MATHS

BOOKS - NEW JYOTHI MATHS (TAMIL ENGLISH)

MATHEMATICAL REASONING

Examples

1. Give three examples of sentences which are not statements.

2. Write the negation of the following statements:

(i) Chennai is the capital of Tami Nadu.

(ii) $\sqrt{2}$ is not a complex number

(iii) All triangle are not equilateral triangle.

3. Write the negation of the following statements:

(i) $\sqrt{7}$ is rational.

4. Write the negation of the following statements:

(i) p: All birds have wings.

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

5. Write the negation of the following statements: Both the diagonals of a rectangle have the same length.

6. Write the component statement of the compound statement " All living things have two legs and two eyes".

7. Write the component statements of the following compound statements. Mention the connecting world.

(i) It is raining and it is cold.

(ii) Zero is a positive or negative number.

8. 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, all integers are negative (False).

(iii) 100 is divisible by 3,11 and 5.

9. Cheek 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

10. Consider the statement "$\sqrt{5}$ is a rational number or an irrational number".

i. Find the component statements and check whether they are true or false.

ii. Check whether the compound statement is true or false.

11. Write the component statements of the following compound statements and check whether the compound statement is true of false.

(i) Two lines in a plane intersect at a point. or they are parallel.

(ii) 125 is a multiple of 7 or 8

iii. 36 is divisible by 6 or 9

iv. 48 is divisible by 3 or 6

12. i. Write the component statements, "All prime numbers are either even or odd.

ii. Check whether these component statements are true or false.

iii. Write the negation of the statement.

13. Identify the quantifier in the following statements and write its negation.

i. for all positive integers x, we have $x + 2 > 8$

ii. There exists a capital for every state in India.

iii. For every real number x, $x < x + 1$.

14. 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.

15. 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.

iii. There exists a capital for every state in India.

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

17. 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.

18. For the given statements identify the necessary and sufficent conditions.

t: If you drive over 80km per hour, then you will get a fine.

19. Write the component statement of each of the following statements. Also check whether the statement are true or not.

i. if ΔABC is equilateral, then it is isosceles.

ii if x and y are integers, then xy is an irrational number.

20. Write down the contrapositive statements of the following statements

i. if a number is divisible by 9, then it is divisible by 3

ii. If a triangle is equilateral, then it is isoceles.

21. 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.

(iii) If two integers a and b are such that $a > b$, then $a - b$ is always a positive integer.

22. 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.

(ii) p: If the sum of digits of a number is divisible by 3, then the number is divisible by 3.

q: If a number is divisible by 3, then the sum of its digits is divisible by 3.

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23. 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.

24. Write the contrapositive and converse of the following statements.

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

25. Write each of the following statements in the form "if-then"

i. You get a job implies that your credentials are good.

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

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

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

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26. Check whether the statement if x and y are odd integers, then xy is an odd integer is true or false by

i. direct method

ii. Contrapositive method.

iii. Contradiction method.

27. Prove that if x is odd , then x^2 is also odd.

28. Show that $\sqrt{2}$ is irrational.

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29. By giving a counter example, show that the following statement 'if n is an odd integer, then n is prime' is false.

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30. Write the negation of the following statement:

i. p: for every positive real number x, the number x-1 is also positive.

ii. q: All cats scratch.

r: For every real number x, either x>1 or x<1.

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

31. 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.

32. 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.

33. 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.

34. 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.

35. 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).

36. 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.

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

p: If x is an integer and x2 is even, then x is also even.

