



UNDERSTAND

11. **Construct Arguments** Why is the following conditional logically true?

If 20 is a multiple of 3, then 101 is a perfect square.

12. **Higher Order Thinking** Write a true biconditional and show that both implied conditionals are true.

13. **Error Analysis** Jacy was asked to write the following statement as a conditional.

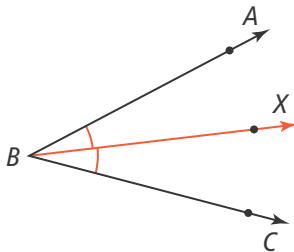
Water freezes if it is below 0°C .

What error did she make? What is the correct conditional?

If water freezes, then it is below 0°C .

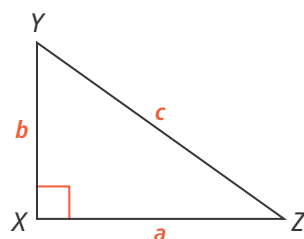


14. **Higher Order Thinking** Write a true biconditional about angle bisectors.



15. **Reason** Can an inverse and the contrapositive both have false truth values? Explain.
16. **Reason** If a biconditional is true, what are the truth values of the hypothesis and conclusion of the conditional? Explain.
17. **Look for Relationships** Emma found a counterexample to a given conditional. What are the truth values of the hypothesis and the conclusion? Explain.

18. **Mathematical Connections** Write the Pythagorean Theorem as a conditional. Then write a biconditional to include the Converse of the Pythagorean Theorem.



PRACTICE

Write each statement as a conditional.

SEE EXAMPLE 1

19. My hair will be shorter if I cut it.
20. A number that is divisible by 6 is divisible by 3.
21. Movie tickets are half-price on Tuesdays.

Find the truth value of each conditional. Explain your reasoning or show a counterexample.

SEE EXAMPLE 2

22. If a pair of lines is parallel, then they do not intersect.
23. If the product of two numbers is positive, then the numbers are both positive.

Write the negation of the hypothesis and the negation of the conclusion for each conditional.

SEE EXAMPLES 3 and 4

24. If the sum of the interior angle measures of a polygon is 180, then the polygon is a triangle.
25. If one whole number is odd and the other whole number is even, then the sum of the two numbers is odd.

Write each related conditional and determine each truth value for the following conditional.

SEE EXAMPLES 3 and 4

If an angle measures 100° , then it is obtuse.

26. converse
27. contrapositive
28. inverse
29. An employee at an animal shelter wrote the true conditional "If 47% of the dogs at the shelter are female, then 53% of the dogs are male." Can he rewrite this as a true biconditional? Explain. SEE EXAMPLE 5

Write two conditionals from each biconditional.

SEE EXAMPLE 6

30. A month has exactly 28 days if and only if it is February.
31. Two angles are complementary if and only if their measures add up to 90.
32. The area of a square is s^2 if and only if the perimeter of the square is $4s$.

APPLY

33. **Model With Mathematics** In general, a person is 1% shorter in the evening than in the morning. Use your height to write a conditional that uses this fact.
34. **Communicate Precisely** In the year 1881, three different men were president of the United States—Rutherford B. Hayes, James Garfield, and Chester A. Arthur.
- Use this fact to write a conditional and a biconditional.
 - There was one other year in which three different men were president of the United States. In 1841, Martin Van Buren, William Henry Harrison, and John Tyler were president. Using this information, determine the truth value of the conditional and the biconditional you wrote for part (a).
35. **Reason** The sign shows the hours for an art museum.

 Modern Art Museum HOURS		
Monday	Closed	
Tuesday	10:00 AM	8:00 PM
Wednesday	10:00 AM	6:00 PM
Thursday	10:00 AM	8:00 PM
Friday	9:00 AM	6:00 PM
Saturday	9:00 AM	6:00 PM
Sunday	12:00 AM	5:00 PM

- Write a conditional to describe the hours of the museum on Mondays.
- Write a conditional to describe the hours of the museum on Thursdays.
- Write the converse, inverse, and contrapositive of the conditional you wrote in part (b). Then give the truth value for each statement.
- Can each conditional you wrote for parts (a) and (b) be written as a true biconditional? Why or why not? If so, give each biconditional.



ASSESSMENT PRACTICE

36. Consider the conditional $p \rightarrow q$, where p is true and q is false. Copy and complete the table to show the truth value of each statement.

Statement	Truth Value
Conditional	F
Converse	
Inverse	
Contrapositive	

37. **SAT/ACT** Which represents the contrapositive of $p \rightarrow q$?
- $p \leftrightarrow q$
 - $q \rightarrow p$
 - $\sim p \rightarrow \sim q$
 - $\sim q \rightarrow \sim p$
 - $\sim q \leftrightarrow \sim p$

38. **Performance Task** A group of students drew several different right triangles and found the measures of the two non-right angles. Their findings are shown in the table.

Angle Measure	Angle Measure	Sum
27	63	90
41	49	90
70	20	90
33	57	90

Part A Make a conjecture about the sum of two non-right angles in a right triangle. Write the conjecture in the form of a conditional.

Part B Construct several right triangles, and then measure the angles of each triangle. Do your measurements support your conjecture, or were you able to find a counterexample?

Part C Write the converse, the inverse, and the contrapositive of your conditional. Then, write a biconditional. Is the biconditional true? Explain.