

SECTION I

NTS Guide

Quantitative Ability

The basic mathematical skills, understanding of elementary mathematical concepts, and the ability to reason quantitatively and solve problems in a quantitative setting are measured in the quantitative part of the test. The knowledge of **arithmetic**, **algebra**, **geometry** and **data analysis**, which are usually essential area of study of the high school level are measured in balanced questions. The questions about quantitative ability can also be asked from:

- ➔ Discrete Quantitative Questions
- ➔ Quantitative Comparison Questions
- ➔ Data Interpretation Questions etc.

This section is discussed and explained in detail in this book. Topic by topic explanation is given to facilitate the candidates. Explanatory answers are also given to avoid complications.

NTS Guide

Part 1 Arithmetic

Chapter-1:

NUMBERS

Numbers:

In decimal number system, we use ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 called digits, to represent any number.

Note: A group of figures, denoting a number is called numeral.

Types of Numbers

Natural Numbers:

Numbers which we use for counting the objects are known as natural numbers. It is denoted by ' N '.

$$N = \{1, 2, 3, 4, \dots\}$$

Whole Numbers:

All Natural Numbers together with zero form the set of all whole numbers. It is denoted by ' W '.

$$W = \{0, 1, 2, 3, \dots\}$$

Integers:

The set of numbers which consists of whole numbers and negative numbers is known as integers. It is denoted by ' Z '.

$$Z = \{\dots -3, -2, -1, 0, 1, 2, 3, \dots\}$$

Positive Integers:

The set $Z^+ = \{1, 2, 3, 4, \dots\}$ is the set of all positive integers. It is clear that positive integers and natural numbers are synonyms.

Negative Integers:

The set $Z^- = \{-1, -2, -3, \dots\}$ is the set of all negative integers.

Remember: "0" is neither positive nor negative.

Non-Negative Integers:

The set $\{0, 1, 2, 3, \dots\}$ is a set of non-negative integers.

Non-Positive Integers:

The set $\{0, -1, -2, -3, \dots\}$ is the set of non-positive integers.

Even Numbers:

The numbers which are divisible by 2 are called Even Numbers.

$$E = \{2, 4, 6, \dots\}$$

Odd Numbers:

The numbers which are not divisible by 2 are called Odd Numbers.

$$O = \{3, 9, 11, 17, 19, \dots\}$$

Properties of zero:

1. 0 is neither positive nor negative.
2. 0 is an even integer.
3. 0 is smaller than every positive number.
4. 0 is greater than every negative number.
5. For any integer p ; $p \times 0 = 0$.
6. For any integer p (including 0): $p \div 0 = 0$.
7. For any positive integer p ; $0 \div p$; $\frac{0}{p} = \text{undefined}$.
8. For every integer p ; $p + 0$ and $p - 0 = p$.
9. If the product of two or more numbers is 0, then at least one of them is 0.

Properties of one:

1. For any number p : $p \times 1 = p$ and $\frac{p}{1} = p$.
2. 1 is the divisor of every integer.
3. 1 is an odd integer.
4. 1 is not a prime number, because prime numbers should be greater than 1.
5. 1 is the smallest positive integer.
6. For any number n : $1^n = 1$.

Factors and Multiples:

A number which divides a given number exactly is called a factor of the given number.

Example 1: Find the factors of (i) 64 and (ii) 75.

Solution: (i) $64 = 1 \times 64$
 $= 2 \times 32$
 $= 4 \times 16$
 $= 8 \times 8$

The factors of 64 are 1, 2, 4, 8, 16, 32 and 64.

(ii) $75 = 1 \times 75$
 $= 3 \times 25$
 $= 5 \times 15$

The factors of 75 are 1, 3, 5, 15, 25 and 75.

Division Algorithm:

Let a and b be two given integers such that $b \neq 0$. On dividing a by b , let q be the quotient and r the remainder, then $a = bq + r$.

Clearly, $0 < r < b$

In general, we have

$$\text{Dividend} = (\text{Divisor} \times \text{Quotient}) + \text{Remainder}$$

Multiple of a Number:

A multiple of any natural number is a number obtained by multiplying that number by any natural number.

Example: Find the multiples of:

- (i) 4 less than 30 (ii) 9 less than 60

Solution: (i) $4 \times 1 = 4$
 $4 \times 2 = 8$
 $4 \times 3 = 12$
 $4 \times 4 = 16$
 $4 \times 5 = 20$
 $4 \times 6 = 24$
 $4 \times 7 = 28$ etc.

\therefore The multiples of 4 less than 30 are 4, 8, 12, 16, 20, 24 and 28.

(ii) $9 \times 1 = 9$
 $9 \times 2 = 18$
 $9 \times 3 = 27$
 $9 \times 4 = 36$
 $9 \times 5 = 45$
 $9 \times 6 = 54$ etc.