Exercise

1. A statement among the following is

A. Every rectangle is a parallelogram

B. Who is the father of geometry?

C. Is 1 a prime number?

D. Sit down

Answer: A

2. Of the following the one which is not a statement is

    A. 2+3=4

    B. Moon revolves around the sun

    C. 6 has four different prime factors

    D. Read the question carefully

Answer: D

3. If p and q are two statement then a statement which is always true is

A. $p \vee q$

B. $p \wedge q$

C. $p \vee \sim q$

D. $q \vee \sim q$

Answer: D

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4. If p and q are true and r is false, then

A. $(p \lor r) \land q$ is false

B. $(q \lor r) \land p$ is false

C. $(p \land q) \lor r$ is true

D. $(\sim p \lor q) \land (\sim r)$ is false

Answer: C

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5. if p is true and q is false, then

A. $\sim(p \lor \sim q)$ is true

B. $\sim(\sim p \land \sim q)$ is false

C. $(p \land q) \lor (p \land \sim q)$ is true

D. $(p \lor q) \land (q \lor \sim q)$ is false

Answer: C

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6. Each of the statement $p \rightarrow q, q \rightarrow r$ and ~r is true. Then

A. p is true

B. p is false

C. q is true

D. $q \vee q$ is true

Answer: B

7. If p,q are two statements, then

A. $\neg(p \wedge q) = \neg p \wedge \neg q$

B. $\neg(p \vee q) = \neg p \vee \neg q$

C. $\neg(p \rightarrow q) = p \wedge q$

D. $\neg(p \rightarrow q) = p \wedge \neg q$

Answer: D

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8. The conditional statement $p \Rightarrow q$ is not equivalent to

A. If p then q

B. q if p

C. p leads to q

D. p is necessary for q

Answer: D

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9. The negation of $p \leftrightarrow q$ is

A. $(\sim p \vee q) \wedge (\sim q \vee p)$

B. $(\sim p \vee q) \vee (\sim q \vee p)$

C. $(\sim p \wedge q) \wedge (\sim q \wedge p)$

D. $(\sim p \wedge q) \vee (\sim q \wedge p)$

Answer: D

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10. Each of the statement

$p \Rightarrow \sim q, \ \sim r \Rightarrow q$ and p is true. Then

A. r is false

B. r is true

C. q is true

D. $p \wedge q$ is true

Answer: B

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11. If p:0 is a natural number q:5 is a factor of 10, then

A. $p \Rightarrow \sim q$ and $\sim p \rightarrow q$ are true

B. $p \rightarrow \sim q$ is true and $\sim p \rightarrow q$ is false

C. $\sim p \rightarrow q$ is false

D. $\sim p \rightarrow \sim q$ is true

Answer: A

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12. If $p \rightarrow (\sim p \vee q)$ is false, then p and q are respectively

    A. false, true

    B. false, false

    C. true, true

    D. true, false

Answer: D

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13. $p \rightarrow q$ is equivalent to

    A. $\sim q \rightarrow \sim p$

    B. $q \rightarrow \sim p$

    C. $\sim q \top$

    D. $\sim p \rightarrow \sim q$

Answer: C

14. 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.

(iii) If two integers a and b are such that $a > b$, then $a - b$ is always a positive integer.

A. if a number n^2 is even, then n is even

B. if n^2 not even, then n is not even

C. neither n nor n^2 is even

D. none of these

Answer: A

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15. The negation of the statement given by "He

is rich and happy" is

A. He is not rich and not happy

B. He is not rich or he is not happy

C. He is rich but not happy

D. He is not rich but happy

Answer: B

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16. The converse of the contrapositive of the

conditional $p \rightarrow \sim q$ is

A. $\sim p \rightarrow q$

B. $\sim q \top$

C. $\sim p \rightarrow \sim q$

D. $p \rightarrow q$

Answer: A

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17. If Ram secure 100 marks in Maths, then he will get a mobile.

The converse is

A. If ram gets a mobile, then he will not secure 100 marks in Maths.

B. If Ram does not get a mobile, then he

will secure 100 marks in Maths.

C. If Ram will get a mobile, then he secure

100 marks in maths.

D. none of these

Answer: C

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18. The negation of the proposition

"If a quadrilateral is a square, then it is a

rhombus" is

    A. if a quadrilateral is a square, then it is a

       rhombus.

    B. If a quadrilateral is a square, then it is

       not a rhombus.

    C. A quadrilateral is a square and it is not a

       rhombus

D. A quadrilateral is ont a square and it is a

rhombus

Answer: C

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19. If it is raining, then I will not come. Give its

contrapositive.

