

**Q1.** Write the component statements of the following compound statements and check whether the compound statement is true or false.

“24 is multiple of 4 and 6.

**Q2.** Identify the component statements of following compound statement “2 is positive number or a negative number”.

**Q3.** Find whether the given statement is compound statement or not.

“2 is both an even number and prime number”.

**Q4.** For the following compound statement, first identify the corresponding component statements then check whether the statement are true or not.

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

**Q5.** Find component statements of the following compound statement.

“A square is a quadrilateral and its four sides are equal.

**Q6.** Write the component statement of compound statement

“ All prime numbers are even or odd”.

**Q7.** Write the component statement of the following compound statement and check whether the given compound statement is true or false.

“0 is less than every positive integer and every negative integer”

**Q8.** Find the component statement of the following and check whether they are true or not:

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

**Q9.** Find the component statement of the following and check whether they are true or not:

*Chandigarh is the capital of Haryana and UP.*

**Q10.** Find the component statement of the following and check whether they are true or not:

*A person who has taken Mathematics or  
Computer science can go for MCA.*

**Q11.** Find the component statement of the following and check whether they are true or not:

*All prime numbers are either even or odd.*

**Q12.** Find the component statement of the following and check whether they are true or not:

*A square is a quadrilateral and its four sides equal.*

**Q13.** Find the component statement of the following compound statement:

*0 is a positive number or a negative number.*

**Q14.** Find the component statement of the following compound statement:

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

**Q15. Find the component statement of the following compound statement:**

*It is raining and it is cold.*

**Q16. Find the component statement of the following compound statement:**

*The sky is blue and the grass is green.*

**Q17. Find the component statements of the following compound statements and check whether they are true or false:**

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

**Q18. Write the component statements of the following compound statement and check whether the compound statement is true or false.**

*All living things have two legs and two eyes.*

**Q19. 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.*

**Q20. 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.*

**Q21. Find the component statement of the following and check whether they are true or not:**

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

**Q22. 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 the cases check the validity of the compound statement.

**Q23. Find the component statements of the following compound statements and check whether they are true or false:**

*The Sun shines or it rains.*

**Q24. Find the component statements of the following compound statements and check whether they are true or false:**

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

**Q25. Find the component statements of the following compound statements and check whether they are true or false:**

*All integers are positive or negative.*

**Q26. Find the component statements of the following compound statements and check whether they are true or false:**

*100 is divisible by 3, 11 and 5.*

**S1.**  $p$  : 24 is multiple of 4,  $T$

$q$  : 24 is multiple of 6,  $T$ .

$p \wedge q$  :  $T$ .

**S2.** The component statement are given by

$p$  : 2 is a positive number.

$q$  : 2 is a negative number.

**S3.** The given statement can be broken into two simple statements.

$p$  : "2 is an even number"

$q$  : "2 is a prime number".

and connected by connective "and" hence given statement is compound statement.

**S4.**  $p$  : a and b are integer "  $T$ "

$q$  : ab is a rational number "  $T$ " hence both statements are true.

**S5.** Component statements are

$p$  : A square is a quadrilateral.

$q$  : Its four sides are equal.

**S6.** Component statement are

$p$  : All prime numbers are even

$q$  : All prime numbers are odd

**S7.** Component statement are:

$p$  : 0 is less than every positive integer

$q$  : 0 is less than every negative integer.

Truth value of statement  $p$  is T and truth value of statement  $q$  is false hence truth value of statement  $p$  and  $q$  is F.

**S8.** The component statements are

$p$  :  $\sqrt{2}$  is a rational number.

$q$  :  $\sqrt{2}$  is an irrational number.

The First statement is false and second is true. Here the connecting word is 'or'.

**S9.** The component statements are

*p : Chandigarh is the capital of Haryana.*

*q : Chandigarh is the capital of UP.*

The First statement is true but the second is false. Here the connecting word is 'and'.

**S10.** The component statements are

*p : A person who has taken Mathematics can go for MCA.*

*q : A person who has taken Computer Science can go for MCA.*

Both these statements are true. Here the connecting word is 'or'.

**S11.** The component statements are

*p : All prime numbers are odd number.*

*q : All prime numbers are even number.*

Both these statements are false. Here the connecting word is 'or'.

**S12.** The component statements are

*p : A square is a quadrilateral.*

*q : A square has all sides equal.*

We know that both these statements are true. Here the connecting word is 'and'.

**S13.** The component statements are

*p : 0 is a positive number.*

*q : 0 is a negative number.*

The connecting word is 'or'.

**S14.** The component statements are

*p : All rational numbers are real.*

*q : All real numbers are complex.*

The connecting word is 'and'.

**S15.** The component statements are

*p : It is raining.*

*q : It is cold.*

The connecting word is 'and'.

