LESSON 2-2

Practice A
Conditional Statements

Match the correct term to complete each sentence.

1. A conditional statement is a statement that can be written in the form "__D__ p, __D__ q."
2. The __A__ is the part p of a conditional statement following the word *if.*
3. The __C__ is the part q of a conditional statement following the word *then.*
4. The __E__ is the statement formed by negating the hypothesis and the conclusion.
5. The __B__ is the statement formed by exchanging the hypothesis and the conclusion.
6. The contrapositive is the statement formed by both __F__ and __F__ the hypothesis and the conclusion.

A. hypothesis
B. converse
C. conclusion
D. if; then
E. inverse
F. negating; exchanging

Use the following conditional statement for Exercises 7–12.
If it is a bicycle, then it has two wheels.

7. Give the hypothesis of the conditional statement. **It is a bicycle.**
8. Give the conclusion of the conditional statement. **It has two wheels.**
9. "If it has two wheels, then it is a bicycle." Tell whether this is the converse, the inverse, or the contrapositive of the given conditional. **converse**
10. "If it does not have two wheels, then it is not a bicycle." Tell whether this is the converse, the inverse, or the contrapositive of the given conditional. **contrapositive**
11. "If it is not a bicycle, then it does not have two wheels." Tell whether this is the converse, the inverse, or the contrapositive of the given conditional. **inverse**
12. Tell which of the original statement, the converse, the inverse, and the contrapositive are true statements. (*Hint:* Can you think of another two-wheeled vehicle?)
    original statement and contrapositive

Use the following statements for Exercises 13 and 14.
Ella says, "When it rains, I go indoors." Casey replies, "I play in the rain if there is no lightning."

13. Rewrite Ella's statement as an "if, then" statement.
    If it rains, then I go indoors.
14. Rewrite Casey's statement as an "if, then" statement.
    If there is no lightning, then I play in the rain.

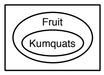
LESSON 2-2

Practice B
Conditional Statements

Identify the hypothesis and conclusion of each conditional.

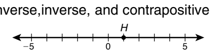
1. If you can see the stars, then it is night.
   Hypothesis: **You can see the stars.**
   Conclusion: **It is night.**
2. A pencil writes well if it is sharp.
   Hypothesis: **A pencil is sharp.**
   Conclusion: **The pencil writes well.**

Write a conditional statement from each of the following.

3. Three noncollinear points determine a plane.
   If three points are noncollinear, then they determine a plane.
4. 

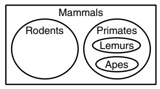
   If a food is a kumquat, then it is a fruit.

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.
   true
6. If a liquid is water, then it is composed of hydrogen and oxygen.
   true
7. If a living thing is green, then it is a plant.
   false; sample answer: a frog
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: **If GH is 3, then G is at 4; false**
   Inverse: **If G is not at 4, then GH is not 3; false**
   Contrapositive: **If GH is not 3, then G is not at 4; true**

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.



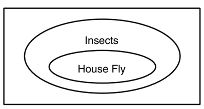
9. primates and mammals **If an animal is a primate, then it is a mammal.**
10. lemurs and rodents **Sample answer: If an animal is a lemur, then it is not a rodent.**
11. rodents and apes **Sample answer: If an animal is a rodent, then it is not an ape.**
12. apes and mammals **If an animal is an ape, then it is a mammal.**

LESSON 2-2

Practice C
Conditional Statements

Rewrite each famous saying as a conditional in Exercises 1–3.

1. "No man is an island." John Donne, *Devotions upon Emergent Occasions*
   Sample answer: If a thing is a man, then it is not an island.
2. "Nothing happens unless first a dream." Carl Sandburg, "Washington Monument by Night"
   Sample answer: If something happens, then it was first a dream.
3. "Never put off till tomorrow what you can do today." Thomas Jefferson, letter to Thomas Jefferson Smith, Feb. 21, 1825
   Sample answer: If you can do it today, then you should not put it off till tomorrow.
4. Write the information in this Venn diagram as a conditional statement.
   If something is a house fly, then it is an insect.



