If the  $m\angle MSN = 95^\circ$ , then  $m\angle NSR =$  \_\_\_\_\_.
- 13) If the  $m\angle SRN = 40^\circ$ , then  $m\angle YRZ =$  \_\_\_\_\_.
- 14) If the  $m\angle XNY = 55^\circ$ , then  $m\angle QNT =$  \_\_\_\_\_.



Given: All lines that appear to be straight lines are straight lines.  
 $m\angle QNP = 90^\circ$ .

The drawing is a sketch and not necessarily to scale. Don't make any assumptions about the lines and angles other than what is actually given.

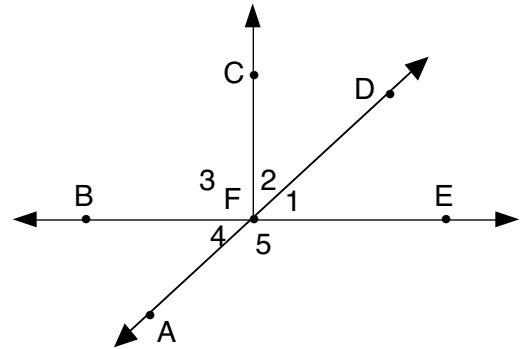
Fill in the blanks with the correct terms.

- 15) The name of the Greek letter  $\alpha$  is \_\_\_\_\_.
- 16) Two angles whose measures add up to  $90^\circ$  are called \_\_\_\_\_.
- 17) Two angles whose measures add up to  $180^\circ$  are called \_\_\_\_\_.
- 18) The name of the Greek letter  $\gamma$  is \_\_\_\_\_.
- 19) Intersecting lines form two pairs of \_\_\_\_\_ angles.
- 20) The name of the Greek letter  $\delta$  is \_\_\_\_\_.

**Sample  
Student Text  
Page**

Use the drawing to fill in the blanks.

- 1)  $\angle 1$  is adjacent to  $\angle$ \_\_\_\_\_ and  $\angle$ \_\_\_\_\_.
- 2)  $\angle 1$  and  $\angle$ \_\_\_\_\_ are vertical angles.
- 3)  $\angle AFE$  and  $\angle$ \_\_\_\_\_ are vertical angles.
- 4)  $\angle$ \_\_\_\_\_ is a straight angle.
- 5)  $\angle$ \_\_\_\_\_ is an obtuse angle.
- 6)  $\angle 2$  and  $\angle$ \_\_\_\_\_ are complementary angles.
- 7) If the  $m\angle 2 = 50^\circ$ ,  $m\angle 1 =$  \_\_\_\_\_. Why?
- 8) If the  $m\angle 2 = 50^\circ$ ,  $m\angle 4 =$  \_\_\_\_\_. Why?
- 9)  $\angle 5$  and  $\angle$ \_\_\_\_\_ are supplementary angles.
- 10) If the  $m\angle 4 = 40^\circ$ , then  $m\angle 5 =$  \_\_\_\_\_. Why?
- 11) Name two acute angles from the drawing.
- 12) Name two right angles from the drawing.
- 13) Draw a line segment  $1\frac{1}{2}$  inches long. Draw its perpendicular bisector using compass and straightedge.



Given:  $\overleftrightarrow{FC} \perp \overleftrightarrow{BE}$   
 $\overleftrightarrow{DA}$  intersects  $\overleftrightarrow{BE}$  at F

Remember not to make any assumptions about the lines and angles other than what is actually given.

- 14) Draw a  $52^\circ$  angle and then bisect it.

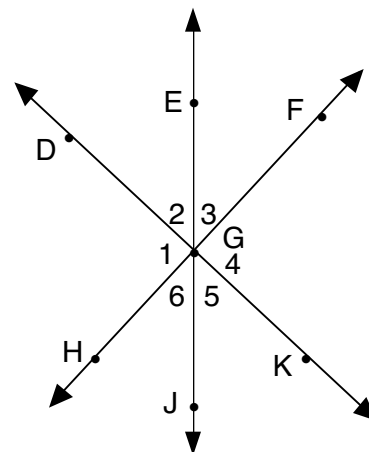
**Sample  
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Fill in the blanks with the correct terms.

