MATHS

BOOKS - CENGAGE

MATHMETICAL REASONING

Examples

1. From the truth table of pvq and $p \vee \sim q$

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2. Find the truth values of

(i) $\sim(P \vee \sim q)$ $(ii) \sim(\sim p \wedge \sim q)$

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3. Find the truth values of the following compound statements :

(i) $P \wedge (q \wedge r)$ $(ii)(p \vee q) \vee r$

(iii) $p \wedge (q \vee r)$ $(iv)(p \wedge q) \vee r$

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4. Find the truth values of

$(i) \sim p \to q \qquad (ii) \sim (p \to q)$

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5. Find the truth values of

(i) $\sim p \leftrightarrow q \qquad (ii) \sim (p \leftrightarrow q)$

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6. Show that the compound statements $(p \vee q) \wedge \sim p$ and $\sim p \wedge q$ are logically equivalent.

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7. Show that $(p \vee q) \rightarrow r \equiv (p \rightarrow r) \wedge (q \rightarrow r)$

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8. For the the statements "If two angles are congurent, then they have the same measure", write the congverse, inverse and contrapositive statements.

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9. Show that

(i) $p \rightarrow (p \vee q)$ is a tautology

$(ii)(p \vee q) \wedge (\sim p \wedge \sim q)$ is a contradiction

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10. Show that $[(p \vee q) \vee r] \leftrightarrow [p \vee (q \vee r)]$ is a tautology

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11. Write the negation of statements "2+3 =5 and 8< 10"

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12. Prove that $q \wedge \sim p \equiv \sim(q \rightarrow p)$

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13. Write the negation of the compound propostion . "If the examination is difficult, then I shall pass if I study hard".

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Exercise 10 1

1. Write down the truth table for the compound statements :

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

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2. Find the truth values of the following compound statements :

$(a)(p \vee \sim r) \wedge (q \vee \sim r)$ $(b) \sim (p \vee \sim q) \wedge (\sim p \vee r)$

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3. Find the truth values of

(a) $\sim p \rightarrow (q \rightarrow p)$ $(b)(p \rightarrow q) \rightarrow (p \wedge q)$

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4. Find the truth values of

(a)

$(p \leftrightarrow \sim q) \leftrightarrow (p \rightarrow p)$ $(b)(p \rightarrow q) \vee \sim (p \leftrightarrow \sim q)$

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5. Construct the truth table for the followings statements :

(a) $(p \wedge q) \rightarrow \sim p$ $(b)(p \wedge q) \rightarrow (p \vee q)$

(c) $(p \wedge q) \rightarrow r$ $(d)[p \wedge (\sim r)] \rightarrow (q \vee r)$

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6. Show that $\sim(p \leftrightarrow q) \equiv (p \wedge \sim q) \vee (\sim p \wedge q)$.

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7. Are the following statements equivalent :

'If the trades do not reduce the price then the government will take action against them '. 'it is not true that the traders do not reduce the prices and government does not take action against them'.

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8. For the statement: "If a quadilateral is a rectangle , then it has two paisrs of parallel

sides", write the converse, inverse and contrapositive statements.

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Exercise 10 2

1. Show that $(p \wedge q) \vee (\sim p) \vee (p \wedge \sim q)$ is a tautology

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2. Show that $[(p \to q) \wedge (q \to r)] \to (p \to r)$ is a tautology

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3. Prove that $\sim((\sim p) \wedge q) \equiv p \vee (\sim q)$.

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4. prove that $(p \wedge q) \wedge \sim(p \vee q)$ is a contradiction.

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5. Prove that $\sim(\sim p \rightarrow \sim q) \equiv \sim p \wedge q$

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Exercise Single

1. Which of the following is not a statement.

A. 2 is an odd number

B. 10 is less than 8

C. the number 13 is prime

D. please do me a favour

Answer: D

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2. If p: 'Ram is tall' and q: 'Ram is intelligent' , then the statement $\sim p \vee q$ is

A. Ram is not tall or he is intelligent.

B. Ram is tall or he is intelligent

C. Ram is not tall and he is intelligent

D. Ram is not all then he is intelligent

Answer: A

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3. Consider the statement p : 'New Delhi is a city'.