5. Make a conclusion about the contrapositive of a true conditional statement.
   The contrapositive of a true conditional statement is also true.
6. Write the converse of "If p, then q." **If q, then p.**
7. Write the contrapositive of the converse of "If p, then q." **If not p, then not q.**
8. Name the relationship between the answer to Exercise 7 and "If p, then q." **inverse**
9. Make a conclusion about the relative truth of the converse and inverse of a conditional statement.
   If the converse is true, then the inverse is true, and vice versa.
10. Definition: A composite number is a positive whole number with three or more factors. Rewrite this definition by using two conditional statements.
    If a number is composite, then it is a whole number with three or more factors. If a whole number has three or more factors, then it is composite.

LESSON 2-2

Reteach
Conditional Statements

A **conditional statement** is a statement that can be written as an if-then statement, "if p, then q."

The **hypothesis** comes after the word *if.*

The **conclusion** comes after the word *then.*

If you buy this cell phone, then you will receive 10 free ringtone downloads.

Sometimes it is necessary to rewrite a conditional statement so that it is in if-then form.

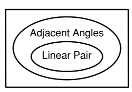
Conditional: A person who practices putting will improve her golf game.
If-Then Form: If a person practices putting, then she will improve her golf game.

A conditional statement has a false **truth value** *only* if the hypothesis (H) is true and the conclusion (C) is false.

For each conditional, underline the hypothesis and double-underline the conclusion.

1. If x is an even number, then x is divisible by 2.
2. The circumference of a circle is 5π inches if the diameter of the circle is 5 inches.
3. If a line containing the points J, K, and L lies in plane $\mathcal{P}$, then J, K, and L are coplanar.

For Exercises 4–6, write a conditional statement from each given statement.

4. Congruent segments have equal measures.
   If segments are congruent, then they have equal measures.
5. On Tuesday, play practice is at 6:00.
   If it is Tuesday, then play practice is at 6:00.
6. 

   If two angles form a linear pair, then they are adjacent angles.

Determine whether the following conditional is true. If false, give a counterexample.

7. If two angles are supplementary, then they form a linear pair.
   False; two supplementary angles need not be adjacent.

LESSON **2-4**

Practice A

Biconditional Statements and Definitions

1. A biconditional statement combines a conditional and its **converse**.
2. A biconditional statement can be written in the form "*p* if and only if *q*," which means "if *p*, then *q*, and if **q**, then **p**."

Write the converse from each given biconditional.

3. Biconditional: A cat is happy if and only if it is purring.
   Conditional: If a cat is happy, then it is purring.
   Converse: **If a cat is purring, then it is happy.**
4. Biconditional: A figure is a segment if and only if it is straight and has two endpoints.
   Conditional: If a figure is a segment, then it is straight and has two endpoints.
   Converse: **If a figure is straight and has two endpoints, then it is a segment.**

Write a biconditional from each given conditional and converse.

5. Conditional: If two angles share a side, then they are adjacent.
   Converse: If two angles are adjacent, then they share a side.
   Biconditional: **Two angles share a side if and only if they are adjacent.**
6. Conditional: If your temperature is normal, then your temperature is 98.6°F.
   Converse: If your temperature is 98.6°F, then your temperature is normal.
   Biconditional: **Your temperature is normal if and only if it is 98.6°F.**

Write *True* or *False* for each statement. A biconditional is true only if both the conditional and the converse are true. If the biconditional is false, give a counterexample.

7. Conditional: If $x = 1$, then $x > 0$. **True**
   Converse: If $x > 0$, then $x = 1$. **False**
   Biconditional: $x = 1$ if and only if $x > 0$. **False**
   Counterexample: **Sample answer: $x = 4$**
8. Conditional: If it is 3:30 A.M., then it is night. **True**
   Converse: If it is night, then it is 3:30 A.M. **False**
   Biconditional: It is 3:30 A.M. if and only if it is night. **False**
   Counterexample: **Sample answer: It is midnight.**
9. Maria says, "I will graduate from high school if and only if I earn a high school diploma." Tell if Maria's biconditional statement is true or false. **True**

LESSON **2-4**

Practice B

Biconditional Statements and Definitions

Write the conditional statement and converse within each biconditional.

