**6.1 Statements**  ---------------------------------------------------

**Decide whether the following is a statement or is not a statement.**

    1) Not all flowers are roses.

    2) 0.7 = .07

    3) Go fly a kite.

**Write a negation for the statement.**

    4) x ≥ −66

    5) That athlete wants to be a musician.

**Translate the symbolic compound statement into words.**

    6) Let p represent the statement "Her name is Lisa" and let q represent the statement "She lives in Chicago."
       p ∨ ~q

    7) Let p represent the statement "It's Monday" and let q represent the statement "It's raining today."
       ~p ∧ ~q

8) Let p represent the statement : "Students are happy" and let q represent the statement: "Teachers are happy."
   ~(p ∨ ~q)

**Let p represent a true statement, and let q and r represent false statements. Find the truth value of the given compound statement.**

9) ~(q ∨ ~r)

10) (p ∧ ~q) ∧ r

11) (~p ∧ ~q) ∨ ~q

**Let p represent the statement "Jim plays football" and let q represent the statement "Michael plays basketball." Convert the compound statement into symbols.**

12) It is not the case that Jim does not play football and Michael does not play basketball.

13) Jim does not play football or Michael does not play basketball.

**6.2 Truth Tables and Equivalence**  --------------------------------------------------

**Give the number of rows in the truth table for the compound statement.**

    14) $p \wedge (\sim q \vee r)$

    15) $\sim(p \wedge q) \wedge (w \wedge \sim s) \wedge (r \vee t) \wedge (\sim u \wedge s)$

**Construct a truth table for the compound statement.**

    16) $\sim s \wedge \sim p$

    17) $(p \wedge \sim t) \wedge q$

18) (p ∧ s) ∨ (~p ∧ ~s)

19) ~(r ∨ t) ∧ ~(t ∧ r)

**Use one of De Morgan's laws to write the negation of the statement.**

20) I was a day late and a dollar short.

21) $2 < 9$ or $7 \neq 6$

22) Roger or Emil will attend the game.

23) The captain of the chess team is handsome and smart.

**Decide whether the statement is true or false. $\underline{\vee}$ is the exclusive disjunction; that is, assume "either p or q is true, but not both."**

    24) $(7 + 1 = 8) \underline{\vee} (2 + 6 = 9)$

**Solve the problem.**

    25) The following statement appears in the instructions for a game: You may make a suggestion and an accusation on the same turn. Write the negation of the statement.

    26) The following statement appears in the instructions for a game: The tile can be played immediately and the turn ends. Write the negation of the statement.

    27) The following statement appears on a warranty: The foregoing limited warranty applies to the motor, and does not apply to electronic controls. Write the negation of the statement.

    28) The following statement appears on a warranty: Replacement of bicycle component parts determined to be defective shall be the remedy of any purchaser and replacement parts must be handled through the retailer from whom the bicycle was purchased. Write the negation of the statement.

    29) The following statement appears on the cover page of a mathematics exam: Work must be shown and the work must lead to your answer choice. Write the negation of the statement.

30) A leading electronics manufacturer guarantees the buyer that their purchase will have no defects. If the purchased item is later shown to be defective, the buyer can receive a full refund along with a 20% discount on their next purchase. Let d represent "The purchase contains no defects," r represent "The buyer will receive a full refund," and q represent "The buyer will receive a 20% discount on their next purchase." Write the guarantee symbolically.

**6.3 The Conditional** -------------------------------------------------

**Determine whether the statement is true or false.**

31) If the antecedent of a conditional statement is true, the conditional statement is true.

32) If p is true, then $\sim p \rightarrow (q \lor r)$ is true.

33) Given that $\sim p$ is false and q is true, the conditional $p \rightarrow q$ is false.

**Tell whether the conditional is true or false. Here T represents a true statement and F represents a false statement.**

34) $(5 = 5) \rightarrow (4 = 3)$

35) $(8 = 12 - 4) \rightarrow (5 > 0)$

36) $(5^2 \neq 25) \rightarrow (2 + 3 = 5)$

**Let p represent "the puppy behaves well," let q represent "the puppy's owners are happy," and let r represent "the puppy is trained." Express the compound statement in words.**

37) $\sim(p \rightarrow q)$

38) p → r

39) r ∧ (p → q)

**Let p represent "I eat too much," let q represent "I exercise," and let r represent "the food is good." Write the compound statement in symbols.**

40) If the food is good or I eat too much, then I exercise.

