

More on the Conditional

Contemporary Math (MAT-130)

For each given conditional statement, write (a) the converse, (b) the inverse, and (c) the contrapositive in if...then form. In some cases it may be helpful to first restate the given statement in if...then form.

1. If you don't behave, you'll be grounded.
2. If you lie down with the dogs, then you'll wake up with the fleas.
3. If it's a danger to the community, we'll have to get rid of it.
4. I'll buy new shoes if I get paid today.
5. Cigarettes are hazardous to your health.
6. An apple a day keeps the doctor away.
7. I will sing when pigs fly.
8. All dogs are animals.
9. All fruits have seeds.
10. Daily exercise will add years to your life.
11. $p \rightarrow q$
12. $q \rightarrow \sim p$
13. $\sim q \rightarrow \sim p$
14. $p \rightarrow \sim(q \wedge r)$

Write each statement in the form "if p, then q."

15. Fluffy is a cat implies that Fluffy is an animal
16. Being 21 implies that you can gamble.
17. All hens are chickens
18. All tables have legs.
19. Bad weather is sufficient for staying home.
20. Rush hour traffic is sufficient for making me angry.
21. A bad smell is necessary for Keith to wash his clothes.
22. An emergency is necessary for Chad to drive his car.
23. The law will pass only if it gets a majority vote.
24. I'll go to the mall only if my friends are there.
25. The Cavaliers will win the finals when they replace Lebron James.
26. No human can survive without air.
27. The square root of a perfect square number is a whole number.
28. A number that can be written as a fraction is a rational number.

Let p and r represent true statements. Let q represent a false statement. Find the truth values of the given compound statements.

29. $p \leftrightarrow r$
30. $q \leftrightarrow r$
31. $\sim p \leftrightarrow q$
32. $\sim(p \leftrightarrow q)$
33. $\sim q \leftrightarrow \sim r$
34. $\sim r \leftrightarrow (p \leftrightarrow q)$

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Solutions:

1. If you don't behave, then you will be grounded.
 - a. If you are grounded, then you did not behave.
 - b. If you do behave, then you will not be grounded.
 - c. If you are not grounded, then you did behave.
2. If you lie down with the dogs, then you'll wake up with the fleas.
 - a. If you wake up with the fleas, then you lay down with the dogs.
 - b. If you do not lie down with the dogs, then you will not wake up with the fleas.
 - c. If you do not wake up with the fleas, then you did not lay down with the dogs.
3. If it's a danger to the community, then we'll have to get rid of it.
 - a. If we have to get rid of it, then it's a danger to the community.
 - b. If it is not a danger to the community, then we will not have to get rid of it.
 - c. If we do not have to get rid of it, then it is not a danger to the community.
4. If I get paid today, then I will buy new shoes.
 - a. If I buy new shoes, then I will get paid today.
 - b. If I do not get paid today, then I will not buy new shoes.
 - c. If I did not buy new shoes, then I did not get paid today.
5. If it is a cigarette, then it is hazardous to your health.
 - a. If it is hazardous to your health, then it is a cigarette.
 - b. If it is not a cigarette, then it is not hazardous to your health.
 - c. If it is not hazardous to your health, then it is not a cigarette.
6. If you eat an apple a day, then you will keep the doctor away.
 - a. If you keep the doctor away, then you eat an apple a day.
 - b. If you do not eat an apple a day, then you will not keep the doctor away.
 - c. If you do not keep the doctor away, then you do not eat an apple a day.
7. If pigs fly, then I will sing.
 - a. If I will sing, then pigs will fly.
 - b. If pigs do not fly, then I will not sing.
 - c. If I will not sing, then pigs will not fly.
8. If it is a dog, then it is an animal.
 - a. If it is an animal, then it is a dog.
 - b. If it is not a dog, then it is not an animal.
 - c. If it is not an animal, then it is not a dog.
9. If it is a fruit, then it has seeds.
 - a. If it has seeds, then it is a fruit.
 - b. If it is not a fruit, then it does not have seeds.
 - c. If it does not have seeds, then it is not a fruit.
10. If you exercise daily, then you will add years to your life.
 - a. If you will add years to your life, then you exercise daily.
 - b. If you do not exercise daily, then you will not add years to your life.
 - c. If you will not add years to your life, then you do not exercise daily.
11. $p \rightarrow q$
 - a. $q \rightarrow p$
 - b. $\sim p \rightarrow \sim q$
 - c. $\sim q \rightarrow \sim p$

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12. $q \rightarrow \sim p$
 - a. $\sim p \rightarrow q$
 - b. $\sim q \rightarrow p$
 - c. $p \rightarrow \sim q$
13. $\sim q \rightarrow \sim p$
 - a. $\sim p \rightarrow \sim q$
 - b. $q \rightarrow p$
 - c. $p \rightarrow q$
14. $p \rightarrow \sim(q \wedge r)$
 - a. $\sim(q \wedge r) \rightarrow p$
 - b. $\sim p \rightarrow (q \wedge r)$
 - c. $(q \vee r) \rightarrow \sim p$
15. If Fluffy is a cat, then Fluffy is an animal.
16. If you are 21, then you can gamble.
17. If it is a hen, then it is a chicken.
18. If it is a table, then it has legs.
19. If the weather is bad, then I will stay at home.
20. If there is rush hour traffic, then I will be angry.
21. If Keith washes his clothes, then there is a bad smell.
22. If Chad drives his car, then there is an emergency.
23. If the law passes, then it got a majority vote.
24. If I go to the mall, then my friends are there.
25. If they replace LeBron James, then the Cavaliers will win the finals.
26. If it can survive without air, then it is not a human.
27. If it is the square root of a perfect square, then it is a whole number.
28. If the number can be written as a fraction, then it is a rational number.
29. T
30. F
31. T
32. T
33. F
34. T