



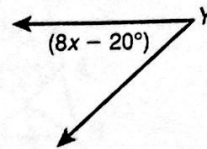
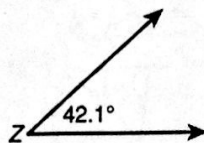
# Additional Practice

- $\angle PQR$  and  $\angle SQR$  form a linear pair. Find the sum of their measures. \_\_\_\_\_
- Name the ray that  $\angle PQR$  and  $\angle SQR$  share. \_\_\_\_\_

Use the figures for Exercises 3 and 4.

3. supplement of  $\angle Z$  \_\_\_\_\_

4. complement of  $\angle Y$  \_\_\_\_\_



- An angle measures 12 degrees less than three times its supplement. Find the measure of the angle. \_\_\_\_\_
- An angle is its own complement. Find the measure of a supplement to this angle. \_\_\_\_\_

7.  $\angle DEF$  and  $\angle FEG$  are complementary.  $m\angle DEF = (3x - 4)^\circ$ , and  $m\angle FEG = (5x + 6)^\circ$ .

Find the measures of both angles. \_\_\_\_\_

8.  $\angle DEF$  and  $\angle FEG$  are supplementary.  $m\angle DEF = (9x + 1)^\circ$ , and  $m\angle FEG = (8x + 9)^\circ$ .

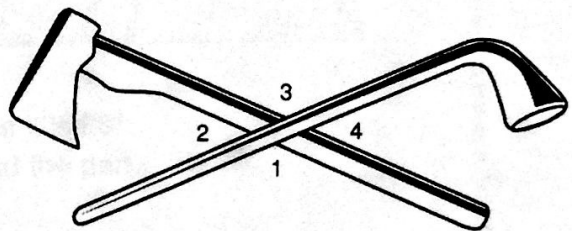
Find the measures of both angles. \_\_\_\_\_

Use the figure for Exercises 9 and 10.

In 2004, several nickels were minted to commemorate the Louisiana Purchase and Lewis and Clark's expedition into the American West. One nickel shows a pipe and a hatchet crossed to symbolize peace between the American government and Native American tribes.

9. Name a pair of vertical angles.

\_\_\_\_\_  
\_\_\_\_\_



10. Name a linear pair of angles.

\_\_\_\_\_

11.  $\angle ABC$  and  $\angle CBD$  form a linear pair and have equal measures. Tell if  $\angle ABC$  is acute, right, or obtuse.

\_\_\_\_\_

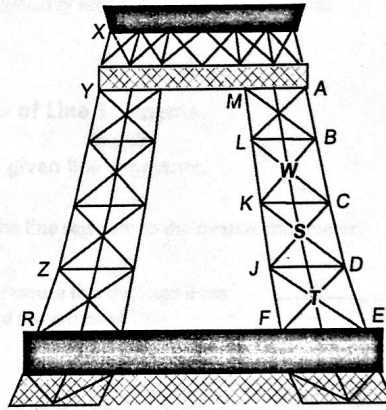
12.  $\angle KLM$  and  $\angle MLN$  are complementary.  $\overline{LM}$  bisects  $\angle KLN$ . Find the measures of  $\angle KLM$  and  $\angle MLN$ .

\_\_\_\_\_

## Problem Solving

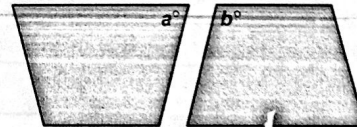
Use the drawing of part of the Eiffel Tower for Exercises 1–5.

1. Name a pair of angles that appear to be complementary.  
\_\_\_\_\_
2. Name a pair of supplementary angles.  
\_\_\_\_\_
3. If  $m\angle CSW = 45^\circ$ , what is  $m\angle JST$ ? How do you know?  
\_\_\_\_\_  
\_\_\_\_\_
4. If  $m\angle FKB = 135^\circ$ , what is  $m\angle BKL$ ? How do you know?  
\_\_\_\_\_  
\_\_\_\_\_
5. Name three angles whose measures sum to  $180^\circ$ .  
\_\_\_\_\_



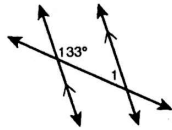
Choose the best answer.

