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# BSHS

## IEEJA

## *Number Theory (Quantitative Aptitude)*

**SET B**

Questions: **19**
Duration: **120min**

### Question Text Array Format

*This section demonstrates basic questions on Number Theory using the question_text array for line breaks.*

**1.** *A perfect number is a positive integer that is equal to the sum of its proper positive divisors.*

*For example, the proper divisors of 6 are 1, 2, and 3, and their sum is 1 + 2 + 3 = 6.*

*Which of the following numbers is the next perfect number after 6?*

**A.** 12 **B.** 24
**C.** 30 **D.** 28

**2.** *The Fundamental Theorem of Arithmetic states that every integer greater than 1 can be uniquely represented as a product of prime numbers.*

*Which of the following is the correct prime factorization of 84?*

**A.** 2 × 3 × 14 **B.** 4 × 3 × 7
**C.** 2 × 6 × 7 **D.** $2^2 \times 3 \times 7$

**3.** *What is a natural number greater than 1 that has no positive divisors other than 1 and itself?*

**A.** Perfect number **B.** Integer
**C.** Prime number **D.** Composite number

### LIST Placeholder Format

*This section demonstrates questions on Number Theory using the LIST placeholder with a list_items array.*

**4.** *The Euclidean algorithm is a method for finding the greatest common divisor (GCD) of two integers.*

*The steps for finding the GCD of 48 and 18 are shown below:*

Step 1: 48 = 2 × 18 + 12
Step 2: 18 = 1 × 12 + 6
Step 3: 12 = 2 × 6 + 0

*What is the GCD of 48 and 18?*

**A.** 48 **B.** 12
**C.** 18 **D.** 6

**5.** *Consider the properties of the number 36:*

i. It is a perfect square.
ii. It is a prime number.
iii. It is an abundant number.
iv. Its prime factorization is $2^2 \times 3^2$.

*Which of the properties listed above are true for the number 36?*

**A.** All of the above **B.** i, iii, and iv only
**C.** ii and iii only **D.** i and iv only

**6.** *Consider the set of integers below:*

2, 9, 15, 23, 51

*Which of the numbers in the list are prime?*

**A.** All are prime **B.** 2 and 23
**C.** 9 and 15 **D.** 2, 23, and 51

### STATEMENT/STATEMENTS Placeholder Format

*This section demonstrates questions on Number Theory using STATEMENT and STATEMENTS placeholders.*

**7.** *Consider the following statement from number theory:*

**Statement:**

The Twin Prime Conjecture states that there are infinitely many pairs of prime numbers that differ by 2.

*Is this statement a proven theorem or an unproven conjecture?*

**A.** It is a proven theorem. **B.** It has been disproven.
**C.** It is not a valid mathematical statement.
**D.** It is an unproven conjecture.

**8.** *Consider the following assertion and reasoning:*

**Assertion (A):**

The numbers 15 and 28 are coprime.

**Reasoning (R):**

Two integers are coprime (or relatively prime) if their greatest common divisor (GCD) is 1.

*Evaluate the correctness of the assertion and reasoning.*

**A.** R is correct, but A is incorrect.
**B.** Both A and R are correct, and R is the correct explanation for A.
**C.** Both A and R are incorrect.
**D.** A is correct, but R is incorrect.

**9.** *Review the following statements about divisibility rules:*

**Statement I:**

A number is divisible by 3 if the sum of its digits is divisible by 3.

**Statement II:**

A number is divisible by 9 if the sum of its digits is divisible by 9.

*Which of these statements are correct?*

**A.** Statement II only **B.** Statement I only
**C.** Neither statement is correct
**D.** Both Statement I and Statement II

## PARAGRAPH Placeholder Format

*This section demonstrates questions on Number Theory using the PARAGRAPH placeholder.*

**10.** *Read the following description of a famous problem in number theory:*

Goldbach's Conjecture is one of the oldest and best-known unsolved problems in number theory. It states that every even integer greater than 2 is the sum of two prime numbers.

*Which of the following expresses the number 20 as a sum of two prime numbers, consistent with the conjecture?*

**A.** 10 + 10 **B.** 1 + 19
**C.** 5 + 15 **D.** 7 + 13

**11.** *Read the passage about the Fibonacci sequence:*

The Fibonacci sequence is a series of numbers where each number is the sum of the two preceding ones, usually starting with 0 and 1. The sequence begins: 0, 1, 1, 2, 3, 5, 8, 13, ...

