

$$p \wedge \sim q$$

b. p : Today is Tuesday.

q : Tomorrow is Friday.

$$p \vee q$$

c. Notice that this compound statement can be rewritten as “If the weather is cool, then I will exercise.”

p : The weather is cool.

q : I will exercise.

$$p \Rightarrow q$$

d. p : I have a pint of milk.

q : I have 16 fl oz of milk.

$$p \Leftrightarrow q$$

Now work margin exercise 9.

Margin exercise answers

1. a. Compound statement **b.** Simple statement **c.** Compound statement **2. a.** Today is Monday and I work today. **b.** Today is Monday and I have a meeting. **c.** Today is Monday, I work today, and I have a meeting. **3. a.** I walk my dog in the morning or after work. **b.** I take my dog to the park or to the agility course. **c.** I take my dog to the park or I do not take my dog to the agility course. **4. a.** If I eat a lot of candy, then I get cavities. **b.** If a number is divisible by 1 and itself, then the number is prime. **5. a.** p : I will go to school; q : It is Wednesday **b.** p : The weather is sunny; q : I want to sleep in; $\sim q$: I don't want to sleep in. **6. a.** The measure of angle A is 90 degrees if and only if angle A is a right angle. **b.** A triangle has 3 equal angles if and only if the triangle has 3 equal sides. **7. p:** The milk will be chocolate; q : The cow is brown; $\sim q$: The cow is not brown. **8. a.** I will study and I will walk. **b.** I will study, I will walk, or I will eat lunch. **c.** If the toast does not have an avocado topping, then I will eat toast. **d.** I will study if and only if I eat toast. **9. a.** p : Today the weather is sunny; q : Today the weather is rainy; $p \vee q$ **b.** p : I will drive a car; q : I have a driver's license; $p \Leftrightarrow q$ **c.** p : I like hamsters; q : I like gerbils; $\sim p \wedge q$ **d.** p : I drink coffee; q : I have creamer; $p \Rightarrow q$

8.5 Exercises

Concept Check

Fill-in-the-Blank. Complete the sentences using information found in this section.

1. A _____ is a word or phrase that connects two or more simple statements.
2. A _____ can be determined to be either true or false, but not both.
3. A _____ is a compound statement made up of two or more simple statements with the logical connector _____.

4. A _____ is a compound statement made up of two or more simple statements with the logical connector _____.
5. A _____ is a compound statement created when a simple statement p implies the simple statement q .
6. A _____ is a compound statement created with a simple statement p implies the simple statement q and q also implies p .

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. “If you take this class, then you will pass” is an example of a biconditional statement.
8. “Tomorrow will be sunny or it will rain” is an example of a conjunction statement.
9. Joining two or more simple statements with a logical connective creates a compound statement.
10. The symbol \wedge represents the logical connective *and*.

Practice

Determine if the following statements are simple or compound. See Example 1.

1. A quarter is a coin.
2. You got an A or B.
3. If I study, then I will get an A on the test.
4. There are 100 pennies or 4 quarters in a dollar.
5. A week has seven days.
6. I do like math and science.

Determine the conjunction of the following statements. See Example 2.

p : You are finished eating dinner

q : You cooked dinner

r : Your stomach is full.

7. p and $\sim q$
8. $\sim p \wedge r$
9. $\sim r \wedge p \wedge \sim q$
10. q and r
11. r and q and $\sim p$

Determine the simple statements used in each conjunction and the compound statement symbolically.

12. Space is vast and the ocean is deep
13. Jets are flying east and ships are not going south
14. Pigs are pink and horses are not pink.
15. No shows are funny and movies aren't free.
16. My classes start at 8:00 am and end at 2:00 pm.
17. I like to swim and don't like jumping rope.

Determine the disjunction of the following statements in words. See Example 3.

p : Bears are big.

q : Lakes are deep.

r : Hills are steep.

- | | |
|--------------------------|--------------------------|
| 18. p or not r | 21. $\sim p \vee \sim r$ |
| 19. $\sim r \vee \sim q$ | 22. Not q or not p |
| 20. r or q | 23. $p \vee q$ |

Determine the simple statements used in each conjunction and the compound statement symbolically.

24. Tomorrow is Tuesday or Wednesday.
25. I will not go to the museum or I will not go to the zoo.
26. The monkeys were eating or they were asleep.
27. The winter is cold or not rainy.
28. Hot dogs are not sold at baseball games or sodas are sold football games.

Use the given simple statements to write the indicated conditional statement. See Example 4.

p : The earth is white.

q : The sky is dark.

r : The night has come.

s : The wind is blowing.

t : The snow is falling.

- | | |
|---------------------|-----------------------|
| 29. p implies q | 31. $r \Rightarrow s$ |
| 30. q implies r | 32. s implies t |

33. $t \Rightarrow p$

34. $r \Rightarrow q$

Identify the simple statements that were used to form the given conditional statement and write the compound statement symbolically. See Example 5.

35. We will go to the beach if Liam finishes his work on time.
36. If the sunset today is red, then tomorrow it will rain.
37. Whenever a storm begins, Jane is afraid to leave the house.
38. I will pay for a taxi if Mike pays for pizza.
39. Every time Mary skips her classes, I don't want to help her prepare for the tests.
40. We will not go ice skating if the pond does not thoroughly freeze.

Use the given simple statements to write the indicated biconditional statements. See Example 6.

p : Zoe will buy a house.

q : The house is in the countryside.

r : The house has a backyard.

s : James will buy a car.

t : Margaret will get a driver's license.

u : John will change his job.

41. $p \Leftrightarrow r$

44. $t \Leftrightarrow s$

42. r if and only if q

45. p if and only if s

43. s if and only if q

46. $u \Leftrightarrow t$

Write the symbolic representation for the given biconditional statement. See Example 6.

47. I can play tennis if and only if I don't play polo.
48. Robots are useful if and only if they work.
49. I can't work on the project if and only if I have a lot of work to do.
50. Swimming in the ocean is fun if and only if there aren't any sharks.

Identify the simple statements that were used to form the given biconditional statement and write the compound statement symbolically. See Example 7.

51. The workers will receive a bonus if and only if they finish their work ahead of time.
52. I will be able to master the technique if and only if I learn it step by step.

- 53. Dominic will get this job if and only if Neil does not come to compete with him.
- 54. Jessica won't stop worrying about the person if and only if this person is extremely important to her.
- 55. Matthew will get to work on time if and only if he is not late for the train.
- 56. The shop owner will not give you a discount is and only if you do not greet him.

Writing & Thinking

- 57. Compare and contrast conditional and biconditional statements.