A. If I will come, then it is not raining.

B. If I will not come, then it is raining

C. If I will not come, then it is not raining

D. If I will come, then it is raining

Answer: A

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20. Let p be the proposition: Mathematics is interesting and let q be the proposition that Mathematics is difficult then the symbol $p \wedge q$ means

A. Mathematics is interesting implies that Mathematics is difficult

B. Mathematics is interesting implies and is implies by Mathematics is difficult

C. mathematics is interesting and Mathematics is difficult

D. Mathematics is interesting or Mathematics is difficult

Answer: C

1. The statement $\sim(p \rightarrow q)$ is equivalent to

   A. $p \wedge (\sim q)$

   B. $\sim p \wedge q$

   C. $p \wedge q$

   D. $\sim p \tilde{\ } q$

Answer: A

2. If p:4 is an even prime number

q:6 is a divisor of 12 and

r: The HCF of 4 and 6 is 2, then which of the following is true.

    A. $(p \wedge q)$

    B. $(p \vee q) \wedge \sim r$

    C. $\sim (q \wedge r) \vee p$

    D. $\sim p \vee (q \wedge r)$

Answer: D

3. Which of the following is not true for any two statements p and q?

A. $\sim[p \vee (\sim q)] \equiv (\sim p) \wedge q$

B. $(p \vee q) \vee (\sim q)$ is a tautology

C. $(p \wedge q) \wedge (\sim q)$ is a contradiction

D. $\sim(p \vee q) \equiv (\sim p) \vee (\sim q)$

Answer: D

4. Let p be the statement 'Ravi races' and let q be the statement 'Ravi wins'. Then the verbal translation of $\sim(p \vee \sim q)$ is

    A. Ravi does not race and Ravi does not win

    B. It is not true that Ravi races and Ravi does not win

    C. Ravi does not race and Ravi wins

D. It is not true that Ravi races or that Ravi does not win

Answer: D

5. Identify the wrong statement from the below

A. $\sim[p \lor (\sim q)] \cong (\sim p) \land q$

B. $[\lor q] \lor (\sim p)$ is tautology

C. $[p \wedge q] \wedge (\sim p)$ is a contradiction

D. $\sim(p \vee q) \equiv (\sim p) \vee (\sim q)$

Answer: D

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6. Let p:7 is not greater than 4 and

q: Paris is in France be two statements.

The $\sim(p \vee q)$ is the statement

A. 7 is greater than 4 or paris is not in

France

B. 7 is not greater than 4 and paris is not

in France

C. 7 is greater than 4 and paris is in France

D. 7 is greater than 4 and paris is not in

France

Answer: D

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7. If $S(p, q, r) = (\sim p) \vee [\sim(q \wedge r)]$ is a compound statement, then $S(\sim p, \sim q, \sim r)$ is

A. $\sim S(p, q, r)$

B. $S(p, q, r)$

C. $p \vee (q \wedge r)$

D. $p \vee (q \vee r)$

Answer: D

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8. For any two statements p and q, $\sim(p \vee q) \vee (\sim p \wedge q)$ is logically equivalents to

A. p

B. $\sim p$

C. q

D. $\sim q$

Answer: B

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9. Let p: roses and red and q: The sun is a star.

Then the verbal translation of $(\sim p) \vee q$ is

A. Roses are not red annd the sun is not a

star

B. It is not true that roses are red or the

sun is not a star

C. It is not true that roses are red and the

sun is not a star

D. Roses are not red or the sun is a star

Answer: D

10. The statement $p \rightarrow (q \rightarrow p)$ is equivalent to

    A. $q \top$

    B. $\sim q \lor \sim p$

    C. $p \land \sim q$

    D. $\sim q \top$

Answer: B

11. The negation of $(p \lor \sim q) \land q$ is

A. $(\sim p \lor q) \land \sim q$

B. $(p \land \sim q) \lor q$

C. $(\sim p \land q) \lor \sim q$

D. $(p \land \sim q) \lor \sim q$

Answer: C

12. Which one of the following is not a statement?

    A. It is not that the sky is blue

    B. Is the sky blue?

    C. The sky is blue

    D. The sky is dark in the night

Answer: B

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13. If p:2 plus 3 is five and

q: Delhi is the capital of India are two

statements, then the statement

"Delhi is the capital of India and it is not that 2

plus 3 is five" is

A. $\sim p \lor q$

B. $\sim p \land q$

C. $p \land \sim q$

D. $p \lor \sim q$

Answer: B

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14. Which one of the following is a statement?