**S16.** The component statements are

*p : The sky is blue.*

*q : The grass is green.*

The connecting word is 'and'.

**S17.** The component statements are

*p : Triangle ABC is equilateral.*

*q : Triangle ABC is isosceles.*

Since, an equilateral triangle is isosceles, hence the given compound statement is true.

**S18.** The component statements are

*p : All living things have two legs.*

*q : All living things have two eyes.*

Both these statements are false. Therefore, the compound statement is false.

**S19.** The component statements are

*p : 0 is less than every positive integer.*

*q : 0 is less than every negative integer*

The second statement is false. Therefore, the compound statement is false.

**S20.** The component statements are

*p : A line is straight.*

*q : A line extends indefinitely in both directions.*

Both these statements are true. Therefore, the compound statement is true.

**S21.** The component statements are

*p : 24 is a multiple of 2.*

*q : 24 is a multiple of 4.*

*r : 24 is a multiple of 8.*

All the three statements are true. Here the connecting word is 'and'.

**S22.** Let,

*p : 25 is a multiple of 5.*

*q : 25 is a multiple of 8.*

(i) Compound statement with 'AND'.

25 is a multiple of 5 and 8.

This is a false statement, since *p* and *q* both are not true.

(ii) Compound statement with 'OR'.

25 is a multiple of 5 or 8.

This is a true statement, since one of the statement is true.

**S23.** The Sun shines, it rains.

It is a true compound statement.

**S24.** The component statements are

*p : a and b are integers.*

*q : ab is a rational number.*

Since, the product of two integers is an integer and therefore, a rational number, the compound statement is true.

**S25.** All integers are positive, all integers are negative.

It is a false compound statement.

**S26.** 100 is divisible by 3. (False).

It is divisible by 11. (False).

100 is divisible by 5. (True).

The compound statement is false.

**Q1.** Write down the converse of the statement “If two integer  $a$  and  $b$  such that  $(a - b)$  is always positive integer, then  $a > b$ .”

**Q2.** Write down the converse of the statement “If I go to Agra, then I will visit Taj Mahal”.

**Q3.** Write down the converse of the statement “If it is cold then it rains”.

**Q4.** Write down the converse of the statement “If  $x > y$ , then  $y > z$ ”.

**Q5.** Write down the converse of the statement “If a quadrilateral is cyclic then its opposite angles are supplementary”.

**Q6.** Write down the converse of the statement “If the angle of a triangle are equal then it is an equilateral triangle”.

**Q7.** Write down the converse of the statement if.  
“ $x : y = 3 : 2$  then  $2x = 3y$ .”

**Q8.** Write the converse of the following statement.  
“If you live in Delhi, then you have winter clothes”.

**Q9.** Write the converse of the following statement  
“If two lines are parallel then they do not intersect in the same plane”

**Q10.** Write the converse of the following statement.  
“If a number  $n$  is even then  $n^2$  is even”.

**Q11.** Write the converse of the following statements:  
If you do all the exercises in the book, you get an A grade in the class.

**Q12.** Write down the converse of the statement “If  $x$  and  $y$  are odd numbers, then their sum is even”.

**Q13.** Write down the converse of the statement “If I go to Amritsar then I will visit Golden Temple”.

**Q14.** Write down the converse of the statement “If  $x$  is an natural number then it is an integer”.

**Q15.** Write down the converse of the statement “If a transversal cuts two parallel lines then corresponding angles are equal”.

**Q16.** Write down the converse of the statement “If all sides of quadrilateral are equal then it is a rhombus”.

**Q17.** Write the converse of the following statements:  
*If two integers  $a$  and  $b$  are such that  $a > b$ , then  $a - b$  is always a positive integer.*

**S1.** “If  $a > b$  then  $(a - b)$  is always positive integers then  $a$  and  $b$  are integers”.

**S2.** “If I visit Taj Mahal then I go to Agra”.

**S3.** “If it rains then it is cold”.

**S4.** “If  $y > z$ , then  $x > y$ ”.

**S5.** “If the opposite angles of a quadrilateral are supplementary then it is a cyclic quadrilateral”.

**S6.** “If triangle is an equilateral then all angles are equal”.

**S7.** “If  $2x = 3y$ , then  $x : y = 3 : 2$ .”

**S8.** “If you have winter clothes then you live in Delhi.”

**S9.** “If two lines do not intersect in same plane, then the lines are parallel.”

**S10.** “If  $n^2$  is even then  $n$  is even”

**S11.** The converse of the statement is  
*If you get an A grade in the class, then you have done all the exercises of the book.*

