

## Chapter 3 Test

Write a negation for each of the following statements.

- $5 + 3 = 9$ .
- Every good boy deserves favour.
- Some people here can't play this game.
- If it ever comes to that, I won't be here.
- My mind is made up and you can't change it.

Let  $p$  represent "it is broken" and let  $q$  represent "you can fix it." Write each of the following in symbols.

- If it isn't broken, then you can fix it.
- It is broken or you can't fix it.
- You can't fix anything that is broken.

Using the same directions as for Exercises 6–8, write each of the following in words.

- $\sim p \wedge q$
- $p \leftrightarrow \sim q$

In each of the following, assume that  $p$  and  $q$  are true, with  $r$  false. Find the truth value of each statement.

- $\sim p \wedge \sim r$
- $r \vee (p \wedge \sim q)$
- $r \rightarrow (s \vee r)$  (The truth value of the statement  $s$  is unknown.)
- $r \leftrightarrow (p \rightarrow \sim q)$
- What are the necessary conditions for a conditional statement to be false? for a conjunction to be true?
- Explain in your own words why, if  $p$  is a statement, the biconditional  $p \leftrightarrow \sim p$  must be false.

Write a truth table for each of the following. Identify any tautologies.

- $p \wedge (\sim p \vee q)$
- $\sim(p \wedge q) \rightarrow (\sim p \vee \sim q)$

Decide whether each statement is true or false.

- All positive integers are whole numbers.
- No real numbers are integers.

Write each conditional statement in the form if . . . then.

- All rational numbers are real numbers.
- Being a rectangle is sufficient for a polygon to be a quadrilateral.
- Being divisible by 2 is necessary for a number to be divisible by 6.
- She cries only if she is hurt.

For each statement, write (a) the converse, (b) the inverse, and (c) the contrapositive.

25. If a picture paints a thousand words, the graph will help me understand it.  
 26.  $\sim p \rightarrow (q \wedge r)$  (Use one of De Morgan's laws as necessary.)  
 27. Use an Euler diagram to determine whether the following argument is *valid* or *invalid*.

All members of that music club save money.  
Steve Gold is a member of that music club.  
 Steve Gold saves money.

28. Match each argument in (a)–(d) with the law that justifies its validity, or the fallacy of which it is an example.  
 A. Modus ponens  
 B. Modus tollens  
 C. Reasoning by transitivity  
 D. Disjunctive syllogism  
 E. Fallacy of the converse  
 F. Fallacy of the inverse

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|--|---|
| (a) If you like ice cream, then you'll like Blue Bell.<br><u>You don't like Blue Bell.</u><br>You don't like ice cream.        | (b) If I buckle up, I'll be safer.<br><u>I don't buckle up.</u><br>I'm not safer. |
| (c) If you love me, you will let me go.<br><u>If you let me go, I'll try to forget.</u><br>If you love me, I'll try to forget. | (d) It is March or April.<br><u>It's not March.</u><br>It's April.                |

Use a truth table to determine whether each argument is valid or invalid.

29. If I hear that song, it reminds me of my youth. If I get sentimental, then it does not remind me of my youth. I get sentimental. Therefore, I don't hear that song.  
 30.  $\sim p \rightarrow \sim q$   
 $q \rightarrow p$   


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 $p \vee q$

1)  $5+3 \neq 9$

2) Some good boys don't deserve a favour.

3) All people can play this game

4) It comes to that and I am here

5) my mind is not made up or you  
can change it.

6)  $p \rightarrow q$     7)  $p \vee \neg q$     8)  $p \rightarrow \neg q$

9) It is not broken and you can fix it.

10) It is broken iff you can't fix it.

11) F    12) F    13) T    14) T

15)  $T \rightarrow F$ ,  $T \wedge T$

16) Both parts must have the same  
truth value

17) T    18) T    19) T

F    T    20) F

F    T

F    T

21) If rational then real

22) If rectangle then quadrilateral

23) If divisible by 6 then divisible by 2

24) If she cries then she is hurt.

25) converse

If the graph helps then a picture  
paints 1000 words.

inverse

If a picture does not paint 1000 word  
then the graph will not help.

Contrapositive

If the graph does not help then  
a picture does not paint 1000 words.

26) converse  $(q \wedge r) \rightarrow \neg p$

inverse  $p \rightarrow \neg(q \wedge r)$

$p \rightarrow (\neg q \vee \neg r)$

Contrapositive  $(\neg q \vee \neg r) \rightarrow \neg p$

27)



28 a) B

b) F

c) C

d) D

29) valid

30) invalid