



# MATHS

## BOOKS - NAGEEN PRAKASHAN

### ENGLISH

#### MATHEMATICAL REASONING

#### Solved Examples

1. Which of the following sentences are statements? Justify your answer:

(i) 9 is greater than 6.

(ii) There is rain with clouds. (iii) Every set is an infinite set.

(iv) The distance between delhi and kolkata is 735km.

(v) the moon is a satellite.

(vi) it is not a good day today.



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2. Which of the following sentences are statements? Justify your answer:

(i) there are 40 days in a month.

(ii) the sum of 7 and 10 is 17.

(iii) the diagonals of a rectangle are equal.

(iv) the heat produced from the fire.



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

(i) ram is a good boy.

(ii) the number 3 is smaller than 5.

(iii) the length of two diagonals of a square

are equal.

(iv) the smallest natural number is one.



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4. Find the component statements of the following compound statements :

(i) 3 is both an odd and prime number .

(ii) 6 is a multiple of 2 and 3 both.

(iii) a person who has taken science or maths can take admission in B.Sc.



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

(i)  $\sqrt{5}$  is a rational number or an irrational number.

(ii) Chandigarh is the capital of haryana and punjab.

(iii) a multiple of 2,4 and 6 is 16.

(iv) a square is a quadrilateral and all 4 sides of it are equal.

(v) all integers are positive or negative.



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6. Check whether the following compound statements are true or false ?

(i) the area of a right -angled triangle and an

equilateral triangle is  $\frac{1}{2} \times \textit{base} \times \textit{height}$ .

(ii) 30 is a multiple of 6 and 15.



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7. For each of the following statement determine which type of 'or ' is used ? Also

check whether the compound statement is true or false.

(i) 5 is prime or odd.

(ii) school is closed if there is a holiday or Sunday.

(iii) a tie or a T-shirt is free on purchasing a coat.



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**8.** Identify the quantifier in the following statements :

(i) there exists a real number which is equal to its 4 times.

(ii) for every real number  $x$ ,  $x - 2$  is less than  $x$ .



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9. Write the negation of the following:

for every real number  $x$ ,  $x + 2 > x$ .



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**10.** Write the contrapositive of the following statements :

(i) if you born in india, then you are a citizen of India.

(ii) If a triangle is equilateral, then it is isosceles.



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**11.** Write the converse of the following statements.(i) If a number  $n$  is even, then  $n^2$  is

even.(ii) If you do all the exercises in the book, you get an A grade in the class.



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**12.** Given below are two pairs of statements. Combine these two statements using "if and only if". (i)  $p$ : If a rectangle is a 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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**13.** Write the component statements of the following compound statements and then check whether the statements is true it is isocetes.

(i) if a triangle is equilateral then it is isosceles

.

(ii) if  $a$  and  $b$  are two natural numbers, then

$a + b$  is also a natural number.



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**14.** Two statements are given :

p: 30 is a multiple of 5.

q: 30 is a multiple of 3.

Connct these two statements with word 'and'  
and check the validity of the compound  
statement.



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**15.** Check whether the following statement is  
true or not: If  $x$  and  $y$  are odd integer, then

$xy$  is an odd integer.



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**16.** Check the validity of the following statement: Square of an integer is positive or negative



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**17.** 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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**18.** Prove that  $\sqrt{2}$  is an irrational number.



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**Exercise 14 A**

1. Which of the following sentences are statement ? Justify your answer :

(1)  $\sqrt{5}$  is a rational number.

(2) it is a cold day today.

(3) The product of 8 and 2 is 16.

(4) how many teachers are there in your school ?

(5) the sum of interior angles of a quadrilateral is  $360^\circ$  .

(6) go to your room.

(7) 15 is smaller than 12.

(8) there are 7 days in a week.

(9) the earth revolves around the sun.

(10) 16 has two prime factors.

(11) the H.C.F. of 15 and 20 is 5.

(12) the L.C.M. of 8 and 12 is 24.

(13) the three sides of equilateral triangle are equal.

(14) New Delhi is the capital of india.

(15) six is a prime number.

(16) it was Saturday yesterday.

(17) the least natural number is one.

(18) maths is an easy subject.



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## Exercise 14 B

1. Write the negation of each of the following :

(i)  $\sqrt{2}$  is an irrational number.

(ii) 3 is a prime number.

(iii) asia is continent.

(iv) the product of 3 and 6 is 12.

(v) every natural number is an integer.

(vi) all triangles are not a right- angled.

(vii) all indian speak hindi.

(viii) 100 is divisible by 8.



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2. State whether the following statements are negation to each other ?

(i) p: ram is a good boy.

q : ram is not a good boy.

(ii) p:  $\sqrt{5}$  is a rational number.

q :  $\sqrt{5}$  is an irrational number.

(iii) p: australia is a continent.

q: australia is not a continent.

(iv) p: a multiple of 2 is 16.

q : a multiple of 2 is 12.



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**3.** Write the component statements of the following compound statements

(i) All numbers are even or odd.

(ii) 18 is divisible by 2 and 9.

(iii) all sides and all angles of a square are equal.

(iv) this pen is black or blue.



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4. Write the component statements of the following compound statements and check whether they are true or false.

(i) a multiple of 9 and 12 is 18.

