



# MATHS

## NCERT - NCERT MATHEMATICS (GUJRATI)

### MATHEMATICAL REASONING

#### Example

1. Check whether the following sentences are statements. Give reasons for your answer.

8 is less than 6.



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2. Write the negation of the following statements.

(i) Both the diagonals of a rectangle have the same length.



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3. Write the negation of the following statement.

$\sqrt{7}$  is rational.



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4. Write the negation of the following statements and check whether the resulting statements are true:

Australia is a continent.



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5. Write the negation of the following statements and check whether the resulting statements are true:

There does not exist a quadrilateral which has all its sides equal.



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6. Write the negation of the following statements and check whether the resulting

statements are true:

Every natural number is greater than 0.



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7. Write the negation of the following statements and check whether the resulting statements are true:

The sum of 3 and 4 is 9.



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**8.** Find the component statements of the following compound statements:

The sky is blue and the grass is green.



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**9.** Find the component statements of the following compound statements:

It is raining and it is cold.



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**10.** Find the component statements of the following compound statements:

All rational numbers are real and all real numbers are complex.



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**11.** Find the component statements of the following compound statements:

0 is a positive number or a negative number.



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**12.** Find the component statements of the following and check whether they are true or not:

A square is a quadrilateral and its four sides equal.



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**13.** Find the component statements of the following and check whether they are true or



not:

All prime numbers are either even or odd.



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**14.** Find the component statements of the following and check whether they are true or

not:

A person who has taken Mathematics or computer Science can go for MCA.



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**15.** Find the component statements of the following and check whether they are true or not:

Chadigarh is the capital of Haryana and UP.



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**16.** Find the component statements of the following and check whether they are true or not:

$\sqrt{2}$  is a rational number or an irrational number.



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**17.** Find the component statements of the following and check whether they are true or not:

24 is a multiple of 2,4, and 8.



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**18.** Write the component statements of the following compound statements and check

whether the compound statement is true or false:

A line is straight and extends indefinitely in both directions.



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**19.** Write the component statements of the following compound statements and check whether the compound statement is true or false:

0 is less than every positive integer and every negative integer.



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**20.** Write the component statements of the following compound statements and check whether the compound statement is true or false:

All living things have two legs and two eyes.



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**21.** For each of the following statements, determine whether an inclusive Or or exclusive or is used. Give reasons for your answer:

To enter a country, you need a passport or a voter registration card.



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**22.** For each of the following statements, determine whether an inclusive Or or exclusive or is used. Give reasons for your answer:

The school is closed if it is a holiday or a Sunday.



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**23.** For each of the following statements, determine whether an inclusive Or or exclusive or is used. Give reasons for your answer:

Two lines intersect at a point or are parallel.



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**24.** For each of the following statements, determine whether an inclusive Or or exclusive or is used. Give reasons for your answer:

Students can take French or Sanskrit as their third language.



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**25.** Identify the type of Or used in the following statements and check whether the statements are true or false:



$\sqrt{2}$  is a rational number or an irrational number.



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**26.** Identify the type of Or used in the following statements and check whether the statements are true or false:

To enter into a public library children need an identity card from the school or a letter from the school authorities.



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**27.** Identify the type of Or used in the following statements and check whether the statements are true or false:

A rectangle is a quadrilateral or a 5-sided polygon.



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**28.** Write the contrapositive of the following statement:

(i) If a number is not divisible by 3, it is not

divisible by 9.

(ii) If you are not a citizen of India, then you were not born in India.

(iii) If a triangle is not isosceles, then it is not equilateral.



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**29.** Write the converse of the following statements:

If a number  $n$  is even, then  $n^2$  is even.



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**30.** For each of the following compound statements, first identify the corresponding component statements. Then check whether the statements are true or not:

If a triangle  $ABC$  is equilateral, then it is isosceles.



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**31.** For each of the following compound statements, first identify the corresponding

component statements. Then check whether the statements are true or not:

If  $a$  and  $b$  are integers, then  $ab$  is a rational number.



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**32.** Given below are two pairs of statements.

Combine these two statements using if and only if.

$p$ : If a rectangle is square, then all its four sides are equal.

q: If all the four sides of a rectangle are equal then the rectangle is a square.



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**33.** Check whether the following statement is true or not:

If  $x, y \in \mathbb{Z}$  are such that  $x$  and  $y$  are odd, then  $xy$  is odd.



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**34.** Check whether the following statement is true or not:

If  $x, y \in \mathbb{Z}$  are such that  $x$  and  $y$  are odd, then  $xy$  is odd.



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**35.** Verify by the method of contradiction.