1. The tea kettle is whistling if and only if the water is boiling.
   Conditional: **If the tea kettle is whistling, then the water is boiling.**
   Converse: **If the water is boiling, then the tea kettle is whistling.**
2. A biconditional is true if and only if the conditional and converse are both true.
   Conditional: **If a biconditional is true, then the conditional and converse are both true**
   Converse: **If the conditional and converse are both true, then the biconditional is true**

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: **If $n - 1$ is divisible by 2, then n is an odd number.**
   Biconditional: **n is an odd number if and only if $n - 1$ is divisible by 2.**
4. Conditional: An angle is obtuse when it measures between 90° and 180°.
   Converse: **If an angle measures between 90° and 180°, then the angle is obtuse.**
   Biconditional: **An angle is obtuse if and only if it measures between 90° and 180°.**

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.
   No; sample answer: The switch could be off.
6. The date can be the 29th if and only if it is not February.
   No; possible answer: Leap years have a Feb. 29th.

Write each definition as a biconditional.

7. A cube is a three-dimensional solid with six square faces.
   A figure is a cube if and only if it is a three-dimensional solid with six square faces.
8. Tanya claims that the definition of *doofus* is "her younger brother."
   A person is a doofus if and only if the person is Tanya's younger brother.

LESSON **2-4**

Practice C

Biconditional Statements and Definitions

The sex of a human is determined genetically by the distribution of X and Y chromosomes. This table shows all the possible normal and abnormal distributions.

Female			Male		
Normal	Abnormal		Normal	Abnormal	
XX	X	XXX	XY	XXY	XYY

Use the table to determine if a true biconditional statement can be written from each conditional in Exercises 1–4. If not, explain why not.

1. All humans have an X chromosome.
   yes
2. If a human is a normal male, then the human has exactly one Y chromosome.
   No; the abnormal XXY male also has exactly one Y chromosome.
3. A normal female has a pair of X chromosomes.
   No; the abnormal XXY male also has a pair of X chromosomes.
4. If a human is female, then the human has no Y chromosomes.
   yes
5. Explain the difference between postulates and definitions.
   Possible answer: Postulates are statements that are accepted as true without proof. Definitions are statements that describe mathematical objects and provide vocabulary for investigating these objects.

Determine whether each of the following statements is a postulate or a definition.

6. If two lines intersect, then they intersect in exactly one point. **postulate**
7. A right triangle is a triangle that contains a right angle. **definition**
8. If *B* is between *A* and *C*, then $AB + BC = AC$. **postulate**
9. If *P*, *Q*, and *R* are three noncollinear points, then there is exactly one plane containing *P*, *Q*, and *R*. **postulate**
10. The midpoint of a segment is the point of the segment that is the same distance from the endpoints. **definition**

LESSON **2-4**

Reteach

Biconditional Statements and Definitions

A **biconditional statement** combines a conditional statement, "if *p*, then *q*," with its converse, "if *q*, then *p*."

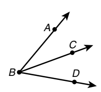
Conditional: If [the sides of a triangle are congruent]ₚ, then [the angles are congruent]_q.

Converse: If [the angles of a triangle are congruent]_q, then [the sides are congruent]ₚ.

Biconditional: [The sides of a triangle are congruent]ₚ if and only if [the angles are congruent]_q.

Write the conditional statement and converse within each biconditional.

1. Lindsay will take photos for the yearbook if and only if she doesn't play soccer.
   Conditional: If Lindsay takes photos for the yearbook, then she doesn't play soccer. Converse: If Lindsay doesn't play soccer, then she will take photos for the yearbook.
2. $m\angle ABC = m\angle CBD$ if and only if $\overrightarrow{BC}$ is an angle bisector of $\angle ABD$.



   Conditional: If $m\angle ABC = m\angle CBD$, then $\overrightarrow{BC}$ is an angle bisector of $\angle ABD$. Converse: If $\overrightarrow{BC}$ is an angle bisector of $\angle ABD$, then $m\angle ABC = m\angle CBD$.

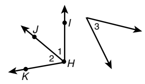
For each conditional, write the converse and a biconditional statement.

3. If you can download 6 songs for $5.94, then each song costs $0.99.
   Converse: If each song costs $0.99, then you can download 6 songs for $5.94.
   Biconditional: You can download 6 songs for $5.94 if and only if each song costs $0.99.
4. If a figure has 10 sides, then it is a decagon.
   Converse: If a figure is a decagon, then it has 10 sides.
   Biconditional: A figure has 10 sides if and only if it is a decagon.

