

Example 4 Construct Truth Tables

Construct a truth table for each compound statement.

a. $p \wedge \sim q$

Step 1 Make columns with the headings p , q , $\sim q$, and $p \wedge \sim q$.

Step 2 List the possible combinations of truth values for p and q .

Step 3 Use the truth values of q to determine the truth values of $\sim q$.

Step 4 Use the truth values for p and $\sim q$ to write the truth values for $p \wedge \sim q$.

Step 1 →

p	q	$\sim q$	$p \wedge \sim q$
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F

Step 2 Step 3 Step 4

b. $\sim p \vee \sim q$

p	q	$\sim p$	$\sim q$	$\sim p \vee \sim q$
T	T	F	F	F
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

c. $(p \wedge q) \vee r$

Make columns for p , q , $p \wedge q$, r , and $(p \wedge q) \vee r$.

p	q	$p \wedge q$	r	$(p \wedge q) \vee r$
T	T	T	T	T
T	F	F	T	T
T	T	T	F	T
T	F	F	F	F
F	T	F	T	T
F	F	F	T	T
F	T	F	F	F
F	F	F	F	F

Study Tip

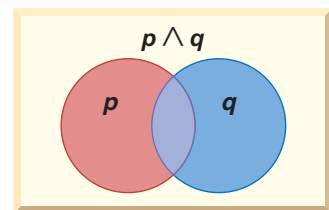
Truth Tables

Use the Fundamental Counting Principle to determine the number of rows necessary.

Check for Understanding

Concept Check

- Describe how to interpret the Venn diagram for $p \wedge q$.
- OPEN ENDED** Write a compound statement for each condition.
 - a true disjunction
 - a false conjunction
 - a true statement that includes a negation
- Explain** the difference between a conjunction and a disjunction.



Guided Practice Use the following statements to write a compound statement for each conjunction and disjunction. Then find its truth value.

- p : $9 + 5 = 14$
 q : February has 30 days.
 r : A square has four sides.

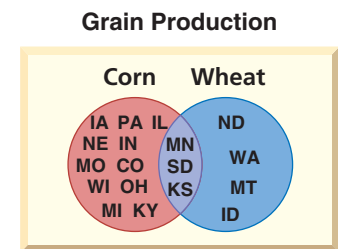
4. p and q 5. p and r 6. $q \wedge r$
 7. p or $\sim q$ 8. $q \vee r$ 9. $\sim p \vee \sim r$
10. Copy and complete the truth table.

p	q	$\sim q$	$p \wedge \sim q$
T	T	F	F
T	F		
F	T		
F	F		

Construct a truth table for each compound statement.

11. $p \wedge q$ 12. $q \vee r$ 13. $\sim p \wedge r$ 14. $(p \vee q) \vee r$

Application **AGRICULTURE** For Exercises 15–17, refer to the Venn diagram that represents the states producing more than 100 million bushels of corn or wheat per year.



Source: U.S. Department of Agriculture

15. How many states produce more than 100 million bushels of corn?
 16. How many states produce more than 100 million bushels of wheat?
 17. How many states produce more than 100 million bushels of corn and wheat?

Practice and Apply

Homework Help

For Exercises	See Examples
18–29	1, 2
30–41	4
42–48	3

Extra Practice
See page 756.

Use the following statements to write a compound statement for each conjunction and disjunction. Then find its truth value.

- p : $\sqrt{-64} = 8$
 q : An equilateral triangle has three congruent sides.
 r : $0 < 0$
 s : An obtuse angle measures greater than 90° and less than 180° .

18. p and q 19. p or q 20. p and r
 21. r and s 22. q or r 23. q and s
 24. $p \wedge s$ 25. $q \wedge r$ 26. $r \vee p$
 27. $s \vee q$ 28. $(p \wedge q) \vee s$ 29. $s \vee (q \text{ and } r)$

Copy and complete each truth table.

30.

p	q	$\sim p$	$\sim p \vee q$
T	T		
T	F		
F	T		
F	F		

31.

p	q	$\sim p$	$\sim q$	$\sim p \wedge \sim q$
T		F	F	
T		F	T	
F		T	F	
F		T	T	

32. Copy and complete the truth table.

p	q	r	$p \vee q$	$(p \vee q) \wedge r$
T	T	T		
T	T	F		
T	F	T		
T	F	F		
F	T	T		
F	T	F		
F	F	T		
F	F	F		

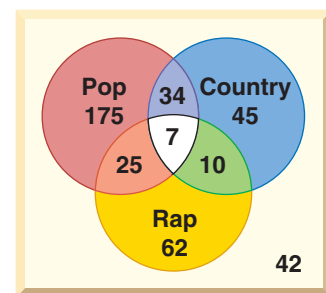
Construct a truth table for each compound statement.