6. A landscaper uses paving stones for a walkway. Which are possible angle measures for  $a^\circ$  and  $b^\circ$  so that the stones do not have space between them?  
A  $50^\circ, 100^\circ$       C  $75^\circ, 105^\circ$   
B  $45^\circ, 45^\circ$       D  $90^\circ, 80^\circ$
7. The angle formed by a tree branch and the part of the trunk above it is  $68^\circ$ . What is the measure of the angle that is formed by the branch and the part of the trunk below it?  
F  $22^\circ$                   H  $158^\circ$   
G  $112^\circ$                  J  $180^\circ$
8.  $\angle R$  and  $\angle S$  are complementary. If  $m\angle R = (7 + 3x)^\circ$  and  $m\angle S = (2x + 13)^\circ$ , which is a true statement?  
A  $\angle R$  is acute.      C  $\angle R$  and  $\angle S$  are right angles.  
B  $\angle R$  is obtuse.     D  $m\angle S > m\angle R$

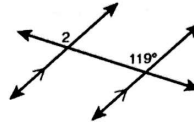


# Additional Practice /

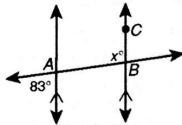
Find each angle measure.



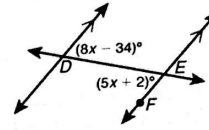
1.  $m\angle 1$  \_\_\_\_\_



2.  $m\angle 2$  \_\_\_\_\_



3.  $m\angle ABC$  \_\_\_\_\_

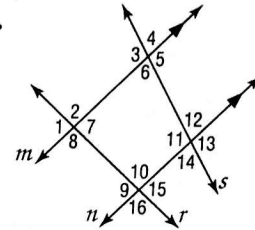


4.  $m\angle DEF$  \_\_\_\_\_

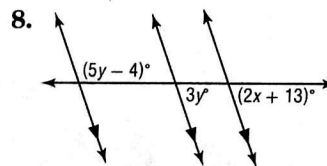
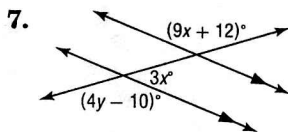
## Angles and Parallel Lines

In the figure,  $m\angle 2 = 92$  and  $m\angle 12 = 74$ . Find the measure of each angle. Tell which postulate(s) or theorem(s) you used.

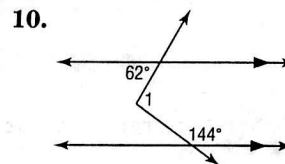
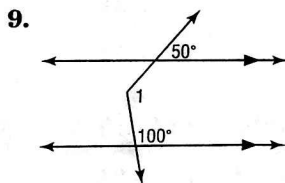
- |                |                |
|----------------|----------------|
| 1. $\angle 10$ | 2. $\angle 8$  |
| 3. $\angle 9$  | 4. $\angle 5$  |
| 5. $\angle 11$ | 6. $\angle 13$ |



Find the value of the variable(s) in each figure. Explain your reasoning.



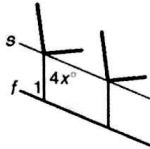
Find  $x$ . (*Hint: Draw an auxiliary line.*)



# Problem Solving

Find each value. Name the postulate or theorem that you used to find the values.

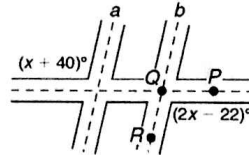
1. In the diagram of movie theater seats, the incline of the floor,  $f$ , is parallel to the seats,  $s$ .



If  $m\angle 1 = 68^\circ$ , what is  $x$ ?

\_\_\_\_\_

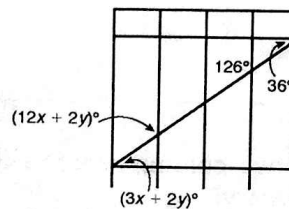
2. In the diagram, roads  $a$  and  $b$  are parallel.



What is the measure of  $\angle PQR$ ?

\_\_\_\_\_

3. In the diagram of the gate, the horizontal bars are parallel and the vertical bars are parallel. Find  $x$  and  $y$ .



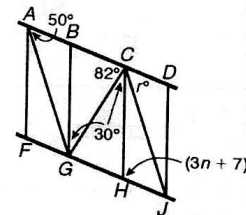
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Use the diagram of a staircase railing for Exercises 4 and 5.  $\overline{AG} \parallel \overline{CJ}$  and  $\overline{AD} \parallel \overline{FJ}$ . Choose the best answer.