$p: \sqrt{7}$  is irrational



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**36.** Check whether "Or" used in the following compound statement is exclusive or inclusive? Write the component statements of the compound statements and use them to check whether the compound statement is true or not. Justify your answer. t: you are wet when it rains or you are in a river.



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**37.** Write the negation of the following statements:



(i)  $p$ : For every real number  $x$ ,  $x^2 > x$ .

(ii)  $q$ : There exists a rational number  $x$  such that  $x^2 = 2$ .

(iii)  $r$ : All birds have wings.

(iv)  $s$ : All students study mathematics at the elementary level.



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**38.** Using the words "necessary and sufficient" rewrite the statement "The integer  $n$  is odd if

and only if  $n^2$  is odd". Also check whether the statement is true.



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**39.** For the given statements identify the necessary and sufficient conditions. t: If you drive over 80 km per hour, then you will get a fine.



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## Exercise 14 1

1. Which of the following sentences are statements? Give reasons for your answer:

There are 35 days in a month.



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2. Which of the following sentences are statements? Give reasons for your answer:

Mathematics is difficult.



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3. Which of the following sentences are statements? Give reasons for your answer:

The sum of 5 and 7 is greater than 10.



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4. Which of the following sentences are statements? Give reasons for your answer

The square of a number is an even number.



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5. Which of the following sentences are statements? Give reasons for your answer:

The sides of a quadrilateral have equal length.



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6. Which of the following sentences are statements? Give reasons for your answer:

Answer this question.



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7. Which of the following sentences are statements? Give reasons for your answer:

The product of  $(-1)$  and  $8$  is  $8$ .



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8. Which of the following sentences are statements? Give reasons for your answer:

The sum of all interior angles of a triangle is  $180^\circ$



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9. Which of the following sentences are statements? Give reasons for your answer:

Today is a windy day.



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10. Which of the following sentences are statements? Give reasons for your answer:

All real numbers are complex numbers.



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11. Give three examples of sentences which are not statements. Give reasons for the answers.



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## Exercise 14 2

1. Write the negation of the following statements:

Chennai is the capital of Tamil Nadu.



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2. Write the negation of the following statements:

$\sqrt{2}$  is not a complex number.



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3. Write the negation of the following statements:

All triangles are not equilateral triangle.



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4. Write the negation of the following statements:

The number 2 is greater than 7.



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5. Write the negation of the following statements:

Every natural number is an integer



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6. Are the following pairs of statements negations of each other:

The number  $x$  is not a rational number.

The number  $x$  is a rational number.



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7. Are the following pairs of statements negations of each other:

The number  $x$  is not a rational number.

The number  $x$  is a rational number.



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8. Find the component statements of the following compound statements and check whether they are true or false:

Number 3 is prime or it is odd.



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9. Find the component statements of the following compound statements and check

whether they are true or false:

All integers are positive or negative.



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**10.** Find the component statements of the following compound statements and check whether they are not or false:

100 is divisible by 3,11 and 5.



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## Exercise 14 3

1. For each of the following compound statements first identify the connecting words and then break it into component statements:

All rational numbers are real and all real numbers are not complex.



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2. For each of the following compound statements first identify the connecting words

and then break it into component statements:

Square of an integer is positive or negative.



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**3.** For each of the following compound statements first identify the connecting words and then break it into component statements:

The sand heats up quickly in the sun and does not cool down fast at night.



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4. For each of the following compound statements first identify the connecting words and then break it into component statements:

$x=2$  and  $x=3$  are the roots of the equation

$$3x^2 - x - 10 = 0.$$



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5. Identify the quantifier in the following statements and write the negation of the statements.



There exists a number which is equal to its square.



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6. Identify the quantifier in the following statements and write the negation of the statements:

For every real number  $x$ ,  $x$  is less than  $x + 1$



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7. Identify the quantifier in the following statements and write the negation of the statements.

There exists a capital for every state in India.



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8. Check whether the following pair of statements are negation of each other. Give reasons for your answer

$x + y = y + x$  is true for every real numbers

x and y.

There exists real numbers x and y for which

$$x + y = y + x.$$



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9. State whether the or used in the following statements is exclusive or inclusive. Give reasons for your answer:

Sun rises or Moon sets.



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**10.** State whether the or used in the following statements is exclusive or inclusive. Give reasons for your answer:

To apply for a driving licence you should have a ration card or a passport.



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**11.** State whether the or used in the following statements is exclusive or inclusive. Give reasons for your answer:

All integers are positive or negative.



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## Exercise 14.4

1. Rewrite the following statement with “if-then” in five different ways conveying the same meaning.

If a natural number is odd, then its square is also odd.



