

2.4 Answer Key

SEE EXAMPLE 3

p. 97

Multi-Step Determine if each biconditional is true. If false, give a counterexample.

6. $xy = 0 \leftrightarrow x = 0$ or $y = 0$. **T**
 7. A figure is a quadrilateral if and only if it is a polygon.

F; a \triangle is a polygon but not a quad.

SEE EXAMPLE 4

p. 98

Write each definition as a biconditional.

8. Parallel lines are two coplanar lines that never intersect.
 9. A hummingbird is a tiny, brightly colored bird with narrow wings, a slender bill, and a long tongue.



PRACTICE AND PROBLEM SOLVING

Write the conditional statement and converse within each biconditional.

10. Three points are coplanar if and only if they lie in the same plane.
 11. A parallelogram is a rectangle if and only if it has four right angles.
 12. A lunar eclipse occurs if and only if Earth is between the Sun and the Moon.

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

13. If today is Saturday or Sunday, then it is the weekend.
 14. If Greg has the fastest time, then he wins the race.
 15. If a triangle contains a right angle, then it is a right triangle.

Multi-Step Determine if each biconditional is true. If false, give a counterexample.

16. Felipe is a swimmer if and only if he is an athlete.
 17. The number $2n$ is even if and only if n is an integer. **T**

Write each definition as a biconditional.

18. A circle is the set of all points in a plane that are a fixed distance from a given point.
 19. A catcher is a baseball player who is positioned behind home plate and who catches throws from the pitcher.

Independent Practice

For Exercises	See Example
10–12	1
13–15	2
16–17	3
18–19	4

Extra Practice

Skills Practice p. 56
 Application Practice p. 529

16. F; possible answer: Felipe could be a runner.

Average 10–32, 35–41, 43–44, 46–54

Advanced 10–29, 30–34 even, 35–54

Homework Quick Check

Quickly check key concepts.
 Exercises: 10, 14, 16, 18, 24, 30

Answers

1. Possible answer: A biconditional contains the conditional and its converse. A conditional is not reversible, but a biconditional is.
 2. Conditional: If Perry can paint the entire living room, then he has enough paint. Converse: If Perry has enough paint, then he can paint the entire living room.
 3. Conditional: If your medicine will be ready by 5 P.M., then you dropped your prescription off by 8 A.M. Converse: If you drop your prescription off by 8 A.M., then your medicine will be ready by 5 P.M.

State Resources

Answers

4. Converse: If a student is in the tenth grade, then the student is a sophomore. Biconditional: A student is a sophomore if and only if the student is in the tenth grade.
 5. Converse: If 2 segs. are \cong , then they have the same length. Biconditional: 2 segs. have the same length if and only if they are \cong .
 8. 2 lines are \parallel if and only if they are coplanar and never intersect.
 9. An animal is a hummingbird if and only if it is a tiny, brightly colored bird with narrow wings, a slender bill, and a long tongue.
 10. Conditional: If 3 pts. are coplanar, then they lie in the same plane. Converse: If 3 pts. lie in the same plane, then they are coplanar.
 11. Conditional: If a \square is a rect., then it has 4 rt. \angle . Converse: If a \square has 4 rt. \angle , then it is a rect.
 12. Conditional: If a lunar eclipse occurs, then Earth is between the Sun and the Moon. Converse: If Earth is between the Sun and the Moon, then a lunar eclipse occurs.
 13. Converse: If it is the weekend, then today is Saturday or Sunday. Biconditional: Today is Saturday or Sunday if and only if it is the weekend.
 14–15, 18–19. See p. A11.

2-4 Exercises

- 14.** Converse: If Greg wins the race, then he has the fastest time.
Biconditional: Greg has the fastest time if and only if he wins the race.
- 15.** Converse: If a \triangle is a rt. \triangle , then it contains a rt. \angle . Biconditional: A \triangle contains a rt. \angle if and only if it is a rt. \triangle .



Inclusion If students have difficulty with Exercises 21 and 22, suggest that they solve the equation in the hypothesis and in the conclusion and see if the solutions are the same.



Exercise 37 involves writing statements as conditionals and then determining the truth value of the resulting biconditional. This exercise prepares students for the Multi-Step Test Prep on page 102.

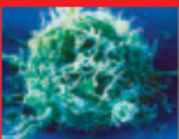
Answers

- 24.** An equil. \triangle is a \triangle with 3 \cong sides.
- 25.** A square is a quad. with 4 \cong sides and 4 rt. \angle .
- 26.** A cell is a white blood cell if and only if it defends the body against invading organisms by engulfing them or releasing antibodies.
- 27.** Possible answer: A bicycle also moves along the ground but is not an automobile.
- 28.** Possible answer: A computer is a machine that performs computations but is not a calculator.
- 29.** Possible answer: The definition does not say that the rays have a common endpoint.
- 35–37.** See p. A11.

20. no; possible answer: $a = 3$, $b = -3$



Biology



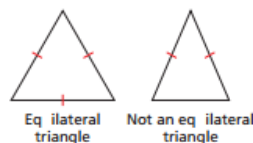
White blood cells live less than a few weeks. A drop of blood can contain anywhere from 7000 to 25,000 white blood cells.

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

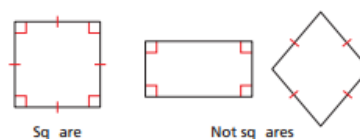
- 20.** If $a = b$, then $|a| = |b|$. **21.** If $3x - 2 = 13$, then $\frac{4}{5}x + 8 = 12$. **yes**
- 22.** If $y^2 = 64$, then $3y = 24$. **no; possible answer: $y = -8$**
- 23.** If $x > 0$, then $x^2 > 0$. **no; possible answer: $x = -2$**

Use the diagrams to write a definition for each figure.

24.



25.



- 26. Biology** White blood cells are cells that defend the body against invading organisms by engulfing them or by releasing chemicals called *antibodies*. Write the definition of a white blood cell as a biconditional statement.

Explain why the given statement is not a definition.

- 27.** An automobile is a vehicle that moves along the ground.
- 28.** A calculator is a machine that performs computations with numbers.
- 29.** An angle is a geometric object formed by two rays.

Chemistry Use the table for Exercises 30–32. Determine if a true biconditional statement can be written from each conditional.

- 30.** If a solution has a pH of 4, then it is tomato juice. **no**
- 31.** If a solution is bleach, then its pH is 13. **no**
- 32.** If a solution has a pH greater than 7, then it is not battery acid. **no**

pH	Examples
0	Battery Acid
4	Acid rain, tomato juice
6	Saliva
8	Sea water
13	Bleach, oven cleaner
14	Drain cleaner

Complete each statement to form a true biconditional.

- 33.** The circumference of a circle is 10π if and only if its radius is ? . **5**
- 34.** Four points in a plane form a ? if and only if no three of them are collinear. **quad.**
- 35. Critical Thinking** Write the definition of a biconditional statement as a biconditional statement. Use the conditional and converse within the statement to explain why your biconditional is true.
- 36. Write About It** Use the definition of an angle bisector to explain what is meant by the statement "A good definition is reversible."