\therefore The multiples of 9 less than 60 are 9, 18, 27, 36, 45 and 54.

Divisible of a Number:

If a number divides a second number without leaving any remainder, then we say that the second number is divisible by the first number. For example, since the number 2 divides 14 without leaving any remainder, we say that 14 is divisible by 2.

Multiple Choice Questions (MCQs)

- Q1. How many numbers between 200 and 500 are divisible by 13?
 (A) 23 (B) 17
 (C) 15 (D) 32
- Q2. The first five multiples of 17 are:
 (A) 0, 1, 17, 34, 51 (B) 17, 34, 51, 68, 85
 (C) 38, 57, 76, 95, 114 (D) None of these
- Q3. The number which is divisible by 7 but not by 14 is:
 (A) 21 (B) 12
 (C) 71 (D) None of these
- Q4. The total number of even prime numbers is:
 (A) 0 (B) 1
 (C) 2 (D) None of these
- Q5. The least prime number is:
 (A) 0 (B) 1
 (C) 2 (D) 3
- Q6. The smallest member of set W is:
 (A) 0 (B) 1
 (C) 2 (D) 3
- Q7. The smallest even number of three digits is:
 (A) 98 (B) 102
 (C) 998 (D) 100
- Q8. The smallest 4-digit number using 7, 0, 8 and 9 is:
 (A) 0879 (B) 0789
 (C) 0978 (D) 7890
- Q9. The cube of $\frac{1}{2}$ is:
 (A) $\frac{1}{4}$ (B) $\frac{1}{8}$
 (C) $\frac{1}{2}$ (D) $\frac{1}{16}$

- Q10. $3 - 7 =$
 (A) -7 (B) 7
 (C) -4 (D) 4
- Q11. If 1 is added to the denominator of a fraction, it becomes $\left(\frac{1}{2}\right)$ and if 1 is added to the numerator the fraction becomes 1. The fraction is:
 (A) $\frac{4}{7}$ (B) $\frac{10}{11}$
 (C) $\frac{2}{3}$ (D) $\frac{5}{9}$
- Q12. How many two-digit numbers are there which are divisible by 6?
 (A) 17 (B) 18
 (C) 16 (D) 15
- Q13. A number whose fifth part increased by 5 is equal to its fourth part diminished by 5, is:
 (A) 160 (B) 180
 (C) 200 (D) 220
- Q14. If $(5^a)(5^b) = \frac{5^c}{5^d}$, what is d in terms of a, b and c ?
 (A) $a + b - c$ (B) $a - b + c$
 (C) $a + b + c$ (D) $c - a - b$
- Q15. Which of the following is equal to $(3^8 \times 3^3)^{10}$?
 (A) 3^{720} (B) 3^{170}
 (C) 3^{27} (D) 3^{98}
- Q16. If $0 < p < 1$, which of the following lists the numbers are in increasing order?
 (A) p, \sqrt{p}, p^2 (B) p, p^2, \sqrt{p}
 (C) \sqrt{p}, p, p^2 (D) p^2, p, \sqrt{p}
- Q17. The value of x satisfying $\sqrt{5 + \sqrt{x}} = 3$ is:
 (A) 64 (B) 27
 (C) 125 (D) 9
- Q18. If, $x^x \sqrt{x} = (x\sqrt{x})^x$, then $x =$
 (A) $\frac{1}{2}$ (B) $\frac{9}{4}$
 (C) $\frac{3}{2}$ (D) $\frac{1}{4}$
- Q19. $(16)^{74}$ is equal to:
 (A) 28 (B) 128
 (C) 27 (D) None of these
- Q20. $\frac{4}{5}$ of a number exceeds its $\frac{2}{3}$ by 8. The number is:
 (A) 30 (B) 60
 (C) 75 (D) 90

Explanatory Answers

- Q1.(A) Number of numbers up to 200 which are divisible by 13
 $= \frac{200}{13} = 15 + \frac{5}{13}$, i.e., 15
 Number of numbers up to 500 which are divisible by 13
 $= \frac{500}{13} = 38 + \frac{6}{13}$ i.e., 38
 The required numbers = $38 - 15 = 23$

Hence, the correct answer is choice A.

Q2.(B) The first five multiples of 17 are

$$17 \times 1 = 17$$

$$17 \times 2 = 34$$

$$17 \times 3 = 51$$

$$17 \times 4 = 68$$

$$17 \times 5 = 85$$

First five multiples of 17 are 17, 34, 51, 68 and 85.

Q3.(A) The number which is divisible by 7 but not by 14 is 21. Hence, the correct answer is choice A.

Q4.(B) There is only one even prime number, namely 2. Hence, the correct answer is choice C.

Q5.(C) The least prime number is 2. Hence, the correct answer is choice C.