LESSON 2-6

Practice A
Geometric Proof

Write the letter of the correct justification next to each step. (Use one justification twice.)



Given: $\overrightarrow{HJ}$ is the bisector of ∠*IHK* and ∠1 ≅ ∠3.

1. $\overrightarrow{HJ}$ is the bisector of ∠*IHK*. B
2. ∠2 ≅ ∠1 A
3. ∠1 ≅ ∠3 B
4. ∠2 ≅ ∠3 C

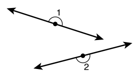
A. Definition of ∠ bisector
B. Given
C. Transitive Prop. of ≅

5. In a two-column proof, each step in the proof is on the left and the reason for the step is on the right.

Fill in the blanks with the justifications and steps listed to complete the two-column proof. Use this list to complete the proof.

∠1 ≅ ∠2
Def. of straight ∠
∠1 and ∠2 are straight angles.

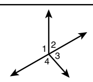
6. **Given:** ∠1 and ∠2 are straight angles.
Prove: ∠1 ≅ ∠2
Proof:



Statements	Reasons
1. a. ∠1 and ∠2 are straight angles.	1. Given
2. m∠1 = 180°, m∠2 = 180°	2. b. Def. of straight ∠
3. m∠1 = m∠2	3. Subst. Prop. of =
4. c. ∠1 ≅ ∠2	4. Def. of ≅ ∠s

Follow the plan to fill in the blanks in the two-column proof.

7. **Given:** ∠1 and ∠2 form a linear pair, and ∠3 and ∠4 form a linear pair.
Prove: m∠1 + m∠2 + m∠3 + m∠4 = 360°
Plan: The Linear Pair Theorem shows that ∠1 and ∠2 are supplementary and ∠3 and ∠4 are supplementary. The definition of supplementary says that m∠1 + m∠2 = 180° and m∠3 + m∠4 = 180°. Use the Addition Property of Equality to make the conclusion.



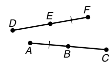
Statements	Reasons
1. ∠1 and ∠2 form a linear pair, and ∠3 and ∠4 form a linear pair.	1. a. Given
2. ∠1 and ∠2 are supplementary, and ∠3 and ∠4 are supplementary.	2. b. Linear Pair Thm.
3. c. m∠1 + m∠2 = 180°, and m∠3 + m∠4 = 180°	3. Def. of supp. ∠s
4. m∠1 + m∠2 + m∠3 + m∠4 = 360°	4. d. Add. Prop. of =

LESSON 2-6

Practice B
Geometric Proof

Write a justification for each step.

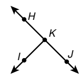
Given: *AB* = *EF*, *B* is the midpoint of $\overline{AC}$, and *E* is the midpoint of $\overline{DF}$.



1. *B* is the midpoint of $\overline{AC}$, and *E* is the midpoint of $\overline{DF}$. — Given
2. $\overline{AB} \cong \overline{BC}$, and $\overline{DE} \cong \overline{EF}$. — Def. of mdpt.
3. *AB* = *BC*, and *DE* = *EF*. — Def. of ≅ segments
4. *AB* + *BC* = *AC*, and *DE* + *EF* = *DF*. — Seg. Add. Post.
5. 2*AB* = *AC*, and 2*EF* = *DF*. — Subst.
6. *AB* = *EF* — Given
7. 2*AB* = 2*EF* — Mult. Prop. of =
8. *AC* = *DF* — Subst. Prop. of =
9. $\overline{AC} \cong \overline{DF}$ — Def. of ≅ segments

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

10. **Given:** ∠*HKJ* is a straight angle. $\overrightarrow{KI}$ bisects ∠*HKJ*.
Prove: ∠*IKJ* is a right angle.
Proof:



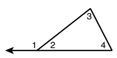
Statements	Reasons
1. a. ∠*HKJ* is a straight angle.	1. Given
2. m∠*HKJ* = 180°	2. b. Def. of straight ∠
3. c. $\overrightarrow{KI}$ bisects ∠*HKJ*	3. Given
4. ∠*IKJ* ≅ ∠*IKH*	4. Def. of ∠ bisector
5. m∠*IKJ* = m∠*IKH*	5. Def. of ≅ ∠s
6. d. m∠*IKJ* + m∠*IKH* = m∠*HKJ*	6. ∠ Add. Post.
7. 2m∠*IKJ* = 180°	7. e. Subst. (Steps 2, 5, 6)
8. m∠*IKJ* = 90°	8. Div. Prop. of =
9. ∠*IKJ* is a right angle.	9. f. Def. of right ∠

LESSON 2-6

Practice C
Geometric Proof

Write a two-column proof.