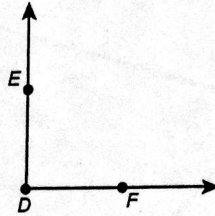
4. Which is a true statement about the measure of  $\angle DCJ$ ?
- A It equals  $30^\circ$ , by the Alternate Interior Angles Theorem.
  - B It equals  $30^\circ$ , by the Corresponding Angles Postulate.
  - C It equals  $50^\circ$ , by the Alternate Interior Angles Theorem.
  - D It equals  $50^\circ$ , by the Corresponding Angles Postulate.
5. Which is a true statement about the value of  $n$ ?
- F It equals  $25^\circ$ , by the Alternate Interior Angles Theorem.
  - G It equals  $25^\circ$ , by the Same-Side Interior Angles Theorem.
  - H It equals  $35^\circ$ , by the Alternate Interior Angles Theorem.
  - J It equals  $35^\circ$ , by the Same-Side Interior Angles Theorem.



## Additional Practice

For Exercises 1 and 2, use the figure shown.

1. Use a compass and straightedge to construct angle bisector  $\overrightarrow{DG}$ . Given that  $m\angle EDF = 90^\circ$ , find  $m\angle EDG$ .



$m\angle EDG =$  \_\_\_\_\_

2. Use your construction of  $\angle EDG$  from Exercise 1. Construct  $\angle XYZ$  with the same measure as  $\angle EDG$ .

3. Use a straightedge to draw an acute angle. Use a compass and straightedge to copy the angle. Then bisect the copy of the angle.

4. Use a straightedge to draw an obtuse angle. Use a compass and straightedge to copy the angle. Then bisect the copy of the angle.

## Problem Solving

For Exercises 1–2, use the figure shown.

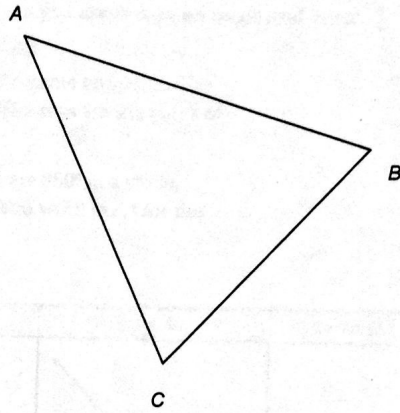
1. Construct the bisector of  $\angle B$  in  $\triangle ABC$ . Construct the bisectors of  $\angle A$  and  $\angle C$ .
2. What do you notice about the bisectors?

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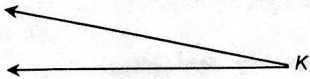
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3. Construct an angle whose measure is four times as great as  $m\angle K$ , shown below.



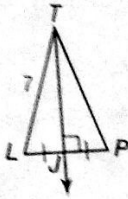
Choose the best answer.

4. Mark drew  $\angle PQR$  with measure  $168^\circ$ . He constructed the angle bisector  $\overrightarrow{QX}$ . Then he bisected  $\angle PQX$  by constructing  $\overrightarrow{PY}$ . What is  $m\angle PQY$ ?  
A  $21^\circ$       B  $42^\circ$       C  $84^\circ$       D  $168^\circ$
5. Paula bisected  $\angle XYZ$ , forming angles  $\angle XYW$  and  $\angle WYZ$ . Given that  $\angle XYZ$  is an obtuse angle, which statement cannot be true?  
F  $m\angle WYZ$  is less than  $90^\circ$ .  
G  $m\angle WYZ = m\angle XYW$   
H  $m\angle WYZ$  is greater than  $90^\circ$ .  
J  $m\angle XYZ = 2 \cdot m\angle XYW$

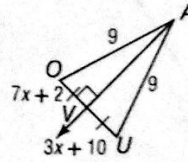
# Bisectors of Triangles

Find each measure.

