

**CBSE Class-11 Mathematics**  
**NCERT Solutions**  
**Chapter - 14 Mathematical Reasoning**  
**Miscellaneous Exercise**

**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  $0 < x < 1$ .

**Ans. (i)**  $\sim p$ : There exists at least one positive real number  $x$  such that  $x-1$  is not positive.

(ii)  $\sim q$ : There exists a cat which does not scratch.

(iii)  $\sim r$ : There exists at least one real number  $x$  such that neither  $x > 1$  or  $x < 1$ .

(iv)  $\sim s$ : There does not exist a number  $x$  such that  $0 < x < 1$ .

**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.

**Ans. (i)** Contrapositive: If a positive integer has no divisors other than 1 and itself then it is not prime.

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

(ii) Contrapositive: If it is not a sunny day then I do not go to a beach .

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

(iii) Contrapositive: If you do not feel thirsty then it is not hot outside.

Converse: If you feel thirsty then it is hot outside.

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**3. Rewrite each of the following statements in the form “ $p$  if - 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.

**Ans. (i)** If you log on to the server then you have a password.

**(ii)** If it rains, then there is traffic jam.

**(iii)** If you pay a subscription fee then you can access the website.

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**4. Rewrite 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.

**Ans. (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.

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**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.**

**Ans.** The compound statement with “and” is: 25 is a multiple of 5 and 8.

Since,  $p$  is true and  $q$  is false therefore the compound statement with “and” is not true.

Therefore, the statement “ $p$  and  $q$ ” is not valid.

Now the compound statement with “or” is: 25 is a multiple of 5 or 8.

Since,  $p$  is true and  $q$  is false therefore the compound statement with “or” is true.

Therefore, the statement “ $p$  or  $q$ ” is valid.

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**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)

**Ans. (i)** Let us assume that  $p$  is not true.

$\therefore$  Sum of an irrational and a rational number is not irrational.

$\Rightarrow$  There exists an irrational number  $a$  and a rational number  $b$  such that  $a+b$  is not irrational.

$\Rightarrow a+b=c$  (say) is a rational number.

$\Rightarrow a=c-b$

$\Rightarrow a$  is rational.

But  $a$  is irrational, which is contradiction, therefore our supposition is wrong.

Therefore,  $p$  is true.

(ii) Let  $r$  and  $s$  be the statements given by

$r : n$  is a real number with  $n > 3$

$s : n^2 > 9$

If possible let  $s$  is not true, then  $\sim s$  is true.

$\Rightarrow r$  and  $\sim s$  is true.

$\Rightarrow n$  is a real number with  $n > 3$  and  $n^2 < 9$  which is contradiction, therefore our supposition is wrong.

Therefore,  $q$  is true.

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

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

**Ans. (i)** A triangle is equiangular implies that it is an obtuse angled triangle.

**(ii)** A triangle is equiangular only if it an obtuse angled triangle.

**(iii)** For a triangle to be equiangular it is necessary it is an obtuse angled triangle.

**(iv)** For a triangle to be obtuse angled triangle it is sufficient that the triangle is equiangular.

**(v)** If a triangle is not equiangular then it is not an obtuse angled triangle.