Which of the following is not negation of p ?

A. New delhi is not a city

B. it is false that new delhi is a city

C. it is not case that New delhi is a city

D. None of these

Answer: D

4. Which of the following is the inverse of the proposition 'If a number is a prime then it is odd' ?

A. IF a number is not odd then it is not a prime

B. if a number is a prime then it is odd

C. If a number of is not odd then it is a prime

D. IF a number is not a prime then it is not odd.

Answer: D

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5. Consider the following statements :

p: It rains today

q: I go to school

r: I Shall meet any friends

s: I shall go for a movie

Then which of the following proposition represents 'If it does not rain or if I do not go to school, then I shall meet my friend and go for a movie .'?

A. $\sim(p \wedge q) \rightarrow (r \wedge s)$

B. $\sim(p \wedge \sim q) \rightarrow (r \wedge s)$

C. $\sim(p \wedge q) \rightarrow (r \vee s)$

D. None of these

Answer: A

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6. Negation of 'Paris is in France and London is in England' is

A. Paris is in England and London is in France

B. Paris is not in France or london is not in England

C. Paris Is in england or london is in France

D. None of these

Answer: B

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7. Which of the following is not a proposition ?

A. $\sqrt{3}$ is a prime

B. $\sqrt{2}$ is irrational

C. Mathematics is interesting

D. 5 is an even integer

Answer: C

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8. $\sim((\sim(\sim p)) \wedge q)$ is equal to

A. $\sim p \wedge q$

B. $\sim p \vee \sim q$

C. $p \wedge \sim q$

D. $\sim p \wedge \sim q$

Answer: B

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9. $\sim(p \vee (\sim q))$ is equal to

A. $\sim p \vee q$

B. $(\sim p) \wedge q$

C. $\sim p \vee \sim p$

D. $\sim p \wedge \sim q$

Answer: B

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10. Which of the following is logically equivalent to $\sim(\sim p \rightarrow q)$?

A. $p \wedge q$

B. $p \wedge \sim q$

C. $\sim p \wedge q$

D. $\sim p \wedge \sim q$

Answer: D

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11. If p,q and r are simple propositions with truth values T,F and T , respectively, then the truth value of $(\sim p \vee q) \wedge \sim r \rightarrow p$ is

A. T

B. False

C. true if r is false

D. true if q is true

Answer: A

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12. If the statements $(p \wedge \sim r) \rightarrow (q \vee r)$, q and r are all false, then p

A. is true

B. is false

C. may be true or false

D. data is insufficient

Answer: A

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13. If p,q and r are simple propositions such that $(p \wedge q) \wedge (q \wedge r)$ is true, then

A. p,q and r are all false

B. p,q and r are all true

C. p,qare true and r is false

D. p is true and q, r are false

Answer: B

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14. $\sim(p \vee (\sim p \vee q))$ is equal to

A. $\sim p \wedge (p \wedge \sim q)$.

B. $(p \vee \sim q) v \sim p$

C. none of these

D.

Answer: A

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15. For any two statements p and q, $\sim(p \vee q) \vee (\sim p \wedge q)$ is logically equivalents to

A. p

B. $\sim p$

C. q

D. $\sim q$

Answer: B

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16. If the inverse of implication $p \to q$ is defined as $\sim p \to \sim q$, then the inverse of the proposition $(p \wedge \sim q) \to r$ is

A. $\sim r \to (\sim p \vee q)$

B. $r \rightarrow (p \wedge \sim q)$

C. $\sim q \vee (p \wedge r)$

D. none of these

Answer: D

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17. The negation of $q \vee (p \wedge r)$ is

A. $\sim q \wedge (-p \wedge -r)$

B. $\sim q \wedge (p \wedge r)$

C. $\sim q \vee (p \wedge r)$

D. none of these

Answer: A

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18. The contrapositive of $(p \vee q) \rightarrow r$ is

A. $r \rightarrow (p \vee q)$

B. $\sim r \rightarrow (p \vee q)$

C. $\sim r \rightarrow (\sim p \wedge \sim q)$

D. $p \to (q \vee r)$

Answer: C

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19. If $p \to (q \vee r)$ is false, then the truth values of p,q, and r are, respectively.