41) I exercise if I eat too much.

42) I exercise if I don't eat too much.

**Find the truth value of the statement. Assume that p and q are false, and r is true.**

43) (q ∧ ~r) → (~p ∨ r)

44) (~r ∧ p) → p

45) $(\sim p \lor \sim q) \rightarrow (p \land \sim r)$

46) $(\sim p \rightarrow \sim r) \land (\sim p \rightarrow \sim r)$

**Construct a truth table for the statement.**

47) $r \rightarrow \sim q$

48) $\sim t \rightarrow (\sim t \land s)$

49) $(p \rightarrow q) \rightarrow (\sim p \lor q)$

50) $(\sim p \lor \sim q) \rightarrow \sim(q \land p)$

**Write the statement as an equivalent statement that does not use the if . . . then connective. Remember that $p \rightarrow q$ is equivalent to $\sim p \lor q$.**

51) If the sun comes out tomorrow, the roses will open.

52) If you can't win the game, then you don't bother playing.

53) If you can't find the right dress for the party, then you make one yourself.

**Write the negation of the statement. Remember that the negation of p → q is p ∧ ~q.**

54) If you give your coat to the doorman, he will give you a dirty look.

55) If it is raining, you take your umbrella.

56) If k – 4 ≤ 3, then k ≤ 7.

57) If the box is in the mail, then it will be here by Thursday.

**Use a truth table to decide if the statements are equivalent.**

58) q → p ; ~q ∨ p

59) ~q ∧ p ; ~q → p

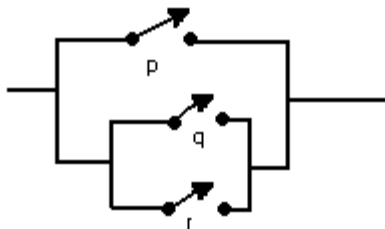60) ~(q → p) ; q ∧ ~p

**Write a logical statement representing the circuit.**
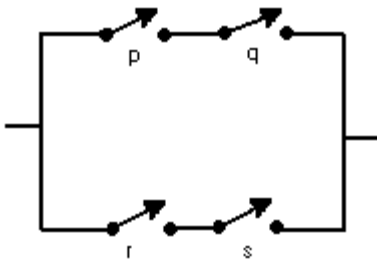
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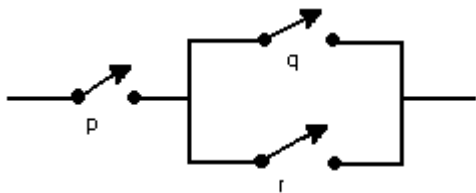


62)



63)

**Draw a circuit representing the following statement as it is given.  Simplify if possible.**

64) (p ∧ ~r) ∨ q

65) [p ∨ (~p ∧ r)] ∨ q

66) ~p → [(q ∧ r) ∨ ~p]

**Solve the problem.**

67) Rewrite the following statement, replacing the "if...then" with an equivalent "or" statement:

If the sun comes out Saturday, the daisies will open.

68) Write the negation of the following statement:

If you give your rain coat to the doorman, he will give you a dirty look.

69) Write the negation of the following statement:

If the hammer is on the floor, the baby will get hurt.