33. q and r 34. p or q 35. p or r 36. p and q
 37. $q \wedge \sim r$ 38. $\sim p \wedge \sim q$ 39. $\sim p \vee (q \wedge \sim r)$ 40. $p \wedge (\sim q \vee \sim r)$

MUSIC For Exercises 41–44, use the following information.

A group of 400 teens were asked what type of music they listened to. They could choose among pop, rap, and country. The results are shown in the Venn diagram.

Music Preference



41. How many teens said that they listened to none of these types of music?
 42. How many said that they listened to all three types of music?
 43. How many said that they listened to only pop and rap music?
 44. How many teens said that they listened to pop, rap, or country music?

SCHOOL For Exercises 45–47, use the following information.

In a school of 310 students, 80 participate in academic clubs, 115 participate in sports, and 20 students participate in both.

45. Make a Venn diagram of the data.
 46. How many students participate in either clubs or sports?
 47. How many students do not participate in either clubs or sports?

RESEARCH For Exercises 48–50, use the Internet or another resource to determine whether each statement about cities in New York is *true* or *false*.

48. Albany is not located on the Hudson river.
 49. Either Rochester or Syracuse is located on Lake Ontario.
 50. It is false that Buffalo is located on Lake Erie.

CRITICAL THINKING For Exercises 51 and 52, use the following information.

All members of Team A also belong to Team B, but only some members of Team B also belong to Team C. Teams A and C have no members in common.

51. Draw a Venn diagram to illustrate the situation.
 52. Which of the following statements is true?
 a. If a person is a member of Team C, then the person is not a member of Team A.
 b. If a person is not a member of Team B, then the person is not a member of Team A.
 c. No person that is a member of Team A can be a member of Team C.



School

Nationwide, approximately 80% of high school seniors participate in extracurricular activities. Athletics, performing arts, and clubs are the most popular.

Source: National Center for Education Statistics

53. **WRITING IN MATH** Answer the question that was posed at the beginning of the lesson.

How does logic apply to school?

Include the following in your answer:

- an example of a conjunction using statements about your favorite subject and your favorite extracurricular activity, and
- a Venn diagram showing various characteristics of the members of your geometry class (for example, male/female, grade in school, and so on).

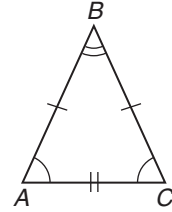
EOC Practice

Standardized Test Practice

- (A) (B) (C) (D)

54. Which statement about $\triangle ABC$ has the same truth value as $AB = BC$?

- (A) $m\angle A = m\angle C$ (B) $m\angle A = m\angle B$
 (C) $AC = BC$ (D) $AB = AC$



55. **ALGEBRA** If the sum of two consecutive even integers is 78, which number is the greater of the two integers?

- (A) 36 (B) 38
 (C) 40 (D) 42

Maintain Your Skills

Mixed Review Make a conjecture about the next item in each sequence. (Lesson 2-1)

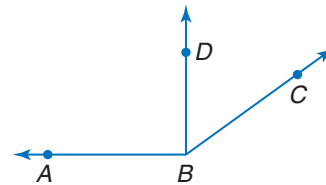
56. 3, 5, 7, 9 57. 1, 3, 9, 27 58. 6, 3, $\frac{3}{2}$, $\frac{3}{4}$
 59. 17, 13, 9, 5 60. 64, 16, 4, 1 61. 5, 15, 45, 135

COORDINATE GEOMETRY Find the perimeter of each polygon. Round answers to the nearest tenth. (Lesson 1-6)

62. triangle ABC with vertices $A(-6, 7)$, $B(1, 3)$, and $C(-2, -7)$
 63. square $DEFG$ with vertices $D(-10, -9)$, $E(-5, -2)$, $F(2, -7)$, and $G(-3, -14)$
 64. quadrilateral $HIIK$ with vertices $H(5, -10)$, $I(-8, -9)$, $J(-5, -5)$, and $K(-2, -4)$
 65. hexagon $LMNPQR$ with vertices $L(2, 1)$, $M(4, 5)$, $N(6, 4)$, $P(7, -4)$, $Q(5, -8)$, and $R(3, -7)$

Measure each angle and classify it as *right*, *acute*, or *obtuse*. (Lesson 1-4)

66. $\angle ABC$
 67. $\angle DBC$
 68. $\angle ABD$



69. **FENCING** Michelle wanted to put a fence around her rectangular garden. The front and back measured 35 feet each, and the sides measured 75 feet each. If she wanted to make sure that she had enough feet of fencing, how much should she buy? (Lesson 1-2)

Getting Ready for the Next Lesson **PREREQUISITE SKILL** Evaluate each expression for the given values. (To review *evaluating algebraic expressions*, see page 736.)

70. $5a - 2b$ if $a = 4$ and $b = 3$ 71. $4cd + 2d$ if $c = 5$ and $d = 2$
 72. $4e + 3f$ if $e = -1$ and $f = -2$ 73. $3g^2 + h$ if $g = 8$ and $h = -8$