*What is the next number in this sequence?*

**A.** 18 **B.** 21
**C.** 20 **D.** 23

**12.** *The following paragraph describes modular arithmetic:*

In modular arithmetic, we are concerned with the remainder when an integer is divided by another integer, called the modulus. The expression 'a ≡ b (mod n)' means that a and b have the same remainder when divided by n. The value of 'a mod n' is the remainder of the division a ÷ n.

*Based on this definition, what is the value of 17 mod 5?*

**A.** 1 **B.** 3
**C.** 4 **D.** 2

## MTF (Match The Following) Placeholder Format

*This section demonstrates match-the-following questions on Number Theory using the MTF_DATA placeholder.*

**13.** *Match the number theory terms with their correct definitions:*

| Term | - | Definition |
|---|---|---|
| i. Prime | - | a. Two integers with a GCD of 1. |
| ii. Coprime | - | b. An integer equal to the sum of its proper divisors. |
| iii. Perfect | - | c. A natural number > 1 with only two divisors: 1 and itself. |

*Which option shows the correct matching?*

**A.** i-a, ii-b, iii-c **B.** i-c, ii-b, iii-a
**C.** i-c, ii-a, iii-b **D.** i-b, ii-c, iii-a

**14.** *Match each number with its unique prime factorization:*

| Number | - | Prime Factorization |
|---|---|---|
| A. 56 | - | 1. $3^2 \times 11$ |
| B. 99 | - | 2. $2^3 \times 3 \times 5$ |
| C. 120 | - | 3. $2^3 \times 7$ |

*Which pairing is correct?*

**A.** A-1, B-2, C-3 **B.** A-3, B-1, C-2
**C.** A-2, B-3, C-1 **D.** A-3, B-2, C-1

**15.** *Match the mathematical notation with its meaning in number theory:*

| Notation | - | Meaning |
|---|---|---|
| 1. a \| b | - | a. The greatest common divisor of a and b. |
| 2. gcd(a, b) | - | b. a and b have the same remainder when divided by n. |
| 3. a ≡ b (mod n) | - | c. a divides b (b is a multiple of a). |

*Which option correctly matches the notations to their meanings?*

**A.** 1-c, 2-b, 3-a **B.** 1-c, 2-a, 3-b
**C.** 1-a, 2-b, 3-c **D.** 1-b, 2-c, 3-a

## Mixed Placeholder Combinations

*This section demonstrates complex questions on Number Theory by combining multiple placeholders.*

**16.** *Read the definition of amicable numbers:*

Amicable numbers are two different positive integers such that the sum of the proper divisors of each is equal to the other number. A proper divisor of a number is a positive divisor other than the number itself.

*Consider the following pairs of numbers:*

i. (110, 150)
ii. (220, 284)
iii. (300, 310)

*Which pair from the list is amicable?*

**A.** Pair iii **B.** None of the pairs are amicable
**C.** Pair i **D.** Pair ii





**17.** *Read the definition of a Mersenne Prime:*

A Mersenne prime is a prime number that can be written in the form 2^p − 1, where p must also be a prime number. Not all numbers of this form with a prime p are themselves prime.

*Now evaluate the following statements:*

**Assertion (A):**
The number 31 is a Mersenne prime.

**Reasoning (R):**
31 can be expressed as 2^5 − 1, and 5 is a prime number.

*Based on the definition provided, what is the most logical conclusion?*

**A.** R is correct, but A is incorrect
**B.** Both A and R are incorrect
**C.** Both A and R are correct, and R explains A
**D.** A is correct, but R is incorrect

**18.** *Consider the numbers in the list below:*

12, 17, 25, 30

*Review the following properties:*

**Statement I:**
The number is a composite number.

**Statement II:**
The number is a deficient number (the sum of its proper divisors is less than the number).

*Which number from the list satisfies both Statement I and Statement II?*

**A.** 17 **B.** 25
**C.** 30 **D.** 12

**19.** *The Chinese Remainder Theorem helps solve systems of congruences.*

The Chinese Remainder Theorem can find an integer x that satisfies multiple remainder conditions simultaneously. For example, finding an integer x that leaves a remainder of 2 when divided by 3, and a remainder of 3 when divided by 5.

*Consider the following system of congruences:*

**Condition I:**
x ≡ 2 (mod 3)

**Condition II:**
x ≡ 3 (mod 5)

*Which number from the list below is the smallest positive integer solution?*

**A.** 11 **B.** 13
**C.** 8 **D.** 5

* * * * **END** * * * *