- 15) Two lines forming a right angle are said to be \_\_\_\_\_ to each other.
- 16) A right angle has a measure of \_\_\_\_\_ $^\circ$ .
- 17) A straight angle has a measure of \_\_\_\_\_ $^\circ$ .
- 18) The measures of two complementary angles add up to \_\_\_\_\_ $^\circ$ .
- 19) The measures of two supplementary angles add up to \_\_\_\_\_ $^\circ$ .
- 20) The intersection of two sets with no elements in common is the \_\_\_\_\_ set.

Use the drawing to tell if each statement is true or false.

- 1)  $\angle 2$  and  $\angle 5$  are vertical angles.
- 2) If  $\overleftrightarrow{FH} \perp \overleftrightarrow{DK}$ , then  $\angle 2$  and  $\angle 3$  are supplementary.
- 3)  $\angle 3$  and  $\angle 4$  are adjacent angles.
- 4)  $\angle FGK$  is known to be a right angle.
- 5)  $\overrightarrow{GJ}$  is the common side for  $\angle JGK$  and  $\angle KGF$ .
- 6)  $\angle 2$ ,  $\angle 3$  and  $\angle 5$  appear to be acute.



Given:  $\overleftrightarrow{DK}$ ,  $\overleftrightarrow{EJ}$  and  $\overleftrightarrow{FH}$  intersect at G

Remember not to make any assumptions about the lines and angles other than what is actually given.

Use the drawing to fill in the blanks.

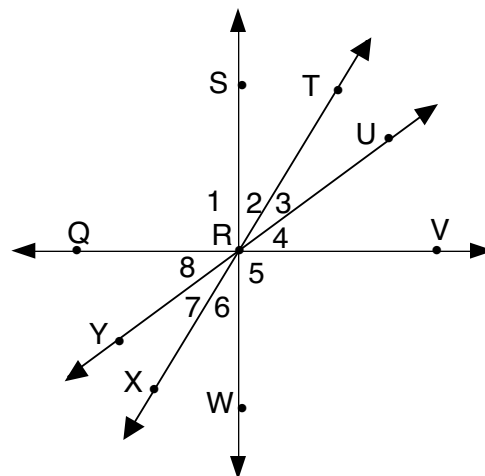
- 7) If the  $m\angle 3 = 39^\circ$ ,  $m\angle 6 = \underline{\hspace{2cm}}$ . Why?
- 8) If  $\overleftrightarrow{FH} \perp \overleftrightarrow{DK}$ , and  $m\angle 3 = 39^\circ$ ,  $m\angle 2 = \underline{\hspace{2cm}}$ . Why?
- 9) If  $\overleftrightarrow{FH} \perp \overleftrightarrow{DK}$ , then  $m\angle 1$  and  $m\angle 4$  are each  $\underline{\hspace{2cm}}$ . Why?
- 10) If the  $m\angle 1$  is  $90^\circ$ , it is a(n)  $\underline{\hspace{2cm}}$  angle.
- 11) If the measures of  $\angle 4$  and  $\angle 1$  add up to  $180^\circ$ , they are called  $\underline{\hspace{2cm}}$  angles.
- 12)  $m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 + m\angle 5 + m\angle 6 = \underline{\hspace{2cm}}^\circ$ .

Match each term to the best answer.

- |  |                  |
|--|------------------|
| 13) Greek letter beta                  | a) $\alpha$      |
| 14) less than $90^\circ$               | b) complementary |
| 15) measures add to $90^\circ$         | c) $\delta$      |
| 16) Greek letter alpha                 | d) obtuse        |
| 17) Greek letter gamma                 | e) acute         |
| 18) between $90^\circ$ and $180^\circ$ | f) $\beta$       |
| 19) measures add to $180^\circ$        | g) $\gamma$      |
| 20) Greek letter delta                 | h) supplementary |

**Sample  
Student Text  
Page**

Use the drawing to fill in the blanks or answer the questions.



**Sample Student Text Page**

Given:  $\overleftrightarrow{SW} \perp \overleftrightarrow{QV}$

All four straight lines intersect at R.

