



**SpeedLabs**  
**Maths**

**CBSE 11<sup>th</sup>**

**TEEVRA EDUTECH PVT. LTD.**

# Mathematical Reasoning

## Chapter 14.6

**Question 1:** Write the negation of the following statements:

- (i) p: For every positive real number  $x$ , the number  $x - 1$  is also positive.
- (ii) q: All cats scratch.
- (iii) r: For every real number  $x$ , either  $x > 1$  or  $x < 1$ .
- (iv) s: There exists a number  $x$  such that  $0 < x < 1$ .

**Answer:**

- (i) The negation of statement p is as follows.

There exists a positive real number  $x$ , such that  $x - 1$  is not positive.

- (ii) The negation of statement q is as follows.

There exists a cat that does not scratch.

- (iii) The negation of statement r is as follows.

There exists a real number  $x$ , such that neither  $x > 1$  nor  $x < 1$ .

- (iv) The negation of statement s is as follows.

There does not exist a number  $x$ , such that  $0 < x < 1$ .

**Question 2:** State the converse and contrapositive of each of the following statements:

- (i) p: A positive integer is prime only if it has no divisors other than 1 and itself.

(ii) q: I go to a beach whenever it is a sunny day.

(iii) r: If it is hot outside, then you feel thirsty.

**Answer:** (i) Statement p can be written as follows.

If a positive integer is prime, then it has no divisors other than 1 and itself.

The converse of the statement is as follows.

If a positive integer has no divisors other than 1 and itself, then it is prime.

The contrapositive of the statement is as follows.

If positive integer has divisors other than 1 and itself, then it is not prime.

(ii) The given statement can be written as follows.

If it is a sunny day, then I go to a beach.

The converse of the statement is as follows.

If I go to a beach, then it is a sunny day.

The contrapositive of the statement is as follows.

If I do not go to a beach, then it is not a sunny day.

(iii) The converse of statement r is as follows.

If you feel thirsty, then it is hot outside.

The contrapositive of statement r is as follows.

If you do not feel thirsty, then it is not hot outside.

**Question 3:** Write each of the statements in the form “if p, then q”.

(i) p: It is necessary to have a password to log on to the server.

(ii) q: There is traffic jam whenever it rains.

(iii) r: You can access the website only if you pay a subscription fee.

**Answer:**

(i) Statement p can be written as follows.

If you log on to the server, then you have a password.

(ii) Statement q can be written as follows.

If it rains, then there is a traffic jam.

(iii) Statement r can be written as follows.

If you can access the website, then you pay a subscription fee.

**Question 4:** Re write each of the following statements in the form “p if and only if q”.

(i) p: If you watch television, then your mind is free and if your mind is free, then you watch television.

(ii) q: For you to get an A grade, it is necessary and sufficient that you do all the homework regularly.

(iii) r: If a quadrilateral is equiangular, then it is a rectangle and if a quadrilateral is a rectangle, then it is equiangular.

**Answer:**

(i) You watch television if and only if your mind is free.

(ii) You get an A grade if and only if you do all the homework regularly.

(iii) A quadrilateral is equiangular if and only if it is a rectangle.

**Question 5:** Given below are two statements

p: 25 is a multiple of 5.

q: 25 is a multiple of 8.

Write the compound statements connecting these two statements with “And” and “Or”. In both cases check the validity of the compound statement.

**Answer:**

The compound statement with ‘And’ is “25 is a multiple of 5 and 8”.

This is a false statement, since 25 is not a multiple of 8.

The compound statement with ‘Or’ is “25 is a multiple of 5 or 8”.

This is a true statement, since 25 is not a multiple of 8 but it is a multiple of 5.

**Question 6:** Check the validity of the statements given below by the method given against it.

(i) p: The sum of an irrational number and a rational number is irrational (by contradiction method).

(ii) q: If  $n$  is a real number with  $n > 3$ , then  $n^2 > 9$  (by contradiction method).

**Answer:**

(i) The given statement is as follows.

p: the sum of an irrational number and a rational number is ir rational.

Let us assume that the given statement, p, is false. That is, we assume that the sum of an irrational number and a rational number is rational.

Therefore,  $\sqrt{a} + \frac{b}{c} = \frac{d}{e}$ , where  $\sqrt{a}$  is irrational and b, c, d, e are integers.

$$\Rightarrow \frac{d}{e} - \frac{b}{c} = \sqrt{a}$$

But here,  $\frac{d}{e} - \frac{b}{c}$  is a rational number and  $\sqrt{a}$  is an irrational number.

This is a contradiction. Therefore, our assumption is wrong.

Therefore, the sum of an irrational number and a rational number is irrational.

Thus, the given statement is true.

(ii) The given statement, q, is as follows.

If n is a real number with  $n > 3$ , then  $n^2 > 9$ .

Let us assume that n is a real number with  $n > 3$ , but  $n^2 > 9$  is not true.

That is,  $n^2 < 9$

Then,  $n > 3$  and n is a real number.

Squaring both the sides, we obtain

$$n^2 > (3)^2$$

$\Rightarrow n^2 > 9$ , which is a contradiction, since we have assumed that  $n^2 < 9$ .

Thus, the given statement is true. That is, if n is a real number with  $n > 3$ , then  $n^2 > 9$ .

**Question 7:** Write the following statement in five different ways, conveying the same meaning.

p: If triangle is equiangular, then it is an obtuse angled triangle.

**Answer:** The given statement can be written in five different ways as follows.

- (i) A triangle is equiangular implies that it is an obtuse-angled triangle.
- (ii) A triangle is equiangular only if it is an obtuse-angled triangle.
- (iii) For a triangle to be equiangular, it is necessary that the triangle is an obtuse-angled triangle.
- (iv) For a triangle to be an obtuse-angled triangle, it is sufficient that the triangle is equiangular.
- (v) If a triangle is not an obtuse-angled triangle, then the triangle is not equiangular.