

Number Theory (Quantitative Aptitude)

SET

A

Questions: 19

Duration: 120min

Question Text Array Format

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

- What is a natural number greater than 1 that has no positive divisors other than 1 and itself?
 - Integer
 - Perfect number
 - Composite number
 - Prime number
- 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?
 - $2^2 \times 3 \times 7$
 - $2 \times 6 \times 7$
 - $4 \times 3 \times 7$
 - $2 \times 3 \times 14$
- 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?
 - 28
 - 30
 - 12
 - 24

LIST Placeholder Format

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

- Consider the properties of the number 36:
 - It is a perfect square.
 - It is a prime number.
 - It is an abundant number.
 - Its prime factorization is $2^2 \times 3^2$.

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

 - i and iv only
 - ii and iii only
 - All of the above
 - i, iii, and iv only
- 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: $48 = 2 \times 18 + 12$
 Step 2: $18 = 1 \times 12 + 6$
 Step 3: $12 = 2 \times 6 + 0$

What is the GCD of 48 and 18?

 - 12
 - 48
 - 18
 - 6

- Consider the set of integers below:

2, 9, 15, 23, 51

Which of the numbers in the list are prime?

 - 9 and 15
 - 2 and 23
 - 2, 23, and 51
 - All are prime

STATEMENT/STATEMENTS Placeholder Format

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

- 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?

 - It is not a valid mathematical statement.
 - It has been disproven.
 - It is an unproven conjecture.
 - It is a proven theorem.
- 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?

 - Neither statement is correct
 - Both Statement I and Statement II
 - Statement I only
 - Statement II only
- 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 is correct, but R is incorrect.
 - R is correct, but A is incorrect.
 - Both A and R are incorrect.
 - Both A and R are correct, and R is the correct explanation for A.

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

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 ' $a \equiv b \pmod{n}$ ' means that a and b have the same remainder when divided by n . The value of ' $a \bmod n$ ' is the remainder of the division $a \div n$.

Based on this definition, what is the value of $17 \bmod 5$?

- A. 3 B. 1
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-b, ii-c, iii-a B. i-a, ii-b, iii-c
C. i-c, ii-a, iii-b D. i-c, ii-b, iii-a

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

Notation	- Meaning
1. $a \mid b$	- 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. $a \equiv b \pmod{n}$	- c. a divides b (b is a multiple of a).

Which option correctly matches the notations to their meanings?

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

15. 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-3, B-2, C-1 B. A-1, B-2, C-3
C. A-2, B-3, C-1 D. A-3, B-1, C-2

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

17. *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:

$$x \equiv 2 \pmod{3}$$

Condition II:

$$x \equiv 3 \pmod{5}$$

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

- | | |
|-------|-------|
| A. 11 | B. 8 |
| C. 5 | D. 13 |

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. 12 |
| C. 30 | D. 25 |

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

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