

# SQUARE ROOTS

## A WHAT ARE SQUARE ROOTS?

### Definition Square root

The **square root** of a non-negative number  $a$  (that is,  $a \geq 0$ ), written as  $\sqrt{a}$ , is the **non-negative number** that, when multiplied by itself, gives  $a$ .

$$(\sqrt{a})^2 = a$$

### Note

- The square root symbol  $\sqrt{\quad}$  always asks for the **positive** root. For example,  $\sqrt{25} = 5$ . It is a common mistake to think that  $\sqrt{25}$  is  $\pm 5$ .  
While it's true that both  $5^2 = 25$  and  $(-5)^2 = 25$ , the symbol  $\sqrt{25}$  refers only to the positive solution, which is 5.
- **Why can't we take the square root of a negative number (in the real numbers)?**  
Consider  $\sqrt{-9}$ . To find this value, we need a number that, when multiplied by itself, gives  $-9$ .
  - A positive number squared is positive ( $3 \times 3 = 9$ ).
  - A negative number squared is also positive ( $-3 \times -3 = 9$ ).

No real number, when squared, can result in a negative number. Therefore, we cannot find the square root of a negative number in the set of real numbers.

### Definition Perfect Squares

A **perfect square** is an integer that is the square of another integer. The square root of a perfect square is an integer.

**Ex:** The first few perfect squares are:

$$1, 4, 9, 16, 25, 36, 49, 64, 81, 100, \dots$$

Their square roots are:

$$\sqrt{1} = 1, \quad \sqrt{4} = 2, \quad \sqrt{9} = 3, \quad \sqrt{16} = 4, \quad \dots$$

## B CALCULATING SQUARE ROOTS

While the square roots of perfect squares are easy to find, most numbers are not perfect squares. We can estimate their square roots or use a calculator for a more precise value.

### Method Use a calculator

On most calculators, you can find a square root using the  $\sqrt{\quad}$  button.

**Ex:** Use a calculator to find  $\sqrt{10}$ , rounded to 2 decimal places.

*Answer:* Entering  $\sqrt{10}$  into a calculator gives approximately 3.162277...  
Rounded to 2 decimal places,  $\sqrt{10} \approx 3.16$ .