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NUMBERS AND SIMPLIFICATIONS

1. **ARITHMETIC** is a science that deals with numbers, and of the methods of computing by means of numbers.
2. **Integers:** Numbers like $-3, -2, -1, 0, 1, 2, 3$ etc. are called integers.
3. **Rational numbers:** All numbers of the type p/q where $q \neq 0$ and p is an integer are called rational numbers; e.g. -2, $\dfrac{7}{3}$, $-\dfrac{4}{7}$, $0, 2$, $\dfrac{9}{13}$ etc. are all rational numbers.
4. **Irrational numbers:** Numbers like $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ etc. are called irrational numbers.
5. **Real numbers:** All rational numbers, irrational numbers and a combination of rational and irrational numbers are called real numbers; *e.g.* $-5, 7/3, \sqrt{2}, +3$ etc. real numbers.
6. **Natural numbers:** The numbers 1, 2, 3, 4,…are called natural numbers.

    (i) Sum of the first n natural numbers, *i.e.*

    $$1 + 2 + 3 + 4 + \ldots + n = \frac{n \times (n + 1)}{2}$$

    (ii) Sum of the first n square numbers, *i.e.*

    $$1^2 + 2^2 + 3^2 + 4^2 + \ldots + n^2 = \frac{n (n + 1) (2n + 1)}{6}$$

(iii) Sum of the first n cube numbers *i.e.*

$$1^3 + 2^3 + 3^3 + 4^3 + \dots + n^3 = \left[\frac{n(n+1)}{2}\right]^2$$

$$\Rightarrow 1^3 + 2^3 + 3^3 + 4^3 + \dots + n^3 = (1 + 2 + 3 + 4 + \dots + n)^2.$$

7. Multiplication Table.

8. Division is the method of finding *how often* one given number, called the *Divisor* is contained in another given number, called the *Dividend*. The number expressing the times the divisor is contained in the dividend is called the *Quotient*.

9. **Long Division:** When the divisor is greater than 20, the process is called *Long Division.*

$$
\begin{array}{r}
\text{Divisor Dividend Quotient} \\
536 \,)\, 870{,}42 \,(\, 162 \\
\underline{536} \\
3344 \\
\underline{3216} \\
1282 \\
\underline{1072} \\
210 \quad \text{Remainder}
\end{array}
$$

The least number consisting of figures from the left of the dividend in which the divisor 536 is contained in 870 is called the *first partial dividend*. The next figure in the dividend 3344 is called the *second partial dividend* and 1282 is the *third partial dividend*. The last figure, which should be less than the divisor, is called the *Remainder*. This is clear that $87042 = 536 \times 162 + 210$.

10. Dividend = Divisor × Quotient + Remainder.

11. Division by factors (successive division); complete remainder. Let us divide 57613 by 210, using factors and explain the rule to find the remainder.

Now

$$210 = 5 \times 6 \times 7.$$

If we take 5, 6, 7 as d_1, d_2, d_3 and 3, 2, 2, as r_1, r_2, r_3.

$$
\begin{array}{r|l}
5 & 5, 7, 6, 1, 2, \\
\hline
6 & 1, 1, 5, 2, 2, \dots 3 \\
\hline
7 & 1, 9, 2, 0, \quad \dots 2 \\
\hline
& 2, 7, 4, \quad\quad \dots 2
\end{array}
$$

Remainder $= 3 + 5 \times 2 + 5 \times 6 \times 2$

$$= 3 + 10 + 60$$

Quotient $= 274$

$\therefore \qquad 57613 = 210 \times 274 + 73.$

The remainder obtained by the Division by factors method is called the complete remainder or true remainder.

⇒ Complete remainder

$$= r_1 + d_1 r_2 + d_1 d_2 r_3.$$

12. **Metric System:** The Government of India has introduced the metric system of weights and measures throughout the country. This system derives its name from the word "Metre" which is the standard unit of length in this system. The advantage of the metric system is the great simplification of calculation in different spheres of work.

    In this system, the various units of length, area (surface) volume, capacity and weight (mass) always bear a strictly decimal relation to each other.

    The international names of the five main units in the metric system of weights and measures are:

    Length measure unit is a Metre.

    Area measure unit is a square metre.

    Volume measure unit is a cubic metre.

    weight measure unit is a Gram.

    Capacity measure unit is a Litre.

    An *are* contains 100 sq. metres and

    A Hectare contains 100 areas or 10,000 sq. metres.

    A cubic metre of volume contains 1000 litres or 1 kilo litre.

13. **Vulgar Fractions:** A fraction is represented by two numbers written one above the other and sperated by a horizontal line. Thus the fraction two-fifths is written as 2/5. The upper number is called the *numerator* where as the lower number is called the *denominator*. The numerator and the denominator of a fraction are its terms.

    A fraction is zero when its numerator is zero alone. The denominator of a fraction is always non-zero. Fractions such as

    $3/5, \dfrac{8}{11}, \dfrac{7}{25}$ ...etc.

    are called common or vulgar fractions. The value of the vulgar fraction is not altered by multiplying or dividing by the numerator and the denominator by the same number.

14. If the numerator and the denominator are large numbers, or if their common factors cannot easily be guessed, we may find their H.C.F.