

Answers to Try This One

- 1 (b), (c), and (d) are statements.
- 2 (a) (conjunction), (c) (conditional), and (d) (disjunction) are compound; (b) and (e) are simple.
- 3 (a) Some cell phones don't have cameras.
 (b) Some women can win the lottery.
 (c) No professors have Ph.Ds.
 (d) No one in this class will get a B.
- 4 (a) $p \wedge q$ (b) $\sim p$ (c) $q \rightarrow p$ (d) $\sim p \wedge q$
- 5 (a) My friend is not a football player.
 (b) My friend is a football player or my friend is smart.
 (c) If my friend is not a football player, then my friend is smart.
 (d) My friend is smart if and only if my friend is a football player.
 (e) My friend is a football player and my friend is smart.

EXERCISE SET 3-1**Writing Exercises**

- Define the term *statement* in your own words.
- Is the sentence "This sentence is a statement" a statement? Explain.
- Explain the difference between a simple and a compound statement.
- Describe the terms and symbols used for the four connectives.
- Write an example of each type of compound statement we studied: conjunction, disjunction, conditional, and biconditional. The topics should be things you find interesting.
- Explain why the negation of "All spring breaks are fun" is not "All spring breaks are not fun."

Applications in Our World

For Exercises 7–16, state whether the sentence is a statement or not.

- Please do not use your cell phone in class.
- $5 + 9 = 14$
- $9 - 3 = 2$
- Nicki is a student in vet school.
- Who will win the student government presidency?
- Neither Sam nor Mary arrives to the exam on time.
- You should carry a cell phone with you.
- Bill Gates is the founder of Microsoft.
- Go with the flow.
- Math is not hard.

For Exercises 17–26, decide if each statement is simple or compound.

- He goes to parties and hangs out at the coffee shop.
- Sara got her hair highlighted.
- Raj will buy an iMac or a Dell computer.
- Euchre is fun if and only if you win.
- February is when Valentine's Day occurs.
- Diane is a chemistry major.

- If you win the Megabucks multistate lottery, you'll be rich.
- He listened to his iPod and he typed a paper.
- $\sqrt{9} = 3$ or -3
- Malcolm and Alisha will both miss the spring break trip.

For Exercises 27–34, identify each statement as a conjunction, disjunction, conditional, or biconditional.

- Bob and Tom like stand-up comedians.
- Either he passes the test, or he fails the course.
- A number is even if and only if it is divisible by 2.
- Her nails are long, and they have rhinestones on them.
- I haven't decided yet if I'm going to the game or to the library to study.
- If you keep hitting on my girlfriend, I'm gonna bust you up.
- I'm going to pass bio lab if and only if my experiment works out the way I hope it will.
- When your battery dies, you need to charge your phone overnight.

For Exercises 35–40, write the negation of the statement.

35. The shirt I'm wearing to my interview is white.
36. Don't worry, your computer doesn't have a virus.
37. The hospital isn't full.
38. My name is not Richard Smoker.
39. Come on, you're not going to flunk this class.
40. Wow, that dude has some big biceps.

For Exercises 41–52, identify the quantifier in the statement as either universal or existential.

41. All fish swim in water.
42. Everyone that buys this hat gets a free bowl of soup.
43. Some people who live in glass houses throw stones.
44. There is at least one person in this class who won't pass.
45. Every happy dog wags its tail.
46. No men can join a sorority.
47. I've seen a four-leaf clover.
48. Each student that participates in this study gets a hundred bucks.
49. As far as I know, nobody's ever survived a fall from Mt. Catherine.
50. Everyone in the class was bored by the professor's lecture.
51. At least one of my friends has an iPhone.
52. No one here gets out alive.

For Exercises 53–64, write the negation of the statements in Exercises 41–52.

For Exercises 65–74, write each statement in symbols. Let p = "Sara is a political science major" and let q = "Jane is a quantum physics major."

65. Sara is a political science major, and Jane is a quantum physics major.
66. Sara is not a political science major.
67. If Jane is not a quantum physics major, then Sara is a political science major.
68. It is not true that Jane is a quantum physics major or Sara is a political science major.
69. It is false that Jane is a quantum physics major.
70. It is not true that Sara is a political science major.

71. Jane is a quantum physics major, or Sara is not a political science major.
72. Jane is not a quantum physics major, or Sara is a political science major.
73. Jane is a quantum physics major if and only if Sara is a political science major.
74. If Sara is a political science major, then Jane is a quantum physics major.

For Exercises 75–84, write each statement in symbols. Let p = "Sophie has been arrested" and q = "Bubba's never been arrested."

75. Bubba has been arrested at least once.
76. Sophie and Bubba have both been arrested.
77. If Bubba's been arrested, then Sophie has been arrested too.
78. You're saying that Sophie's been arrested? That is totally not true.
79. Either Sophie or Bubba has been arrested.
80. When the newspaper reported that Sophie and Bubba had both been arrested, that was inaccurate.
81. Sophie has been arrested if and only if Bubba has not.
82. Neither Bubba nor Sophie has ever been arrested.
83. If Sophie has not been arrested, then Bubba has not.
84. Bubba has never been arrested if and only if Sophie hasn't been arrested either.

For Exercises 85–94, write each statement in words. Let p = "The plane is on time." Let q = "The sky is clear."

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| 85. $p \wedge q$ | 90. $q \leftrightarrow p$ |
| 86. $\sim p \vee q$ | 91. $p \vee \sim q$ |
| 87. $q \rightarrow p$ | 92. $\sim p \leftrightarrow \sim q$ |
| 88. $q \rightarrow \sim p$ | 93. $q \rightarrow (p \vee \sim p)$ |
| 89. $\sim p \wedge \sim q$ | 94. $(p \rightarrow q) \vee \sim p$ |

For Exercises 95–104, write each statement in words. Let p = "Mark lives on campus." Let q = "Trudy lives off campus."

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| 95. $\sim q$ | 100. $\sim p$ |
| 96. $p \rightarrow q$ | 101. $p \vee q$ |
| 97. $p \vee \sim q$ | 102. $(\sim p \vee q) \vee \sim q$ |
| 98. $q \leftrightarrow p$ | 103. $q \vee p$ |
| 99. $\sim p \rightarrow \sim q$ | 104. $(p \vee q) \rightarrow \sim(\sim q)$ |

Critical Thinking

105. Explain why the sentence "This statement is false" is not a statement.
106. Explain why each of the alleged statements listed at the end of the Sidelight on page 99 is actually a paradox.
107. (a) Write a verbal translation of the statement $a < 20$.
(b) Write the negation of the statement you wrote in (a).
(c) Write your statement from (b) in inequality form.
108. (a) Write a verbal translation of the statement $b > 10$.
(b) Write the negation of the statement you wrote in (a).
(c) Write your statement from (b) in inequality form.