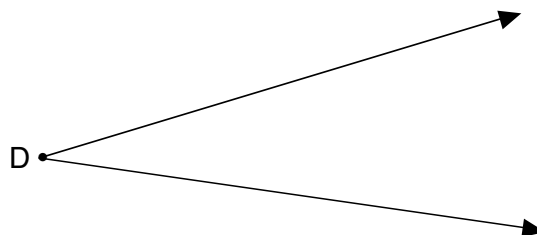
Remember the drawing is a sketch. Use the measurements given in the questions, even if the drawing appears to be different.

- 1) Name a line containing  $\overrightarrow{RV}$ .
- 2) Name a line segment contained in  $\overleftrightarrow{RT}$ .
- 3) If all eight angles were congruent, rather than as given, what would the measure of each be?
- 4) Since the  $m\angle 1$  is  $90^\circ$ , what is  $m\angle 2 + m\angle 3 + m\angle 4$ ?
- 5)  $\angle 4 + \angle 5$  is a(n) \_\_\_\_\_ angle.
- 6) Are  $\angle 1$  and  $\angle 5$  supplementary?
- 7) Are  $\angle 1$  and  $\angle 5$  complementary?
- 8) Are  $\angle 1$  and  $\angle 5$  vertical angles?
- 9) If  $\angle 2 \cong \angle 3 \cong \angle 4$ , then  $m\angle 8 = \underline{\hspace{2cm}}$ .
- 10)  $\angle 6 \cong \angle \underline{\hspace{2cm}}$
- 11)  $\angle 2$  and  $\angle 3$  are \_\_\_\_\_ angles. (size)
- 12) If the  $m\angle 2 = 25^\circ$ , and  $m\angle 4 = 35^\circ$ , then  $m\angle 3 = \underline{\hspace{2cm}}$ .
- 13) If the  $m\angle 2 = 25^\circ$ , and  $m\angle 4 = 35^\circ$ , then  $m\angle YRX = \underline{\hspace{2cm}}$ .
- 14) Which ray is the common side for  $\angle SRQ$  and  $\angle QRX$ ?

- 15) Draw the perpendicular bisector of the given line segment.



- 16) Draw a ray bisecting the given angle.



Sharpen your algebra skills! \_\_\_\_\_

*Be very careful when squaring negative numbers.*

Example 1:  $(-5)^2 = (-5)(-5) = +25$

Example 2:  $-(-8)^2 = -(8)(8) = -64$

Example 3:  $-6^2 = -(6)(6) = -36$

17)  $(-7)^2 =$

18)  $-(-15)^2 =$

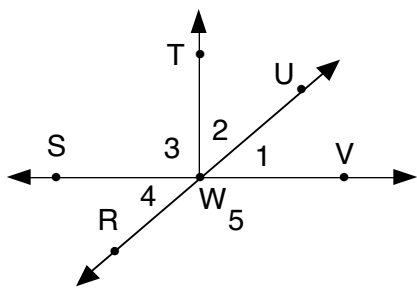
19)  $-12^2 =$

20)  $-(-9)^2 =$

- 1) Two angles whose measures add up to  $180^\circ$  are called  
 (A) straight (B) complementary (C) acute  
 (D) obtuse (E) supplementary
- 2) Vertical angles are  
 (A) supplementary (B) complementary  
 (C) congruent (D) adjacent (E) obtuse
- 3)  $m\angle XYZ = 35^\circ$ . What is the measure of its complement?  
 (A)  $145^\circ$  (B)  $55^\circ$  (C)  $35^\circ$  (D)  $65^\circ$   
 (E)  $125^\circ$

- 4)  $m\angle GEF = 40^\circ$ . What is the measure of its supplement?  
 (A)  $60^\circ$  (B)  $50^\circ$  (C)  $140^\circ$  (D)  $320^\circ$  (E)  $40^\circ$
- 5) Angle A is  $20^\circ$  and angle B is  $70^\circ$ . What is their relationship?  
 (A) supplementary (B) vertical (C) reflexive  
 (D) coplanar (E) complementary

Use this diagram for numbers 6 - 10.

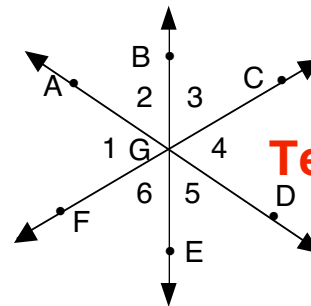


Given:  $WT \perp SV$ ;  $RU \cap SV$  at  $W$ .