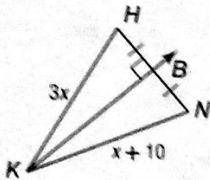
1.  $TP$



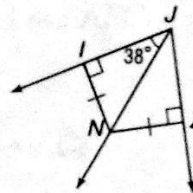
2.  $VU$



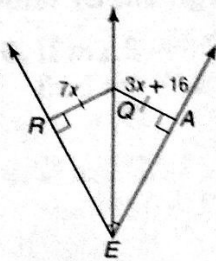
3.  $KN$



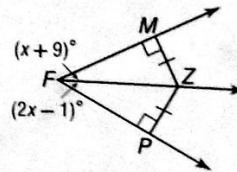
4.  $\angle NJZ$



5.  $QA$



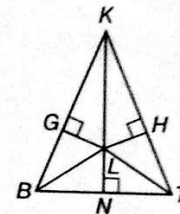
6.  $\angle MFZ$



Point  $L$  is the circumcenter of  $\triangle ABC$ . List any segment(s) congruent to each segment.

7.  $\overline{BN}$

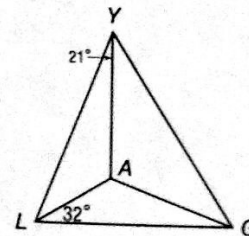
8.  $\overline{BL}$



Point  $A$  is the incenter of  $\triangle PQR$ . Find each measure.

9.  $\angle YLA$

10.  $\angle YGA$



11. **SCULPTURE** A triangular entranceway has walls with corner angles of  $50^\circ$ ,  $70^\circ$ , and  $60^\circ$ . The designer wants to place a tall bronze sculpture on a round pedestal in a central location equidistant from the three walls. How can the designer find where to place the sculpture?



# Additional Practice

Identify the hypothesis and conclusion of each conditional.

1. If you can see the stars, then it is night.

Hypothesis: \_\_\_\_\_

Conclusion: \_\_\_\_\_

2. A pencil writes well if it is sharp.

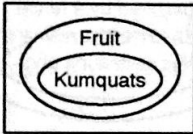
Hypothesis: \_\_\_\_\_

Conclusion: \_\_\_\_\_

Write a conditional statement from each of the following.

3. Three noncollinear points determine a plane.

4.



\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

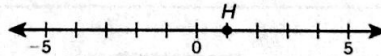
Determine if each conditional is true. If false, give a counterexample.

5. If two points are noncollinear, then a right triangle contains one obtuse angle.

6. If a liquid is water, then it is composed of hydrogen and oxygen.

7. If a living thing is green, then it is a plant.

8. "If  $G$  is at 4, then  $GH$  is 3." Write the converse, inverse, and contrapositive of this statement. Find the truth value of each.

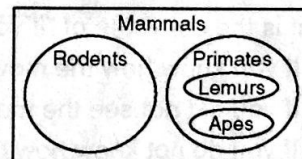


Converse: \_\_\_\_\_

Inverse: \_\_\_\_\_

Contrapositive: \_\_\_\_\_

This chart shows a small part of the *Mammalia* class of animals, the mammals. Write a conditional to describe the relationship between each given pair.



9. primates and mammals \_\_\_\_\_

10. lemurs and rodents \_\_\_\_\_

11. rodents and apes \_\_\_\_\_

12. apes and mammals \_\_\_\_\_

# Problem Solving

1. Write the converse, inverse, and contrapositive of the conditional statement. Find the truth value of each.

*If it is April, then there are 30 days in the month.*

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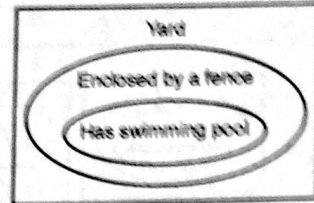


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2. Write a conditional statement from the diagram. Then write the converse, inverse, and contrapositive. Find the truth value of each.




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Use the table and the statements listed. Write each conditional and find its truth value.

$p$ : 1777     $q$ : 30 stars     $r$ : after 1818     $s$ : less than 50 stars

U.S. Flag	
Year	Number of Stars
1777	13
1818	20
1848	30
1959	50

3.  $p \rightarrow q$  \_\_\_\_\_

4.  $r \rightarrow s$  \_\_\_\_\_

5.  $q \rightarrow s$  \_\_\_\_\_

Choose the best answer.