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2. Write the contrapositive and converse of the following statements:

If  $x$  is a prime number, then  $x$  is odd.



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3. Write the contrapositive and converse of the following statements:

If the two lines are parallel, then they do not intersect in the same plane.



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4. Write the contrapositive and converse of the following statements:

Something is cold implies that it has low temperature.



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5. Write the contrapositive and converse of the following statements:

You cannot comprehend geometry if you do not know how to reason deductively.





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6. Write the contrapositive and converse of the following statements:

$x$  is an even number implies that  $x$  is divisible by 4.



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7. Write each of the following statements in the form if then:



You get a job implies that your credentials are good.



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**8.** Write each of the following statements in the form if then:

The banana trees will bloom if it stays warm for a month.



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**9.** Write each of the following statements in the form if then:

A quadrilateral is a parallelogram if its diagonals bisect each other.



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**10.** Write each of the following statements in the form if then:

To get an A+ in the class, it is necessary that you do all the exercises of the book.





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**11.** Given statements (a) and (b). Identify the statements given below as contrapositive or converse of each other.

If you live in Delhi, then you have winter clothes.

(i) If you do not have winter clothes, then you do not live in Delhi.

(ii) If you have winter clothes, then you live in Delhi.



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**12.** Given statements in a and b. Identify the statements given below as contrapositive or converse of each other.

If a quadrilateral is a parallelogram, then its diagonals bisect each other.

(i) If the diagonals of a quadrilateral do not bisect each other, then the quadrilateral is not a parallelogram

(ii) If the diagonals of the quadrilateral bisect each other then it is a parallelogram.



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## Exercise 14 5

1. Show that the statement

$p$ : "If  $x$  is a real number such that  $x^3 + 4x = 0$

, then  $x$  is 0" is true by

(i) direct method, (ii) method of contradiction,

(iii) method of contrapositive



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2. Show that the statement "For any real numbers  $a$  and  $b$ ,  $a^2 = b^2$  implies that  $a = b$ " is not true by giving a counter-example.



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3. Show that the following statement is true by the method of contrapositive.

$p$ : If  $x$  is an integer and  $x^2$  is even, then  $x$  is also even.



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4. By giving a counter example, show that the following statements are not true.

(i) p: If all the angles of a triangle are equal, then the triangle is an obtuse angled triangle.



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5. By giving a counter example, show that the following statements are not true.

(ii) q: The equation  $x^2 - 1 = 0$  does not have a root lying between 0 and 2.



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6. Which of the following statements are true and which are false? In each case given a valid reason for saying so:

(i) p: Each radius of a circle is a chord of the circle.



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7. Which of the following statements are true and which are false? In each case given a valid reason for saying so:

q: The centre of a circle bisects each chord of the circle.



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8. Which of the following statements are true and which are false? In each case given a valid

reason for saying so:

r: Circle is a particular case of an ellipse.



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9. Which of the following statements are true and which are false? In each case given a valid reason for saying so:

s: If  $x$  and  $y$  are integers such that  $x > y$  then

$$-x < -y.$$



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**10.** Which of the following statements are true and which are false? In each case given a valid reason for saying so:

$t$ :  $\sqrt{11}$  is a rational number.



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## Miscellaneous Exercise On Chapter 14

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

p: For every positive real number  $x$  the number  $x - 1$  is also positive.



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2. Write the negation of the following statements:

q: All cats scratch.



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3. Write the negation of the following statements:

$r$ : For every real number  $x$  such that  $x > 1$  or  $x < 1$ .



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4. Write the negation of the following statements:

$s$ : There exists a number  $x$  such that  $0 < x < 1$





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5. State the converse and contrapositive of each of the following statements:

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



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6. State the converse and contrapositive of each of the following statements:

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



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7. State the converse and contrapositive of each of the following statements:

$r$ : If it is hot outside, then you feel thirsty.



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8. Write each of the statement in the form if  $p$ , then  $q$ :

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



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9. Write each of the statement in the form if p, then q:

q: There is traffic jam whenever it rains.



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**10.** Write each of the statement in the form if  $p$ , then  $q$ :

$r$ : You can access the website only if you pay a subscription fee.



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**11.** Rewrite each of the following statements in the form  $p$  if and only if  $q$ :

$p$ : If you watch television, then you mind is

free and if you mind is free, then you watch television.



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**12.** Rewrite each of the following statements in the form  $p$  if and only if  $q$ :

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



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**13.** Rewrite each of the following statements in the form  $p$  if and only if  $q$ :

$r$ : If a quadrilaterals equiangular, then it is a rectangle and if a quadrilateral is a rectangle, then it is equiangular.



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**14.** Given below we 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.



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

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



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**16.** 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.



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