(ii) all sides of equilateral triangle are equal and each angle is  $60^\circ$ .

(iii) All angles and all sides of a rectangle are equal.

(iv) 0 is smaller than 1 and greater than  $-1$ .



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## Exercise 14 C

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

(i) the perimeter of a right-angled triangle and an equilateral triangle is equal to the sum of three sides.

(ii) 72 is a multiple of 18 and 24.

(iii) 0 is smaller than every positive integer and every negative integer.

(iv) a line is straight and extends indefinitely in both directions.



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

(i) the square of an integer is positive or negative.

(ii) to enter into a public library children need

an identity card form the school or a letter form the school authorities.

(iii)  $\sqrt{3}$  is a rational or an irrational number.



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3. For each of the following statement determine which type of 'or' is used ?

(i) the rectangle is a four sided or a five sided polygon.

(ii) two lines intersect at a point or are parallel.

(iii) sun rises or moon sets.



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4. Identify the quantifiers used in the following statements and write the negation of the statements :

(i) there exists a number which is equal to its cube.

(ii) for all states in india, there is a capital in india.

(iii) there exists a man whose age is 150 years.

(iv) all students are of 25 years or more.



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## Exercise 14 D

1. Statement : if a natural number is even, then its square is also even.

write this statement in 5 different forms of the same meaning.



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

(i) if two lines are parallel, then they do not intersect in the same plane.

(ii) something is hot implies that it has high temperature.

(iii) if  $x$  is an odd number, then it is prime.

(iv) if  $x$  is an even number, then it is divisible by 2.

(iv) if the diagonals of a rectangle intersect at  $90^\circ$ , then it is a rhombus.



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**3.** Write the following statements in the form of "if -then".

(i) you get a job implies your credibility are good.

(ii) a quadrilateral is a prallelogram if its diagonals biset each other.

(iii) to get a grade in the class, it is necessary that you do all the exercise of the book.



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



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**Exercise 14 E**

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



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2. Check the validity of the following statements :

(i) every radius of a circle is its chord.

(ii) if  $x$  and  $y$  are integers such that  $x > y$ .

Then  $-x < -y$ .

(iii)  $\sqrt{5}$  is a rational number.



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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. 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  $n^2 > 9$



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5. The two statements are given :

p: 40 is multiple of 5.

q : 40 is a multiple of 6.

check the validity of the compound statements by connecting the words 'and' and 'or'.



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6. Verify by the method of contradiction that  $\sqrt{7}$  is irrational.



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**Exercise 14 1**



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

(i) there are 35 days in a month.

(ii) mathematics is difficult.

(iii) the sum of 5 and 7 is greater than 10.

(iv) the square of a number is an even number.

(v) the sides of a quadrilateral have equal length.

(vi) answer this question.

(vii) the product of (-1) and 8 is 8.

(viii) the sum of all interior angles of a triangle is  $180^\circ$ .

(ix) today is a windy day.

(x) all real numbers are complex numbers.



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2. 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:(i) Chennai is the capital of Tamil Nadu,(ii)  $\sqrt{2}$  is not a complex number(iii) All triangles are not equilateral triangle.(iv) The number 2 is greater than 7.(v) Every natural number is



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2. Are the following pairs of statements negations of each other: (i) The number  $x$  is

not a rational number. The number  $x$  is not an irrational number. (ii) The number  $x$  is a rational number. The number  $x$  is an irrational number.



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**3.** Find the component statements of the following compound statements and check whether they are true or false. (i) Number 3 is prime or it is odd. (ii) All integers are positive or negative. (iii) 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.

(i) All rational numbers are real and all real numbers are not complex.(ii) Square of an integer is positive or negative



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2. Identify the quantifier in the following statements and write the negation of the statements. (i) There exists a number which is equal to its square. (ii) For every real number  $x$ ,  $x$  is less than  $x + 1$



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3. Check whether the following pair of statements are negation of each other. Given reasons for your answer:  $a + b = b + a$  is

true for every real number  $a$  and  $b$ . There exist real numbers  $a$  and  $b$  for which  $a + b = b + a$ .



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4. State whether the "Or" used in the following statements is "exclusive" or "inclusive". Give reasons for your answer. (i) Sun rises or Moon sets. (ii) To apply for a driving license, you should have a ration card or a passport. (iii) All integers  $a$



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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. (i) If  $x$  is a prime number, then  $x$  is odd. (ii) If the two lines are parallel, then they do not intersect in the same plane, (iii) Something is cold implies that it has low tempe



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3. Write each of the following statements in the form "if-then" (i) You get a job implies that

your credentials are good. (ii) The Banana trees will bloom if it stays warm for a month. (iii) A quadrilateral is a parallelogram if its diagonals bisect



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



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



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

reason for saying so.

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

(ii) q: the centre of a circle bisects each chord of the circle.

(iii) r: circles is a particular case of an ellipse.

(iv) s : if  $x$  and  $y$  are integeres such that  $x > y$ , then  $-x < -y$ .

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



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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  $x < 1$ .



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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 outs



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**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.



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4. Rewrite each of the following statements in the form  $p$  if and only if  $q$ :  $p$ : if you watch television then your mind is free and if your mind is free, then you watch television.



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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.



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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).



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

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



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