

**Questions with Answer Keys**

MathonGo

**Q1 (20 July 2021 Shift 1)**

The Boolean expression  $(p \wedge \sim q) \Rightarrow (q \vee \sim p)$  is equivalent to:

- (1)  $q \Rightarrow p$
- (2)  $p \Rightarrow q$
- (3)  $\sim q \Rightarrow p$
- (4)  $p \Rightarrow \sim q$

**Q2 (20 July 2021 Shift 2)**

Consider the following three statements:

- (A) If  $3 + 3 = 7$  then  $4 + 3 = 8$ .
- (B) If  $5 + 3 = 8$  then earth is flat.
- (C) If both (A) and (B) are true then  $5 + 6 = 17$ .

Then, which of the following statements is correct?

- (1) (A) is false, but (B) and (C) are true
- (2) (A) and (C) are true while (B) is false
- (3) (A) is true while (B) and (C) are false
- (4) (A) and (B) are false while (C) is true

**Q3 (22 July 2021 Shift 1)**

Which of the following Boolean expressions is not a tautology?

- (1)  $(p \Rightarrow q) \vee (\sim q \Rightarrow p)$
- (2)  $(q \Rightarrow p) \vee (\sim q \Rightarrow p)$
- (3)  $(p \Rightarrow \sim q) \vee (\sim q \Rightarrow p)$
- (4)  $(\sim p \Rightarrow q) \vee (\sim q \Rightarrow p)$

**Q4 (25 July 2021 Shift 1)**

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## Questions with Answer Keys

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The Boolean expression  $(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$  is equivalent to :

- (1)  $\sim q$
- (2)  $q$
- (3)  $p$
- (4)  $p$

**Q5 (25 July 2021 Shift 2)**

Consider the statement "The match will be played only if the weather is good and ground is not wet". Select the correct negation from the following:

- (1) The match will not be played and weather is not good and ground is wet.
- (2) If the match will not be played, then either weather is not good or ground is wet.
- (3) The match will be played and weather is not good or ground is wet.
- (4) The match will not be played or weather is good and ground is not wet.

**Q6 (27 July 2021 Shift 1)**

The compound statement  $(P \vee Q) \wedge (\sim P) \Rightarrow Q$  is equivalent to:

- (1)  $P \vee Q$
- (2)  $P \wedge \sim Q$
- (3)  $\sim (P \Rightarrow Q)$
- (4)  $\sim (P \Rightarrow Q) \Leftrightarrow P \wedge \sim Q$

**Q7 (27 July 2021 Shift 2)**

Which of the following is the negation of the

statement "for all  $M > 0$ , there exists  $x \in S$  such that  $x \geq M''?$

- (1) there exists  $M > 0$ , such that  $x < M$  for all  $x \in S$

## **Mathematical Reasoning**

## JEE Main 2021 (July) Chapter-wise Questions

## Questions with Answer Keys

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- (2) there exists  $M > 0$ , there exists  $x \in S$  such that  $x \geq M$

(3) there exists  $M > 0$ , there exists  $x \in S$  such that  $x < M$

(4) there exists  $M > 0$ , such that  $x \geq M$  for all  $x \in S$

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## **Mathematical Reasoning**

## JEE Main 2021 (July) Chapter-wise Questions

## **Questions with Answer Keys**

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## Answer Key

**Q1 (2)**      **Q2 (2)**      **Q3 (4)**      **Q4 (4)**

QS(3) QS(4) QS(1)

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## Hints and Solutions

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**Q1** mathongo mathongo mathongo mathongo mathongo mathongo mathongo mathongo

p	q	$\sim p$	$\sim q$	$p \wedge \sim q$	$q \vee \sim p$	$(p \wedge \sim q) \Rightarrow (q \vee \sim p)$	$p \Rightarrow q$
T	F	F	T	T	F	F	F
F	T	T	F	F	T	T	T
T	T	F	F	F	T	T	T
F	F	T	T	F	T	T	T

$\therefore (p \wedge \sim q) \Rightarrow (q \vee \sim p)$   
 $\equiv p \Rightarrow q$

So, option (2) is correct.

**Q2** mathongo mathongo mathongo mathongo mathongo mathongo mathongo

P	q	$P \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

**Q3** mathongo mathongo mathongo mathongo mathongo mathongo

$$(1) (p \rightarrow q) \vee (\sim q \rightarrow p) \\ = (\sim p \vee q) \vee (q \vee p)$$

$$= (\sim p \vee p) \vee q \\ = t \vee q = t$$

$$(2) (q \rightarrow p) \vee (\sim q \rightarrow p) \\ = (\sim q \vee p) \vee (q \vee p) \\ = (\sim q \vee q) \vee p \\ = t \vee p = t$$

$$(3) (p \rightarrow \sim q) \vee (\sim q \rightarrow p)$$

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## Mathematical Reasoning

## JEE Main 2021 (July) Chapter-wise Questions

### Hints and Solutions

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$$\begin{aligned} &= (\sim p \vee \sim q) \vee (q \vee p) \\ &= (\sim p \vee q) \vee (\sim q \vee q) \\ &= t \vee t = t \\ (4) \quad &(\sim q \rightarrow q) \vee (\sim q \rightarrow p) \\ &= (p \vee q) \vee (q \vee p) \\ &= (p \vee p) \vee (q \vee p) \\ &= p \vee q \end{aligned}$$

Which is not a tautology.

Q4

$$\begin{aligned} &(p \rightarrow q) \wedge (q \rightarrow \sim p) \\ &= (\sim p \vee q) \wedge (\sim q \vee \sim p) \{p \rightarrow q = \sim p \vee q\} \\ &= (\sim p \vee q) \wedge (\sim p \vee \sim q) \{\text{commutative property}\} \\ &= \sim p \vee (q \wedge \sim q) \{\text{distributive property}\} \\ &= \sim p \end{aligned}$$

Q5

p : weather is food q : ground is not wet

$$\begin{aligned} &\sim (p \wedge q) \equiv \sim p \vee \sim q \\ &\equiv \text{weather is not good or ground is wet} \end{aligned}$$

Q6

$$\begin{aligned} &\sim (p \wedge q) \equiv \sim p \vee \sim q \\ &\equiv \sim p \vee (\sim q \wedge \sim p) \\ &\equiv (\sim p \vee \sim q) \wedge (\sim p \vee \sim p) \\ &\equiv \sim p \end{aligned}$$

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### Hints and Solutions

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Using Truth Table

P	Q	$P \vee Q$	$\sim P$	$(P \vee Q) \wedge P$	$(P \vee Q) \wedge \sim P \rightarrow Q$
T	T	T	F	F	T
T	F	T	F	F	T
F	T	T	T	T	T
F	F	F	T	F	T

P	Q	$\sim Q$	$P \wedge \sim Q$	$P \rightarrow Q$	$\sim(P \rightarrow Q)$
T	T	F	F	T	F
T	F	T	T	F	T
F	T	F	F	T	F
F	F	T	F	T	F

$\sim(P \rightarrow Q)$	$P \wedge \sim Q$	$\sim(P \rightarrow Q) \Leftrightarrow P \wedge \sim Q$
F	F	T
T	T	T
F	F	T

Q7

P : for all  $M > 0$ , there exists  $x \in S$  such that  $x \geq M$

$\sim P$  : there exists  $M > 0$ , for all  $x \in S$

Such that  $x < m$

Negation of 'there exists' is 'for all'.

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