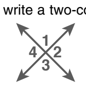
1. **Given:** The sum of the angle measures in a triangle is 180°.
Prove: m∠1 = m∠3 + m∠4



Statements	Reasons
1. m∠2 + m∠3 + m∠4 = 180°	1. Given
2. ∠1 and ∠2 are supplementary.	2. Linear Pair Thm.
3. m∠1 + m∠2 = 180°	3. Def. of supp. ∠s
4. m∠1 + m∠2 = m∠2 + m∠3 + m∠4	4. Subst. Prop. of =
5. m∠1 = m∠3 + m∠4	5. Subtr. Prop. of =

2. Peter drives on a straight road and stops at an intersection. The intersecting road is also straight. Peter notices that one of the angles formed by the intersection is a right angle. He concludes that the other three angles must also be right angles. Draw a diagram and write a two-column proof to show that Peter is correct.

Possible answer:



Statements	Reasons
1. ∠1 is a right angle.	1. Given
2. ∠1 and ∠2, ∠1 and ∠4, ∠2 and ∠3 are supplementary.	2. Linear Pair Thm.
3. ∠1 ≅ ∠3	3. Congruent Supps. Thm.
4. ∠3 is a right angle.	4. Rt. ∠ ≅ Thm.
5. m∠1 + m∠2 = 180°, m∠1 + m∠4 = 180°	5. Def. of supp. ∠s
6. m∠1 = 90°	6. Def. of rt. ∠
7. 90° + m∠2 = 180°, 90° + m∠4 = 180°	7. Subst.
8. m∠2 = 90°, m∠4 = 90°	8. Subtr. Prop. of =
9. ∠2 and ∠4 are right angles.	9. Def. of rt. ∠

LESSON 2-6

Reteach
Geometric Proof

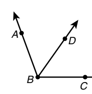
To write a geometric proof, start with the hypothesis of a conditional. → **Hypothesis**

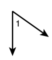
Apply deductive reasoning. → **Deductive Reasoning**
- Definitions
- Properties
- Postulates
- Theorems

Prove that the conclusion of the conditional is true. → **Conclusion**

Conditional: If $\overrightarrow{BD}$ is the angle bisector of ∠*ABC*, and ∠*ABD* ≅ ∠1, then ∠*DBC* ≅ ∠1.

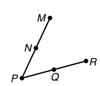
Given: $\overrightarrow{BD}$ is the angle bisector of ∠*ABC*, and ∠*ABD* ≅ ∠1.
Prove: ∠*DBC* ≅ ∠1
Proof:





1. $\overrightarrow{BD}$ is the angle bisector of ∠*ABC*.	1. Given
2. ∠*ABD* ≅ ∠*DBC*	2. Def. of ∠ bisector
3. ∠*ABD* ≅ ∠1	3. Given
4. ∠*DBC* ≅ ∠1	4. Transitive Prop. of ≅

1. **Given:** *N* is the midpoint of $\overline{MP}$, *Q* is the midpoint of $\overline{RP}$, and $\overline{PQ} \cong \overline{NM}$.
Prove: $\overline{PN} \cong \overline{QR}$



Write a justification for each step.

Proof:

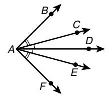
1. *N* is the midpoint of $\overline{MP}$. — 1. Given
2. *Q* is the midpoint of $\overline{RP}$. — 2. Given
3. $\overline{PN} \cong \overline{NM}$ — 3. Def. of midpoint
4. $\overline{PQ} \cong \overline{NM}$ — 4. Given
5. $\overline{PN} \cong \overline{PQ}$ — 5. Transitive Prop. of ≅
6. $\overline{PQ} \cong \overline{QR}$ — 6. Def. of midpoint
7. $\overline{PN} \cong \overline{QR}$ — 7. Transitive Prop. of ≅