Q6.(A) 0 is the smallest member of the set W . Hence, the correct choice is A.

Q7.(D) The smallest even number of three digits is 100. The correct choice is choice D.

Q8.(B) Using 0, 7, 8, 9, the smallest number is 0789. Hence, the correct answer is choice B.

$$\begin{aligned} \text{Q9.(B)} \quad \left(\frac{1}{2}\right)^3 &= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \\ &= \frac{1 \times 1 \times 1}{2 \times 2 \times 2} = \frac{1}{8} \end{aligned}$$

Correct answer is choice B.

$$\text{Q10.(C)} \quad 3 + (-7) = 3 - 7 = -4$$

Correct answer is choice C.

Q11.(C) Let the fraction be $\frac{x}{y}$. Then $\frac{x}{y+1} = \frac{1}{2}$ and $\frac{x+1}{y} = 1$

$$\begin{aligned} \text{First we solve } \frac{x}{y+1} = \frac{1}{2} &\Rightarrow y+1 = 2x \\ &\Rightarrow 2x - y = 1 \quad \dots(i) \end{aligned}$$

$$\begin{aligned} \text{Similarly } \frac{x+1}{y} = 1 &\Rightarrow x+1 = y \\ &\Rightarrow x - y = -1 \quad \dots(ii) \end{aligned}$$

Subtracting (ii) from (i), we have

$$\begin{array}{r} 2x - y = 1 \\ - \quad x - y = -1 \\ \hline x = 2 \end{array}$$

$$x = 2, \Rightarrow x - y = -1 \Rightarrow 2 - y = -1 \Rightarrow y = 3$$

Hence, the required fraction is $\frac{2}{3}$.

The correct answer is choice C.

Q12.(D) Required numbers are 12, 18, 24, 96

Here, $a = 12$ and $d = 6$

$$\begin{aligned} T_n = 96 &\Rightarrow a + (n-1)d = 96 \\ &\Rightarrow 12 + (n-1)6 = 96 \\ &\Rightarrow 12 + 6n - 6 = 96 \\ &\Rightarrow 6(n+1) = 96 \\ &\Rightarrow n+1 = \frac{96}{6} = 16 \\ &\Rightarrow \boxed{n = 15} \end{aligned}$$

Hence, the correct answer is choice D.

$$\text{Q13.(C)} \quad \frac{x}{5} + 5 = \frac{x}{4} - 5 \Rightarrow \frac{x}{4} - \frac{x}{5} = 10$$

$$\Rightarrow 5x - 4x = 200$$

$$\Rightarrow x = 200$$

Hence, the correct answer is choice C.

Q14.(D) $(5^a)(5^b) = \frac{5^c}{5^d}$
 $5^{a+b} = 5^{c-d}$ (By power rule)
 $\Rightarrow a+b = c-d$
 $\Rightarrow d = c-a-b$

Hence, the correct answer is choice D.

Q15.(B) Given that, $(3^8 \times 3^9)^{10}$
 $= (3^{8+9})^{10}$ (By power rule)
 $= (3^{17})^{10}$
 $= 3^{17 \times 10}$
 $= 3^{170}$

Hence, the correct answer is choice B.

Q16.(D) For any number p , between 0 and 1

$$p^2 < p \text{ and } p < \sqrt{p}$$

Hence, the correct answer is choice D.

Q17.(A) $\sqrt{5 + \sqrt[3]{x}} = 3$
 $5 + \sqrt[3]{x} = 9$ (Squaring both sides)
 $\sqrt[3]{x} = 9 - 5$
 $\sqrt[3]{x} = 4$
 $((x)^{1/3})^3 = (4)^3$
 $x^{1/3 \times 3} = 4 \times 4 \times 4$
 $x = 64$

Hence, the correct answer is choice A.

Q18.(B) $x^x \sqrt{x} = (x\sqrt{x})^x$
 $x^x \sqrt{x} = (x \cdot x^{1/2})^x$
 $\Rightarrow x^x \sqrt{x} = (x^{3/2})^x$
 $\Rightarrow x^x \sqrt{x} = (x^{3x/2})$
 $\Rightarrow x\sqrt{x} = \frac{3x}{2}$
 $\Rightarrow \sqrt{x} = \frac{3}{2}$
 $\Rightarrow x = \frac{9}{4}$

Hence, the correct answer is choice B.

Q19.(B) $(16)^{7/4}$
 $= (2^4)^{7/4}$
 $= 2^{4 \times 7/4}$
 $= 2^7$
 $= 128$

Hence, the correct answer is choice B.

Q20.(B) $\frac{4}{5}x - \frac{2}{3}x = 8$
 $\Rightarrow 12x - 10x = 120$
 $\Rightarrow -2x = 120$
 $\Rightarrow x = 60$

Hence, the correct answer is choice B.
