Square and Square Roots

Introduction

 $a \times a \times a = a^3$ read as "a raised to the power three". a is called base and 3 is called power or exponent.

When the exponent is 2, the numbers thus obtained are called square numbers. The base is the square root of the obtained square number.

Squares

Square of a number is that number which is raised to the power 2.

2 × 2 = 2^2 = 4 is called square of 2 is 4 3 × 3 = 3^2 = 9 is called square of 3 is 9

The square of a number is that number raised to the power 2.

Square Numbers

A natural number is called a perfect square or a square number if it is the square of some natural number. It is also known as the perfect square.

How to find whether a given number is a perfect square

Step 1 : Write the given number as a product of its prime factors.

- Step 2 : Make pairs of the same numbers of prime factors.
- Step 3 : Check for unpaired factors.
- Step 4 : If there is no unpaired factors, then the number will be a perfect square.

Properties of Perfect Squares

- 1. Squares of even numbers are always even.
- 2. Squares of odd numbers are always odd.

- 3. A number ending in 2, 3, 7 or 8 is never a perfect square.
- 4. A number ending with an odd number of zeros is not a perfect square.
- 5. The square of a natural number (other than 1) is a multiple of 3 or exceeds a multiple of 3 by 1.
- 6. The square of a natural number 'n' is equal to the sum of the first n odd numbers.
- 7. The difference of the squares of two consecutive natural numbers is equal to their sum.

Pattern of Square Numbers

1. 1² = 1 11² = 121 111² = 12321 1111² = 1234321 11111² = 123454321

2. The numbers 1, 3, 6, 10, 15, 21 ,... are called triangular numbers because they all can be depicted as triangles.

0	0 00	0 00 000	0 00 000 0000	0 00 000 0000 0000
1	3	6	10	15

3. 1,3,6,10,15 etc. are called the terms of the series of triangular numbers.

Term Number	1	2	3	4	5	6	7	8	9	10
Triangular Number	1	3	6	10	15	21	28	36	45	55

4. Pythagorean Triplets : For every natural number m (other than 1), there is a triplet such as (2m), $(m^2 - 1)$ and $(m^2 + 1)$.

 $(2m)^2 + (m^2 - 1)^2 = (m^2 + 1)^2$

Square roots

The square root of a number x is that number which when multiplied by itself gives x as the product.

The square root of a number x is represented as \sqrt{x} . The symbol $\sqrt{-}$ stands for square root of.

Square root of a perfect square by Prime Factorization Method

Step 1: Factorize the given number.

Step 2: Make pairs of similar factors.

Step 3: Select one factor from each group and multiply them.

Square root by long division method

Step 1 : Make the pairs of digits starting from once place towards the left. Each pair and the remaining digit (if any) is called period.

Step 2 : Divide the first period by the largest number, whose square is equal to or just less than the first period. Let this number be the divisor and the quotient both.

Step 3 : Subtract the product of the divisor and the quotient from the first period and bring down the next period to the right of the remainder. This will become the new dividend.

Step 4 : Now the next divisor will be obtained by taking times of the quotient and annexing with it a suitable digit, which is also taken as the next digit of the quotient.

Step 5 : The new digit should be chosen in such a manner that the product of the new divisor and this digit is equal to or just less than the new dividend.

Step 6 : Repeat the steps (2), (3) and (4) till all the periods have been taken up.

Thus the quotient obtained is the required square root of the given number.

Square root of number in decimal form

Step 1 : First, make the number of decimal places even by putting a zero, if necessary. Step 2 : Mark the period as usual(from right to left) and find the square root by long division method.

Step 3 : Put the decimal point in the quotient i.e. square root as soon as the integral part is used up.

Square root of Fractions

For any positive number x and y we have :

(i) $\sqrt{xy} = \sqrt{x} \times \sqrt{y}$ (ii) $\sqrt{\frac{x}{y}} = \frac{\sqrt{x}}{\sqrt{y}}$