LESSON 2-7

Practice A

Flowchart and Paragraph Proofs

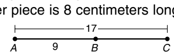
1. Use the given flowchart proof to complete the two-column proof.
Given: m∠*BAC* = m∠*EAF*, m∠*CAD* = m∠*DAE*
Prove: m∠*BAD* = m∠*DAF*



m∠*BAC* = m∠*EAF*, m∠*CAD* = m∠*DAE* → Given
m∠*BAC* + m∠*CAD* = m∠*BAD*, m∠*EAF* + m∠*DAE* = m∠*DAF* → ∠ Add. Post.
m∠*BAC* + m∠*CAD* = m∠*EAF* + m∠*DAE* → Add. Prop. of =
m∠*BAD* = m∠*DAF* → Subst.

Statements	Reasons
1. m∠*BAC* = m∠*EAF*, m∠*CAD* = m∠*DAE*	1. a. Given
2. b. m∠*BAC* + m∠*CAD* = m∠*EAF* + m∠*DAE*	2. Add. Prop. of =
3. m∠*BAC* + m∠*CAD* = m∠*BAD*, m∠*EAF* + m∠*DAE* = m∠*DAF*	3. ∠ Add. Post.
4. m∠*BAD* = m∠*DAF*	4. c. Subst.

2. Miguel breaks a 17-centimeter-long pencil into two pieces. One of the pieces is 9 centimeters long. Use the given paragraph proof to complete the two-column proof showing that the other piece is 8 centimeters long.
Given: *AC* = 17, *AB* = 9
Prove: *BC* = 8



By the Segment Addition Postulate, the sum of *AB* and *BC* equals *AC*. That is, *AB* + *BC* = *AC*. It is given that *AC* = 17 and *AB* = 9. Substitution leaves the equation 9 + *BC* = 17. Using the Subtraction Property of Equality to take 9 away from both sides shows that *BC* = 8.

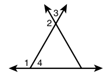
Statements	Reasons
1. *AB* + *BC* = *AC*	1. a. Seg. Add. Post.
2. *AC* = 17, *AB* = 9	2. Given
3. b. 9 + *BC* = 17	3. Subst.
4. c. *BC* = 8	4. Subtr. Prop. of =

LESSON 2-7

Practice B

Flowchart and Paragraph Proofs

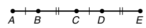
1. Use the given two-column proof to write a flowchart proof.
Given: ∠4 ≅ ∠3
Prove: m∠1 = m∠2



Statements	Reasons
1. ∠1 and ∠4 are supplementary, ∠2 and ∠3 are supplementary.	1. Linear Pair Thm.
2. ∠4 ≅ ∠3	2. Given
3. ∠1 ≅ ∠2	3. ≅ Supps. Thm.
4. m∠1 = m∠2	4. Def. of ≅ ∠s

∠4 ≅ ∠3 → Given
∠1 and ∠4 are supplementary, ∠2 and ∠3 are supplementary. → Lin. Pair Thm.
∠1 ≅ ∠2 → ≅ Supps. Thm.
m∠1 = m∠2 → Def. of ≅ ∠s

2. Use the given two-column proof to write a paragraph proof.
Given: *AB* = *CD*, *BC* = *DE*
Prove: *C* is the midpoint of $\overline{AE}$.



Statements	Reasons
1. *AB* = *CD*, *BC* = *DE*	1. Given
2. *AB* + *BC* = *CD* + *DE*	2. Add. Prop. of =
3. *AB* + *BC* = *AC*, *CD* + *DE* = *CE*	3. Seg. Add. Post.
4. *AC* = *CE*	4. Subst.
5. $\overline{AC} \cong \overline{CE}$	5. Def. of ≅ segs.
6. *C* is the midpoint of $\overline{AE}$.	6. Def. of mdpt.

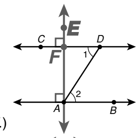
It is given that *AB* = *CD* and *BC* = *DE*, so by the Addition Property of Equality, *AB* + *BC* = *CD* + *DE*. But by the Segment Addition Postulate, *AB* + *BC* = *AC* and *CD* + *DE* = *CE*. Therefore substitution yields *AC* = *CE*. By the definition of congruent segments, $\overline{AC} \cong \overline{CE}$ and thus *C* is the midpoint of $\overline{AE}$ by the definition of midpoint.