A. T,T,F

B. F,F,F

C. F,T,T

D. T,F,F

Answer: D

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20. $(p \wedge \sim q) \wedge (\sim p \wedge q)$ is

A. a tautology

B. a contradiction

C. neither a tautology nor a contradiction

D. None of these

Answer: B

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21. The properties $(p \to \sim p) \wedge (\sim p \to p)$ is a

A. tautology and contradiction

B. neither tautology nor contradiction

C. contradiction

D. tautology

Answer: C

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22. The false statement among the following is

A. $p \wedge (\sim p)$ is a contradiction

B. $(p \to q) \leftrightarrow (\sim q \to \sim p)$ is a contradiction

C. $p \vee (\sim p)$ is a tautology

D.

Answer: B

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23. Which of the following is logically equivalent to $\sim(\sim p \rightarrow q)$?

A. $p \wedge q$

B. $p \wedge \sim q$

C. $\sim p \wedge q$

D. $\sim p \wedge \sim q$

Answer: D

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24. If $p \to (\sim p \vee q)$ is false, then p and q are respectively

A. F,T

B. F,F

C. T,T

D. T,F

Answer: D

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25. The conditional statement $(p \wedge q) \rightarrow p$ is

A. a tautology

B. a fallacy

C. neither tautology nor fallacy

D. None of these

Answer: A

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26. $(p \wedge \sim q) \wedge (\sim p \wedge q)$ is

A. a contradiction

B. a tautology

C. either (1) or (2)

D. neither (1) nor (2)

Answer: A

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27. The proposition $p \rightarrow \sim(p \wedge \sim q)$ is

A. a contradiction

B. a tautology

C. either (1) or (2)

D. neither (1) nor (2)

Answer: D

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28. $(p \wedge \sim q) \wedge (\sim p \vee q)$ is

A. a contradiction

B. a tautology

C. either (1) or (2)

D. neither (1) nor (2)

Answer: A

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29. In the truth table for the statements $(p \to q) \leftrightarrow (\sim p \vee q)$, the last column has the truth value in the following order

A. TTTT

B. FTFT

C. TTFF

D. FFFF

Answer: A

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30. If each of the statements $p \to \sim q, \sim r \to q$ and p are true then which of the following is NOT true ?

A. q is false

B. r is true

C. $r \rightarrow q$ is false

D. $r \wedge \sim q$ is false

Answer: D

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31. Which of the following is true?

A. $p \wedge \sim p \equiv t$

B. $p \vee \sim p \equiv f$

C. $p \rightarrow q \equiv q \rightarrow p$

D. $p \rightarrow q \equiv \sim q \rightarrow \sim p$

Answer: D

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32. If p is true and q is false, then which of the following statements is NOT true ?

A. $p \vee q$

B. $p \wedge (\sim q)$

C. $p \rightarrow p$

D. $p \rightarrow q$

Answer: D

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33. If $(p \wedge \sim r) \rightarrow (\sim p \vee q)$ is false, then truth values of p,q and r are respectively.