- 6)  $\angle 1$  is adjacent to  
 (A)  $\angle 1$  (B)  $\angle 2$  and  $\angle 5$  (C)  $\angle 3$  (D)  $\angle 4$   
 (E)  $\angle 2$
- 7) The sum of  $m\angle 1$  and  $m\angle 2$  is  
 (A)  $90^\circ$  (B)  $180^\circ$  (C)  $45^\circ$  (D)  $360^\circ$   
 (E) can't tell from information given

- 8) The measure of  $\angle UWV$  is  
 (A)  $45^\circ$  (B)  $30^\circ$  (C)  $90^\circ$  (D)  $35^\circ$   
 (E) can't tell from information given
- 9)  $\angle 4$  and what other angle are vertical angles?  
 (A)  $\angle 3$  (B)  $\angle 4$  (C)  $\angle 2$  (D)  $\angle 1$   
 (E)  $\angle TWV$
- 10)  $\angle SWT + \angle TWU + \angle UWV =$   
 (A)  $180^\circ$  (B)  $360^\circ$  (C)  $90^\circ$  (D)  $100^\circ$   
 (E) can't tell from information given

Use this diagram for numbers 11 - 15



Sample  
Test Booklet  
Page

Given:  $\overleftrightarrow{FC}, \overleftrightarrow{AD}, \overleftrightarrow{BE}$  intersect at  $G$ .

For numbers 11-15, answer:

- A if the quantity in column A is greater.
- B if the quantity in column B is greater.
- C if the two quantities are equal.
- D if the relationship cannot be determined from the information given.

	A	B
11)	$m\angle 2$	$m\angle 5$
12)	$m\angle 4 + m\angle 5$	$136^\circ$
13)	$180^\circ$	$m\angle 2 + m\angle 3$
14)	$m\angle 2$	$m\angle 3$
15)	$185^\circ$	measure of 2 right angles



# Sample Teacher Manual Page

Practice 6A	Practice 6B	Lesson 6A	Lesson 6B
1) $\angle AHG, \angle CHF$	1) $\angle MNG, \angle SNR$	1) 2,5	1) True
2) $\angle FHB, \angle GHD$	2) $\angle MNG, \angle TNP$	2) 4	2) False; they are complementary
3) $\angle AHG$	3) $\angle YRZ$	3) BFD	3) True
4) $\angle GHD$	4) $\angle TNP$	4) BFE or AFD	4) False; perpendicular angles were not listed in "Given"
5) $\angle LFK$ or $\angle JFH$	5) $\angle QNM$ or $\angle PNR$	5) BFD or AFC or AFE	5) False; GK is the common side $\rightarrow$
6) $\angle CHA$	6) $\angle TNP$	6) 1	6) True
7) $\angle HFK$ or $\angle JFL$	7) $\angle YRZ$ or $\angle SRN$	7) $40^\circ$ ; they are complementary	7) $39^\circ$ ; they are vertical angles
8) $\angle DHG$	8) $\angle SNR$	8) $40^\circ$ ; $m\angle 1 = 40^\circ$ , $\angle 1$ and $\angle 4$ are vertical angles	8) $51^\circ$ ; they are complementary
9) $40^\circ$	9) $55^\circ$	9) $\angle 1$ , or $\angle 4$	9) $90^\circ$ ; perpendicular lines form $90^\circ$ angles
10) $65^\circ$	10) $35^\circ$	10) $140^\circ$ ; they are supplementary	10) right
11) $90^\circ$	11) $90^\circ$	11) $\angle 2, \angle 1, \angle 4$	11) supplementary
12) $50^\circ$	12) $85^\circ$	12) $\angle 3; \angle CFE$	12) 360
13) $115^\circ$	13) $40^\circ$	13) Use a ruler to check. The segment on each side of the bisector should measure $3/4"$ .	13) f
14) $90^\circ$	14) $55^\circ$	14) The angles on each side of the bisector should measure $26^\circ$ .	14) e
15) f	15) alpha	15) perpendicular	15) b
16) a	16) complementary	16) 90	16) a
17) e	17) supplementary	17) 180	17) g
18) b	18) gamma	18) 90	18) d
19) d	19) vertical	19) 180	19) h
20) c	20) delta	20) empty or null	20) c