1) Statement
2) Statement
3) Not a statement
4) x < –66
5) That athlete does not want to be a musician.
6) Her name is Lisa or she does not live in Chicago.
7) It's not Monday and it's not raining today.
8) It is not the case that students are happy or teachers are not happy.
9) False
10) False
11) True
12) ~(~p ∧ ~q)
13) ~p ∨ ~q
14) 8
15) 128
16)

| s | p | (~s ∧ ~p) |
|---|---|-----------|
| T | T | F |
| T | F | F |
| F | T | F |
| F | F | T |

17)

| p | t | q | (p ∧ ~t) ∧ q |
|---|---|---|--------------|
| T | T | T | F |
| T | T | F | F |
| T | F | T | T |
| T | F | F | F |
| F | T | T | F |
| F | T | F | F |
| F | F | T | F |
| F | F | F | F |

18)

| p | s | (p ∧ s) ∨ (~p ∧ ~s) |
|---|---|---------------------|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | T |

19)

| r | t | ~(r ∨ t) ∧ ~(t ∧ r) |
|---|---|---------------------|
| T | T | F |
| T | F | F |
| F | T | F |
| F | F | T |

20) I was not a day late or not a dollar short.
21) 2 ≥ 9 and 7 = 6
22) Roger will not attend the game and Emil will not attend the game.
23) The captain of the chess team is not handsome or not smart.
24) True
25) You may not make a suggestion or not make an accusation on the same turn.
26) The tile cannot be played immediately or the turn does not end.

27) The foregoing limited warranty does not apply to the motor, or does apply to electronic controls.
28) Replacement of bicycle component parts determined to be defective shall not be the remedy of any purchaser or replacement parts must not be handled through the retailer from whom the bicycle was purchased.
29) Work must not be shown or the work must not lead to your answer choice.
30) d ∨ (r ∧ q)
31) False
32) True
33) False
34) False
35) True
36) True
37) It is not the case that if the puppy behaves well, then his owners are happy.
38) If the puppy behaves well, then the puppy is trained.
39) The puppy is trained, and if the puppy behaves well then his owners are happy.
40) (r ∨ p) → q
41) p → q
42) ~p → q
43) True
44) True
45) False
46) False
47)

| r | q | r → ~q |
|---|---|--------|
| T | T | F |
| T | F | T |
| F | T | T |
| F | F | T |

48)

| t | s | ~t →(~t ∧ s) |
|---|---|--------------|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | F |

49)

| p | q | (p → q) → (~p ∨ q) |
|---|---|--------------------|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | T |

50)

| p | q | (~p ∨ ~q) → ~(q ∧ p) |
|---|---|----------------------|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | T |

51) The sun does not come out tomorrow or the roses will open.
52) You can win the game or you don't bother playing.
53) You can find the right dress for the party or you make one yourself.
54) You give your coat to the doorman and he does not give you a dirty look.
55) It is raining and you do not take your umbrella.

56) k − 4 ≤ 3 and k > 7.
57) The box is in the mail and it will not be here by Thursday.
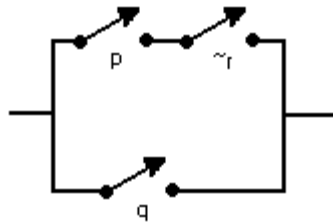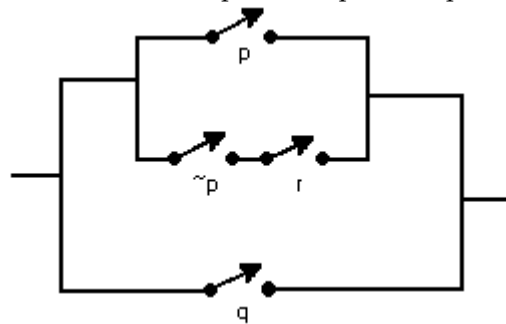58) Equivalent
59) Not equivalent
60) Equivalent
61) p ∧ (q ∨ r)
62) p ∨ (q ∨ r)
63) (p ∧ q) ∨ (r ∧ s)
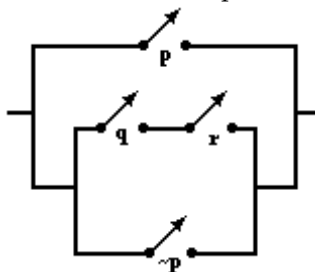64)



65) The statement simplifies to (p ∨ r) ∨ q.



66) The statement simplifies to T.



67) The sun does not come out Saturday or the daisies will open.
68) You give your rain coat to the doorman and he will not give you a dirty look.
69) The hammer is on the floor and the baby will not get hurt.