LESSON 2-7

Practice C

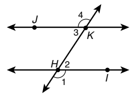
Flowchart and Paragraph Proofs

1. A definition of parallel lines is "two coplanar lines that never intersect." Imagine railroad tracks or the strings on a guitar. Another way to think about parallel lines is that they extend in exactly the same direction. Or to say it more mathematically, if a third line intersects one line in a right angle and intersects a second line in a right angle, then the first and second lines are parallel. Use this last definition as the final step in a paragraph proof of the following.
Given: The sum of the angle measures in any triangle is 180°; ∠1 ≅ ∠2
Prove: $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are parallel lines.
(*Hint:* First draw line $\overleftrightarrow{AE}$ so it forms a 90° angle with $\overleftrightarrow{AB}$. This step can be justified by the Protractor Postulate. On the figure, label the intersection of $\overleftrightarrow{AE}$ and $\overleftrightarrow{CD}$ point *F*.)



Possible answer: Draw $\overleftrightarrow{AE}$ so it forms a 90° angle with $\overleftrightarrow{AB}$ by the Protractor Postulate. The Angle Addition Postulate states that m∠*FAD* + m∠2 = m∠*FAB*, so by substitution m∠*FAD* + m∠2 = 90°. It is given that ∠1 ≅ ∠2, so m∠1 = m∠2 by the definition of congruent angles. Substituting again reveals that m∠*FAD* + m∠1 = 90°. ∠*FAD*, ∠1, and ∠*AFD* form a triangle, so by the given information m∠*FAD* + m∠1 + m∠*AFD* = 180°. Substitution and the Subtraction Property of Equality show that m∠*AFD* = 90°. Then by the definition of right angle, ∠*FAB* and ∠*AFD* are right angles. $\overleftrightarrow{AE}$ intersects both $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ in right angles, so $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are parallel lines.

2. Write a flowchart proof of the following. Use "Proof 1" as a justification to refer to your work in Exercise 1.
Given: ∠1 ≅ ∠4
Prove: $\overleftrightarrow{HI}$ and $\overleftrightarrow{JK}$ are parallel lines.



Possible answer:

∠1 ≅ ∠4 → Given
∠1 and ∠2 are supplementary, ∠3 and ∠4 are supplementary. → Lin. Pair Thm.
∠2 ≅ ∠3 → ≅ Supps. Thm.
$\overleftrightarrow{HI}$ and $\overleftrightarrow{JK}$ are parallel lines. → Proof 1

LESSON 2-7

Reteach

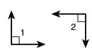
Flowchart and Paragraph Proofs

In addition to the two-column proof, there are other types of proofs that you can use to prove conjectures are true.

Flowchart Proof	• Uses boxes and arrows. • Steps go left to right or top to bottom, as shown by arrows. • The justification for each step is written below the box.

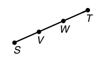
You can write a flowchart proof of the Right Angle Congruence Theorem.

Given: ∠1 and ∠2 are right angles.
Prove: ∠1 ≅ ∠2



∠1 and ∠2 are rt. ∠s. → Given
m∠1 = 90°, m∠2 = 90° → Def. of rt. ∠
m∠1 = m∠2 → Trans. Prop. of =
∠1 ≅ ∠2 → Def. of ≅ ∠s

1. Use the given two-column proof to write a flowchart proof.
Given: *V* is the midpoint of $\overline{SW}$, and *W* is the midpoint of $\overline{VT}$.
Prove: $\overline{SV} \cong \overline{WT}$
Two-Column Proof:



Statements	Reasons
1. *V* is the midpoint of $\overline{SW}$.	1. Given
2. *W* is the midpoint of $\overline{VT}$.	2. Given
3. $\overline{SV} \cong \overline{VW}$, $\overline{VW} \cong \overline{WT}$	3. Definition of midpoint
4. $\overline{SV} \cong \overline{WT}$	4. Transitive Property of Equality

V is the midpoint of $\overline{SW}$. → Given
W is the midpoint of $\overline{VT}$. → Given
$\overline{SV} \cong \overline{VW}$ → Def. of midpoint
$\overline{VW} \cong \overline{WT}$ → Def. of midpoint
$\overline{SV} \cong \overline{WT}$ → Trans. Prop. of =