**S12.** “If the sum of  $x$  and  $y$  is even, then  $x$  and  $y$  are odd”.

**S13.** “If I visit Golden temple, then I will go to Amritsar”

**S14.** “If  $x$  is an integer, then  $x$  is a natural number”.

**S15.** “If the corresponding angles are equal, then the transversal lines cuts the two parallel lines.

**S16.** “If quadrilateral is a rhombus, then its all the sides are equal”.

**S17.** The converse of the statement is  
*If two integers  $a$  and  $b$  are such that  $a - b$  is always a positive integer, then  $a > b$ .*

**Q1.** Check whether “How far is Chennai from here” is a statement.

**Q2.** Check whether “Two plus three is five” is a statement.

**Q3.** Check whether “Four multiplied by 3 is ten” is a statement.

**Q4.** Check whether “Have you seen Landon” is a statement.

**Q5.** Check whether “Close the door” is a statement.

**Q6.** Check whether “Earth is a star” is a statement.

**Q7.** Check whether “Sun is a planet” is a statement.

**Q8.** Check whether the following sentence is statement. Give reasons for your answer.  
8 is less than 6.

**Q9.** Check whether the following sentence is statement. Give reasons for your answer.  
Every set is a finite set.

**Q10.** Check whether the following sentence is statement. Give reasons for your answer.  
The Sun is a Star.

**Q11.** Check whether the following sentence is statement. Give reasons for your answer.  
Mathematics is fun.

**Q12.** Check whether the following sentence is statement. Give reasons for your answer.  
There is no rain without clouds.

**Q13.** Is the following sentences are statements? Give reasons for your answer.  
*The product of (– 1) and 8 is 8.*

**Q14.** Is the following sentences are statements? Give reasons for your answer.  
*Answer this question.*

**Q15.** Is the following sentences are statements? Give reasons for your answer.  
The sides of a quadrilateral have equal length.

**Q16.** Is the following sentences are statements? Give reasons for your answer.  
*The square of a number is an even number.*

**Q17.** Is the following sentences are statements? Give reasons for your answer.  
*The sum of 5 and 7 is greater than 10.*

**Q18.** Is the following sentences are statements? Give reasons for your answer.  
*Mathematics is difficult.*

**Q19.** Is the following sentences are statements? Give reasons for your answer.  
*There are 35 days in a month.*

**Q20.** Check whether the following statement is true or false by proving its contrapositive.  
If  $x, y \in \mathbb{Z}$  are such that  $xy$  is odd, then both  $x$  and  $y$  are odd.

**Q21.** 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.

**Q22.** By giving a counter example, show that the following statement is not true:

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

**Q23.** Give three examples of sentences which are not statements. Give reasons for the answers.

**Q24.** Is the following sentences are statements? Give reasons for your answer.

*All real numbers are complex numbers.*

**Q25.** Is the following sentences are statements? Give reasons for your answer.

*Today is a windy day.*

**Q26.** Is the following sentences are statements? Give reasons for your answer.

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

**Q27.** By giving a counter example, show that the following statement is not true:

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

**Q28.** 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 : Circle is a particular case of an ellipse.*
- (iv) *s : If  $x$  and  $y$  are integers such that  $x > y$ , then  $-x < -y$ .*
- (v) *t :  $\sqrt{11}$  is a rational number.*

**Q29.** Check the validity of the statement given below by the method given agains 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  $n > 2$ , then  $n^2 > 9$  (by contradiction method.)*

**S1.** Not a statement as “here” is not specified.

**S2.** “Two plus three is five, this sentence is true hence it is a statement”.

**S3.** “Four multiplied by 3 is ten, this sentence is false, hence it is a statement.

**S4.** “Have you seen landon This sentence is neither true nor false and hence not a statement : (It is a question).

**S5.** “Close the door” this sentence is neither true nor false (It is a command.) Hence it is not a statement.

**S6.** Earth is a star this sentence is false (Earth is planet). Hence it is a statement.

**S7.** “Sun is a planet. This sentence is false (Sun is a star). Hence it is a statement.

**S8.** This sentence is false because 8 is greater than 6. Hence it is a statement.

**S9.** This sentence is also false since there are sets which are not finite. Hence it is a statement.

**S10.** It is a scientifically established fact that Sun is a Star and therefore, this sentence is always true. Hence it is a statement.

**S11.** This sentence is subjective in the sense that for those who like mathematics, it may be fun but for others it may not be. This means that this sentence is not always true. Hence it is not a statement.

**S12.** It is a scientifically established natural phenomenon that cloud is formed before it rains. Therefore, this sentence is always true. Hence it is a statement.

**S13.** This sentence is false as the product is  $(-8)$ . Therefore, it is a statement.

**S14.** It is a command and therefore, is not a statement.

**S15.** The given sentence is sometimes true and sometimes false. For example, squares and rhombus have equal length whereas rectangles and trapezium have unequal lengths. Therefore, it is not a statement.