A. T,T,T

B. T,F,T

C. T,F,F

D. F,T,T

Answer: C

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34. Statements $(p \to q) \leftrightarrow (\sim q \to \sim p)$

A. is contradiction

B. is tautology

C. is neither contradiction not tautology

D. None of these

Answer: B

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35. The contrapositive of inverse of $p \rightarrow \sim q$ is

A. $p \rightarrow q$

B. $\sim q \rightarrow p$

C. $q \rightarrow p$

D. $\sim q \rightarrow \sim p$

Answer: B

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36. Consider the following statements :

p: He is intelligent

q: He is strong

Then symbolic form of statements 'it is wrong that he is intelligent or strong's

A. $\sim p \vee \sim q$

B. $\sim p \vee q$

C. $\sim p \wedge \sim q$

D. $p \wedge \sim q$

Answer: C

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37. $\sim(p \vee q) \vee (\sim p \wedge q)$ is equivalent to

A. q

B. p

C. $\sim p$

D. $\sim q$

Answer: C

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38. If $p \to (q \vee r)$ is false, then the truth values of p,q and r are repspectively,

A. F,T,T

B. T,T,F

C. T,F,F

D. F,F,F

Answer: C

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Jee Previous Year

1. Statement-1: $\sim(p \leftrightarrow \sim q)$ is equivalent to $(p \leftrightarrow q)$.

Statement-2: $\sim(p \leftrightarrow \sim q)$ is a tautology.

A. Statement-1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1

B. Statement 1 is true, statement-2 is true, statement 2 is not a correct explanation

for statement 1

C. Statement 1 is true , statement 2 is false,

D. statement 1 is false, statement 2 is true

Answer: C

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2. Let S be a non-empty subset of R. consider the following statement:

P: There is a rational number $x \in S$ such that $x > 0$.

Which of the following statements is the negation of the statement P?

A. $x \in S$ and $x \leq 0 \Rightarrow x$ is not rational

B. There is rational number $x \in S$ such that $x \leq 0$.

C. There is no rational number $x \in S$ such that $x \leq 0$.

D. Every rational number $x \in S$ satisfies $x \leq 0$

Answer: D

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3. Consider the following statements

p: Suman is brilliant

q: Suman is rich

r: Suman is honest

The negation of the statement "Suman is brilliant and dishonest if and only if Suman is rich" can be expressed as

A. $\sim(p \wedge R) \leftrightarrow Q$

B. $\sim p \wedge (Q \leftrightarrow \sim R)$

C. $\sim(Q \leftrightarrow (P \wedge \sim R))$

D. $\sim Q \leftrightarrow \sim P \wedge R$

Answer: C

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4. The negation of the statement

"If I becomes a teacher, then I will open a school",

is

A. I will become a teacher and I will not open a school.

B. Either I will not becomes a teacher or I will not open a school.

C. Neither I will becomes a teacher nor I will open a school

D. I will not becomes a teacher or I will open a school.

Answer: A

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5. Consider :

Statement I:

$(p \wedge \sim q) \wedge (\sim p \wedge q)$ is a fallacy

Statement II: $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology

A. Statement-1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1

B. Statement 1 is true, statement-2 is true, statement 2 is not a correct explanation

for statement 1

C. Statement 1 is true , statement 2 is false,

D. statement 1 is false, statement 2 is true

Answer: B

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6. The statement $\sim(p \leftrightarrow \sim q)$ is

A. equivalent to $p \leftrightarrow q$

B. equivalent to $\sim p \leftrightarrow q$

C. a tautology

D. a fallacy

Answer: A

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7. The negation of $\sim s \vee (\sim r \wedge s)$ is equivalent to

A. $s \wedge \sim r$

B. $s \wedge (r \wedge \sim s)$

C. $s \vee (r \vee \sim s)$

D. $s \wedge r$

Answer: D

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8. The Boolean Expression $(p \wedge \sim q) \vee q \vee (\sim p \wedge q)$ is equivalent to :

A. $p \wedge q$

B. $p \vee q$

C. $p \vee \sim p$

D. $\sim p \wedge q$

Answer: B

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9. The following statement $(p \to q) \to [(\sim p \to q) \to q]$ is

A. a fallacy

B. a tautology

C. equivalent to $\sim p \to q$

D. equivalent to $p \rightarrow \sim q$

Answer: B

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10. The Boolean Expression $\sim(p \vee q) \vee (\sim p \vee q)$ is equivalent to

A. $\sim p$

B. $\sim q$

C. p

D. q

Answer: B

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