A. close the door

B. Good evening sir

C. Bring the book

D. Mumbai is the capital of india

Answer: D

15. Let p,q and r be any three logical statements. Which one of the following is true?

A. $\sim[p \wedge (\sim q)] \equiv (\sim p) \wedge q$

B. $\sim(p \vee q) \wedge (\sim r) \equiv (\sim p) \vee (\sim q) \vee (\sim r)$

C. $\sim[p \wedge (\sim q)] \equiv (\sim p) \wedge q$

D. $\sim[p \wedge (\sim q)] \equiv (\sim p) \wedge \sim q$

Answer: C

16. The truth values of p,q are r for which

$(p \wedge q) \vee (\sim r)$ has truth value F are

respectively

A. F,T,F

B. F,F,F

C. T,T,T

D. F,F,T

Answer: D

17. $\sim[(\sim p) \wedge q]$ is logically equivalent to

A. $\sim (p \vee q)$

B. $\sim [p \wedge (\sim q)]$

C. $p \wedge (\sim q)$

D. $p \vee (\sim q)$

Answer: D

18. The statement $\sim(p \rightarrow q)$ is equivalent to

A. Statement-1 is true, statement-2 is false

B. Statement-1 is false, statement-2 is true

C. Statement-1 is true, statement-2 is true,

Statement-2 is a correct explanation for

statement-1

D. Statement-1 is true, statement-2 is true,

Statement-2 is not a correct explanation

for statement-1

Answer: A

19. The statement $p \to (q \to p)$ is equivalent to

A. $p \to (p \leftrightarrow q)$

B. $p \to (p \to q)$

C. $p \to (p \vee q)$

D. $p \to (q \wedge q)$

Answer: C

20. Statement-1: $\sim(p \leftrightarrow \sim q)$ is equivalent to $(p \leftrightarrow q)$.

Statement-2: $\sim(p \leftrightarrow \sim q)$ is a tautology.

A. Statement-1 is true, statement-2 is true:

Statement-2 is not a correct explanation

for statement-1

B. Statement-1 is true, statement-2 is false

C. Statement-1 is true, statement-2 is true

D. Statement-1 is true, statement-2 is true,

statement-2 is correct explanation for

statement-1

Answer: B

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21. Let S be a non-empty subset of R. consider

the following statement:

P: There is a rational number $x \in S$ such that

$x > 0$.

Which of the following statements is the negation of the statement P?

A. There is a rational number $x \in S$ such that $x \le 0$

B. There is no rational number $x \in S$ such that $x \le 0$

C. Every rational number $x \in S$ satisfies $x \le 0$.

D. $x \in S$ and $x \le 0 \Rightarrow x$ is not rational

Answer: C

22. Consider the following statements

p: Suman is brilliant

q: Suman is rich

r: Suman is honest

The negation of the statement "Suman is brilliant and dishonest if and only if Suman is rich" can be expressed as

A. $\sim q \leftrightarrow \sim p \wedge r$

B. $\sim(p \wedge \sim r) \leftrightarrow q$

C. $\sim p \wedge (q \leftrightarrow \sim r)$

D. $\sim(q \leftrightarrow (p \wedge -r))$

Answer: D

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23. The negation of the statement given by "He is rich and happy" is

A. Neither I will become a teacher nor I will

open a school

B. I will not become a teacher or I will open

a school

C. I will become a teacher and I will not

open a school

D. Either I will not become a teacher or I

will not open a school

Answer: C

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