**S16.** The given sentence is sometimes true and sometimes is not true. For example the square of 2 is an even number and the square of 3 is an odd number. Therefore, it is not a statement.

**S17.** The given sentence is always true because the sum is 12 and it is greater than 10. Therefore, it is a statement.

**S18.** The given sentence is not a statement because for some people mathematics can be easy and for some other, it can be difficult.

**S19.** The given sentence is always false because the maximum number of days in a month is 31. Therefore, it is a statement.

**S20.** Let us name the statement as below

$p$  :  $xy$  is odd.

$q$  : both  $x$  and  $y$  are odd.

We have to check whether the statement  $p \Rightarrow q$  is true or not, that is, by checking its contrapositive statement i.e.,  $\sim q \Rightarrow \sim p$ .

Now,  $\sim q$  : It is false that both  $x$  and  $y$  are odd. This implies that  $x$  (or  $y$ ) is even.

Then,  $x = 2n$  for some integer  $n$ .

Therefore,  $xy = 2ny$  for some integer  $n$ . This shows that  $xy$  is even. That is  $\sim p$  is true.

Thus, we have shown that  $\sim q \Rightarrow \sim p$  and hence the given statement is true.

**S21.** Let

$p$  :  $x, y \in \mathbb{Z}$  such that  $x$  and  $y$  are odd.

$q$  :  $xy$  is odd.

To check the validity of the given statement, Let us assume that if  $p$  is true, then  $q$  is true.

$p$  is true means that  $x$  and  $y$  are odd integers. Then

$x = 2m + 1$ , for some integer  $m$ .

$y = 2n + 1$ , for some integer  $n$ .

Thus,

$$xy = (2m + 1)(2n + 1)$$

$$= 2(2mn + m + n) + 1$$

This shows that  $xy$  is odd. Therefore, the given statement is true.

**S22.**  $p$  : If all the angles of triangle are equal, then the triangle is an obtuse angled triangle.

Let an angle of a triangle be  $90^\circ + \theta$  (obtuse angle)

Now sum of the angles of triangle =  $3(90^\circ + \theta) = 270^\circ + 3\theta$  which is greater than  $180^\circ$ .

Hence, a triangle having equal angles cannot be obtuse angle triangle.

**S23.** The three examples are:

- Everyone in this class is intelligent. This is not a statement because from the context it is not clear which class is referred here and the term intelligent is not precisely defined.
- He is a commerce student. This is also not a statement, because who 'he' is.
- " $\sin^2 \theta$  is always greater than  $\frac{1}{2}$ ." Unless, we know what  $\theta$  is, we cannot say whether the sentence is true or not.

**S24.** This is a true statement because all real numbers can be written in the form  $a + i \times 0$ .

**S25.** It is not clear from the context which day is referred and therefore, it is not a statement.

**S26.** This sentence is always true and therefore it is a statement.

**S27.**  $q$  : The equation  $x^2 - 1 = 0$  does not have a root lying between 0 and 2.

The equation  $x^2 - 1 = 0$  has the root  $x = 1$  which lies between 0 and 2. Hence, the given statement is not true.

**S28.** (i)  $p$  : Each radius of a circle is a chord of the circle.

' $p$ ' is false. By definition of the chord, it should intersect the circle in two points.

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

' $q$ ' is false. We can show this by giving a counter-example. A chord which is not a diameter does not pass through the centre.

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

' $r$ ' is true. In the equation of an ellipse if we put  $a = b$ , then it is a circle. (Direct method.)

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

' $s$ ' is true. By rule of inequality.

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

' $t$ ' is false. Since, 11 is a prime number, there  $\sqrt{11}$  is irrational.

**S29.** (i)  $p$  : The sum of an irrational number and a rational number is irrational.

Let  $\sqrt{a}$  be an irrational number and  $b$  be a rational number.

Now, their sum  $= b + \sqrt{a}$

Let  $b$  be not irrational.

Therefore, it is a rational

... (i)

Therefore,  $b + \sqrt{a} = \frac{p}{q}$  where  $p, q$  are co-primes

$$\sqrt{a} = \frac{p}{q} - b$$

L.H.S.  $= \sqrt{a}$  = An irrational number.

R.H.S.  $= \frac{p}{q} - b$  = A rational number

Now, this is a contradiction.

Thus, our supposition is wrong.

Hence, sum of a rational and irrational number is irrational.

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

Let  $n > 3$  and  $n^2 \leq 9$

Let  $n = 3 + a$

$$n^2 = 9 + 6a + a^2$$

$$n^2 = 9 + a(6 + a)$$

$$n^2 > 9$$

Which is a contradiction.

Thus, our supposition is wrong.

Hence, if  $n > 3$ , then  $n^2 > 9$ .

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