6. What is the converse of "If you saw the movie, then you know how it ends"?
- A If you know how the movie ends, then you saw the movie.
  - B If you did not see the movie, then you do not know how it ends.
  - C If you do not know how the movie ends, then you did not see the movie.
  - D If you do not know how the movie ends, then you saw the movie.
7. What is the inverse of "If you received a text message, then you have a cell phone"?
- F If you have a cell phone, then you received a text message.
  - G If you do not have a cell phone, then you did not receive a text message.
  - H If you did not receive a text message, then you do not have a cell phone.
  - J If you received a text message, then you do not have a cell phone.

## Additional Practice

Write the conditional statement and converse within each biconditional.

1. The tea kettle is whistling if and only if the water is boiling.

Conditional: \_\_\_\_\_

Converse: \_\_\_\_\_

2. A biconditional is true if and only if the conditional and converse are both true.

Conditional: \_\_\_\_\_

Converse: \_\_\_\_\_

For each conditional, write the converse and a biconditional statement.

3. Conditional: If  $n$  is an odd number, then  $n - 1$  is divisible by 2.

Converse: \_\_\_\_\_

Biconditional: \_\_\_\_\_

4. Conditional: An angle is obtuse when it measures between  $90^\circ$  and  $180^\circ$ .

Converse: \_\_\_\_\_

Biconditional: \_\_\_\_\_

Determine whether a true biconditional can be written from each conditional statement. If not, give a counterexample.

5. If the lamp is unplugged, then the bulb does not shine.

\_\_\_\_\_

6. The date can be the 29th if and only if it is not February.

\_\_\_\_\_

Write each definition as a biconditional.

7. A cube is a three-dimensional solid with six square faces.

\_\_\_\_\_

\_\_\_\_\_

8. Tanya claims that the definition of *doofus* is "her younger brother."

\_\_\_\_\_

\_\_\_\_\_

## Problem Solving

Use the table for Exercises 1–4. Determine if a true biconditional statement can be written from each conditional. If so, then write a biconditional. If not, then explain why not.

Mountain Bike Races	Characteristics
Cross-country	A massed-start race. Riders must carry their own tools to make repairs.
Downhill	Riders start at intervals. The rider with the lowest time wins.
Freeride	Courses contain cliffs, drops, and ramps. Scoring depends on the style and the time.
Marathon	A massed-start race that covers more than 250 kilometers.

1. If a mountain bike race is mass-started, then it is a cross-country race.

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2. If a mountain bike race is downhill, then time is a factor in who wins.

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3. If a mountain bike race covers more than 250 kilometers, then it is a marathon race.

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4. If a race course contains cliffs, drops, and ramps, then it is not a marathon race.

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**Choose the best answer.**

5. The cat is the only species that can hold its tail vertically while it walks.
- A The converse of this statement is false.
  - B The biconditional of this statement is false.
  - C The biconditional of this statement is true.
  - D This statement cannot be written as a biconditional.
6. Which conditional statement can be used to write a true biconditional?
- F If you travel 2 miles in 4 minutes, then distance is a function of time.
  - G If the distance depends on the time, then distance is a function of time.
  - H If  $y$  increases as  $x$  increases, then  $y$  is a function of  $x$ .
  - J If  $y$  is not a function of  $x$ , then  $y$  does not increase as  $x$  increases.

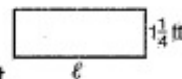
# Additional Practice

Solve each equation. Show all your steps and write a justification for each step.

1.  $\frac{1}{5}(a + 10) = -3$

2.  $t + 6.5 = 3t - 1.3$

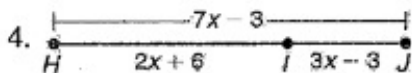
3. The formula for the perimeter  $P$  of a rectangle with length  $\ell$  and width  $w$  is



$P = 2(\ell + w)$ . Find the length of the rectangle shown here if the perimeter is  $9\frac{1}{2}$  feet.

Solve the equation for  $\ell$  and justify each step.

Write a justification for each step.



$HJ = HI + IJ$

$7x - 3 = (2x + 6) + (3x - 3)$

$7x - 3 = 5x + 3$

$7x = 5x + 6$

$2x = 6$

$x = 3$

Identify the property that justifies each statement.

5.  $m = n$ , so  $n = m$ .

6.  $\angle ABC \cong \angle ABC$

7.  $\overline{KL} \cong \overline{LK}$

8.  $p = q$  and  $q = -1$ , so  $p = -1$ .

