

Which of the following are propositions?

1. The sky is blue.
2. $2+2 = 3$.
3. No smoking.

What is the negation of each of these propositions?

4. Today is Monday.
5. $2+2 < 3$.

p is "It is below freezing"

q is "It is snowing"

Express each of the following as English sentences.

6. $p \wedge q$

7. $\neg p \wedge \neg q$

8. $p \rightarrow q$

9. $p \vee q$

Write these propositions using p and q and logical connectives.

10. It is not snowing.

11. If it is not below freezing then it is not snowing.

12. It is snowing if and only if it is below freezing.

Which of the following conditionals are true.

13. If $2+3=5$ then $1+1=2$

14. If $2+2=5$ then $1+1=3$

15. If $2+3=5$ then $1+1=3$

State the converse, inverse and contrapositive

Conditional	Converse	Contrapositive	Inverse
$p \rightarrow q$	$q \rightarrow p$	$\neg q \rightarrow \neg p$	$\neg p \rightarrow \neg q$

16. If it snows today then I will ski tomorrow.

17. Construct a truth table for: $\neg p \wedge (q \rightarrow r)$

18. Find the bitwise OR and AND of:

$$\begin{array}{r} 1001 \\ \wedge \underline{1110} \end{array} \quad \begin{array}{r} 1001 \\ \vee \underline{1110} \end{array}$$

19. Use truth tables to verify: $\neg(p \vee q) \equiv \neg p \wedge \neg q$

$P(x)$ is $x \leq 4$. What are the truth values of:

20. $P(0)$

21. $P(4)$

22. $P(6)$

$C(x)$ is "x is a comedian"

The domain is all people.

$F(x)$ is "x is funny"

Translate:

23. $\forall x(C(x) \rightarrow F(x))$

24. $\exists x(C(x) \rightarrow F(x))$

Determine the truth value of each if the domain consists of all integers.

25. $\forall n(n^2 > n)$

26. $\exists n(n^2 < 0)$

27. $\neg \forall n(n^2 > n)$

28. $\neg \exists n(n^2 < 0)$

Which of the following are propositions?

- | | |
|---------------------|-----|
| 1. The sky is blue. | Yes |
| 2. $2+2 = 3$. | Yes |
| 3. No smoking. | No |

What is the negation of each of these propositions?

- | | |
|---------------------|----------------------|
| 4. Today is Monday. | Today is not Monday. |
| 5. $2+2 < 3$. | $2+2 \geq 3$. |

p is "It is below freezing"

q is "It is snowing"

Express each of the following as English sentences.

6. It is below freezing and snowing. $p \wedge q$
7. It is not below freezing and it is not snowing. $\neg p \wedge \neg q$
8. If it is below freezing then it is snowing. $p \rightarrow q$
9. It is snowing or below freezing. $p \vee q$

Write these propositions using p and q and logical connectives.

10. It is not snowing. $\neg q$
11. If it is not below freezing then it is not snowing.
 $\neg p \rightarrow \neg q$
12. It is snowing if and only if it is below freezing. $p \leftrightarrow q$

Which of the following conditionals are true.

- | | |
|-----------------------------|-------|
| 13. If $2+3=5$ then $1+1=2$ | True |
| 14. If $2+2=5$ then $1+1=3$ | True |
| 15. If $2+3=5$ then $1+1=3$ | False |

State the converse, inverse and contrapositive

16. If it snows today then I will ski tomorrow.
Converse: If I will ski tomorrow then it snows today.

Inverse: If it does not snow today then I will not ski tomorrow.

Contrapositive: If I do not ski tomorrow then it did not snow today.

17. Construct a truth table for: $\neg p \wedge (q \rightarrow r)$

p	q	r	$\neg p$	$q \rightarrow r$	$\neg p \wedge (q \rightarrow r)$
T	T	T	F	T	F
T	T	F	F	F	F
T	F	T	F	T	F
T	F	F	F	T	F
F	T	T	T	T	T
F	T	F	T	F	F
F	F	T	T	T	T
F	F	F	T	T	T

18. Find the bitwise OR and AND of:

$$\begin{array}{r}
 1001 \\
 \wedge \underline{1110} \\
 \hline
 1000
 \end{array}
 \qquad
 \begin{array}{r}
 1001 \\
 \vee \underline{1110} \\
 \hline
 1111
 \end{array}$$

19. Use truth tables to verify: $\neg(p \vee q) \equiv \neg p \wedge \neg q$

p	q	$\neg p$	$\neg q$	$p \vee q$	$\neg(p \vee q)$	$\neg p \wedge \neg q$
T	T	F	F	T	F	F
T	F	F	T	T	F	F
F	T	T	F	T	F	F
F	F	T	T	F	T	T

$P(x)$ is $x \leq 4$. What are the truth values of:

20. $P(0)$ True

21. $P(4)$ True

22. $P(6)$ False

$C(x)$ is "x is a comedian"

$F(x)$ is "x is funny"

The domain is all people.

Translate:

24. $\forall x(C(x) \rightarrow F(x))$ For all people, if they are a comedian then they are funny.

25. $\exists x(C(x) \rightarrow F(x))$ There exists a person that if they are a comedian then they are funny.

Determine the truth value of each if the domain consists of all integers.

25. $\forall n(n^2 > n)$ False, $1^2 > 1$

26. $\exists n(n^2 < 0)$ False, $n^2 \geq 0$

27. $\neg \forall n(n^2 > n) = \exists n \neg(n^2 > n) = \exists n(n^2 \leq n)$ True, $1^2 \leq 1$

28. $\neg \exists n(n^2 < 0) = \forall n \neg(n^2 < 0) = \forall n(n^2 \geq 0)$ True