1.11 Square Roots and Irrational Numbers
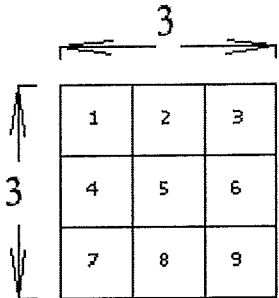
To square a number, _multiply it by itself._

For example, what is 3 squared?

3 squared = $\xrightarrow{\quad 3 \quad}$
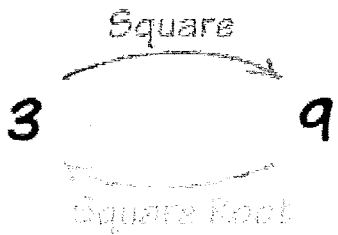
1	2	3
4	5	6
7	8	9

3 (vertical) $= 3 \times 3 = 9$

"Squared" is often written as a little 2 like this: *this means "squared"*

$$4^2 = 16$$

This says: _4 squared equals 16_ .

quare Roots

A square root _is inverse of square_ .

Square

3 ⟶ 9

Square Root

3 squared is 9, so _Square root of 9 is 3._

The Square Root Symbol

$\sqrt{}$ This is the special symbol that means "square root. It is called the *radical.*

We use it like this:

$$\sqrt{9} = 3$$

We would say *"square root of 9 equals 3"*

A square root of a number is a value that can be **multiplied by itself** to give the original number. A square root of **9** is **3**, because **when 3 is multiplied by itself** we get **9**.

It is like asking: What can we multiply by itself to get this?

- But wait a minute! Can't the square root **also be −3**? Because (−3) × (−3) = **9** too.
- Well the **square root of 9** could be −3 or +3.

But when we use the **radical symbol** $\sqrt{}$ we only give the **positive result**.

Perfect Squares

The perfect squares are the squares of the whole numbers:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	etc

Perfect Squares: 1 4 9 16 25 36 49 64 81 100 121 144 169 196 225 ...

In other words, square roots of perfect square is whole number.

Ex. 1)

i) $\sqrt{81}$

$= 9$

ii) $2\sqrt{25}$

$= 2(5)$
$= 10$

iii) $-\sqrt{256}$

$= -16$

iv) $\sqrt{1.44}$

v) $\sqrt{16}$

$= 4$

vi) $\sqrt{25 - 16}$

$= \sqrt{9}$
$= 3$

*The radical sign is like a bracket.

vii) $\sqrt{-49}$

NOT POSSIBLE (SQUARE ROOT OF A NEGATIVE NOT DEFINED)

Note: Numbers like $\sqrt{5}$ and $-\sqrt{17}$ cannot be written as a terminating or repeating decimal. They are called **irrational numbers**.

Ex. 2) Evaluating to the nearest tenth:

i) $\sqrt{41}$ ii) $-\sqrt{191}$ iii) $4\sqrt{2} + 3\sqrt{5}$ iv) $\frac{4\sqrt{7}}{3}$

$= 6.4$ $\doteq -13.8$ $\doteq 5.65 + 6.71$ $= 3.5$

                                    $\doteq 12.4$

Ex. 3) Evaluate for $a = 5, b = -2$

2.1 $\sqrt{a^2 - 2ab + b^2}$

$= \sqrt{25 - 2(5)(-2) + 4}$

$= \sqrt{25 + 20 + 4}$

$= \sqrt{49}$

$= 7$

Ex. 4) The area of a square is $98cm^2$, what is the length of each side? What is the perimeter?

$\sqrt{98} \doteq 9.9 =$ length & width

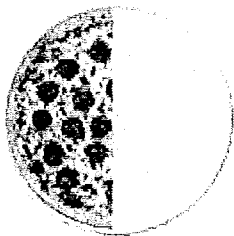$\therefore P = 9.9 \times 4$

$= 39.6$ cm

1.12 Fractions, Decimals, Percent

Decimals, fractions and percents are just different ways of showing the same value.

A half can be written as:
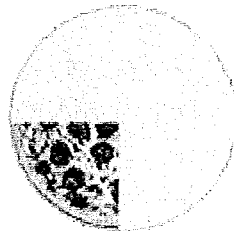
A fraction: _____1/2_____

A decimal: _____0.50_____

A percent: _____50%_____

A quarter can be written as:

A fraction: _____1/4_____

A decimal: _____0.25_____

A percent: _____25%_____

Conversions:

Fraction to a Decimal:

Divide (long division)

Decimal to Fraction:

1. Write the decimal ÷ 1

2. multiply top and bottom by 10, 100, 1000, ... (depending on decimal)
   $0.1 = \frac{1}{10}$, $0.12 = \frac{12}{100}$

3. Reduce to lowest terms (divide by common factor)

4. Represent as a mixed fraction if numerator > denominator

Convert 0.75 to a fraction $= \frac{0.75}{1.}$

$\frac{75}{100} \begin{array}{c} \div 25 \\ \div 25 \end{array}$

$= \frac{3}{4}$