# Problem Solving

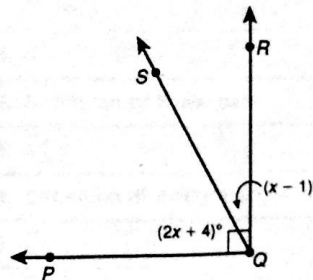
1. Because of a recent computer glitch, an airline mistakenly sold tickets for round-trip flights at a discounted price. The equation  $n(p + t) = 3298.75$  relates the number of discounted tickets sold  $n$ , the price of each ticket  $p$ , and the tax per ticket  $t$ . What was the discounted price of each ticket if 1015 tickets were sold and the tax per ticket was \$1.39? Solve the equation for  $p$ . Justify each step.

2. The equation  $C = 7.25s + 15.95a$  describes the total cost of admission  $C$  to the aquarium. How many student tickets were sold if the total cost for the entire class and 6 adults was \$298.70? Solve the equation for  $s$ . Justify each step.

$s$ = number of student tickets $a$ = number of adult tickets $C$ = total cost of admission
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Refer to the figure. Choose the best answer.

3. Which could be used to find the value of  $x$ ?
- A Segment Addition Postulate
  - B Angle Addition Postulate
  - C Transitive Property of Congruence
  - D Definition of supplementary angles
4. What is  $m\angle SQR$ ?
- |              |              |
|--------------|--------------|
| F $28^\circ$ | H $61^\circ$ |
| G $29^\circ$ | J $62^\circ$ |



# PRACTICE

In Exercises 1–2, complete each proof by writing the missing statements or reasons.

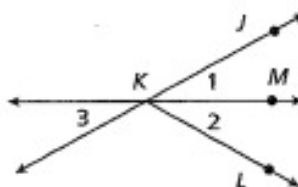
1. If  $A$ ,  $B$ ,  $C$ , and  $D$  are collinear, as shown in the figure, with  $AC = BD$ , then  $AB = CD$ .



**Given:**  $AC = BD$   
**Prove:**  $AB = CD$

Statements	Reasons
1. $AC = BD$	1. _____
2. $AC = AB + BC$ ; $BD = BC + CD$	2. _____
3. _____	3. Substitution Property of Equality
4. $AB = CD$	4. _____

2. **Given:**  $\overrightarrow{KM}$  bisects  $\angle JKL$ .  
**Prove:**  $m\angle 2 = m\angle 3$



Statements	Reasons
1. $\overrightarrow{KM}$ bisects $\angle JKL$ .	1. _____
2. $m\angle 1 = m\angle 2$	2. _____
3. $\angle 1$ and $\angle 3$ form two pairs of opposite rays.	3. Given
4. $\angle 1$ and $\angle 3$ are vertical angles.	4. _____
5. $m\angle 1 = m\angle 3$	5. Vertical Angles Theorem
6. $m\angle 2 = m\angle 3$	6. Substitution Property of Equality

3. In the figure,  $X$  is the midpoint of  $\overline{WY}$ , and  $Y$  is the midpoint of  $\overline{XZ}$ . Explain how to prove  $WX = YZ$ .




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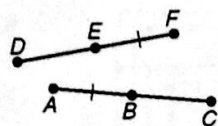


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# Additional Practice

Write a justification for each step.

Given:  $AB = EF$ ,  $B$  is the midpoint of  $\overline{AC}$ ,  
and  $E$  is the midpoint of  $\overline{DF}$ .



1.  $B$  is the midpoint of  $\overline{AC}$ ,  
and  $E$  is the midpoint of  $\overline{DF}$ .
2.  $\overline{AB} \cong \overline{BC}$ , and  $\overline{DE} \cong \overline{EF}$ .
3.  $AB = BC$ , and  $DE = EF$ .
4.  $AB + BC = AC$ , and  $DE + EF = DF$ .
5.  $2AB = AC$ , and  $2EF = DF$ .
6.  $AB = EF$
7.  $2AB = 2EF$
8.  $AC = DF$
9.  $\overline{AC} \cong \overline{DF}$

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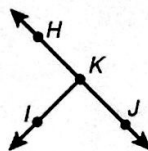
Fill in the blanks to complete the two-column proof.

10. Given:  $\angle HKJ$  is a straight angle.

$\overline{KI}$  bisects  $\angle HKJ$ .

Prove:  $\angle IKJ$  is a right angle.

Proof:



Statements	Reasons
1. a. _____	1. Given
2. $m\angle HKJ = 180^\circ$	2. b. _____
3. c. _____	3. Given
4. $\angle IKJ \cong \angle IKH$	4. Def. of $\angle$ bisector
5. $m\angle IKJ = m\angle IKH$	5. Def. of $\cong \angle$
6. d. _____	6. $\angle$ Add. Post.
7. $2m\angle IKJ = 180^\circ$	7. e. Subst. (Steps _____)
8. $m\angle IKJ = 90^\circ$	8. Div. Prop. of =
9. $\angle IKJ$ is a right angle.	9. f. _____



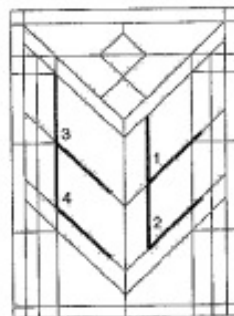
## Problem Solving

1. Refer to the diagram of the stained-glass window and use the given plan to write a two-column proof.

**Given:**  $\angle 1$  and  $\angle 3$  are supplementary.  
 $\angle 2$  and  $\angle 4$  are supplementary.  
 $\angle 3 \cong \angle 4$

**Prove:**  $\angle 1 \cong \angle 2$

**Plan:** Use the definition of supplementary angles to write the given information in terms of angle measures. Then use the Substitution Property of Equality and the Subtraction Property of Equality to conclude that  $\angle 1 \cong \angle 2$ .



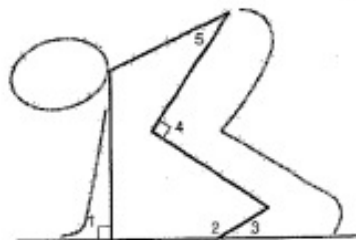
The position of a sprinter at the starting blocks is shown in the diagram. Which statement can be proved using the given information? Choose the best answer.

2. **Given:**  $\angle 1$  and  $\angle 4$  are right angles.

A  $\angle 3 \cong \angle 5$       C  $m\angle 1 + m\angle 4 = 90^\circ$   
 B  $\angle 1 \cong \angle 4$       D  $m\angle 3 + m\angle 5 = 180^\circ$

3. **Given:**  $\angle 2$  and  $\angle 3$  are supplementary.  
 $\angle 2$  and  $\angle 5$  are supplementary.

F  $\angle 3 \cong \angle 5$       H  $\angle 3$  and  $\angle 5$  are complementary.  
 G  $\angle 2 \cong \angle 5$       J  $\angle 1$  and  $\angle 2$  are supplementary.



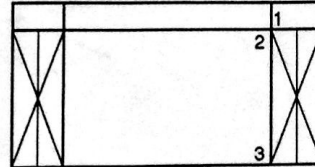
# Problem Solving

The diagram shows the second-floor glass railing at a mall.

1. Use the given two-column proof to write a flowchart proof.

**Given:**  $\angle 2$  and  $\angle 3$  are supplementary.

**Prove:**  $\angle 1$  and  $\angle 3$  are supplementary.



**Two-Column Proof:**

Statements	Reasons
1. $\angle 2$ and $\angle 3$ are supplementary.	1. Given
2. $m\angle 2 + m\angle 3 = 180^\circ$	2. Def. of supp. $\sphericalangle$
3. $\angle 2 \cong \angle 1$	3. Vert. $\sphericalangle$ Thm.
4. $m\angle 2 = m\angle 1$	4. Def. of $\cong \sphericalangle$
5. $m\angle 1 + m\angle 3 = 180^\circ$	5. Subst.
6. $\angle 1$ and $\angle 3$ are supplementary.	6. Def. of supp. $\sphericalangle$

**Choose the best answer.**

2. Which would NOT be included in a paragraph proof of the two-column proof above?
- A Since  $\angle 2$  and  $\angle 3$  are supplementary,  $m\angle 2 = m\angle 3$ .
  - B  $\angle 2 \cong \angle 1$  by the Vertical Angles Theorem.
  - C Using substitution,  $m\angle 1 + m\angle 3 = 180^\circ$ .
  - D  $m\angle 2 = m\angle 1$  by the definition of congruent angles.