# Introduction to Square Roots

Explore ideas and representations

**Name** _____ **Date** _____ **Score** _____ / 10

**QUICK REVIEW**

$\sqrt{N}$ is the nonnegative number whose square is $N$. For example, $2^2 = 4$, so $\sqrt{4} = 2$, not $-2$. An equation such as $x^2 = 4$ can have two solutions. A side length is never negative.

**Worked example**

A square has area $121$ cm$^2$. Find its side and perimeter.

**1.** $11 \times 11 = 121$, so the side is $\sqrt{121} = 11$ cm.
**2.** Four equal sides give $4(11) = 44$ cm.
**3.** Check area: $11^2 = 121$ cm$^2$.
**Answer:** Side $11$ cm; perimeter $44$ cm.

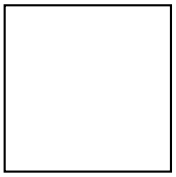
## Practice Problems

Show your thinking.

**1.** Evaluate $\sqrt{16}$ and explain why the answer cannot be negative.

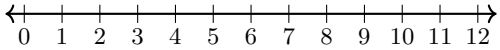
**2.** A square has area $25$ cm$^2$. Find its side length and perimeter.

**3.** Solve $x^2 = 36$ for the nonnegative side length $x$. Label the square model with its side length and area.



**4.** Which is larger, $\sqrt{49}$ or $\sqrt{64}$, and by how much?

**5.** Mark $\sqrt{64}$ on the line and check its value by multiplication.




**6.** Find the nonnegative number whose square is $81$. Does its negative also solve $x^2 = 81$?

**7.** Signal record: evaluate $\sqrt{144}$ and its opposite.

**8.** Distance marker: recover $N$ from $\sqrt{N} = 13$. Verify by multiplication.

**9.** Balance check: between which consecutive whole numbers is $\sqrt{199}$? Use nearby perfect squares.

**10.** Reference scale: a square panel has area $225$ cm$^2$. Find its side and the total edge length for $2$ panels.

# Answer Key

1. $4$.
2. Side $5$ cm; perimeter $20$ cm.
3. Side $6$ units; area $36$ square units.
4. $\sqrt{64}$ is larger by $1$.
5. Mark the tick at $8$.
6. $9$; yes, $-9$ also solves the equation.
7. Root $12$; opposite $-12$.
8. $N = 169$.
9. $14 < \sqrt{199} < 15$.
10. Side $15$ cm; total edges $120$ cm.

## Step-by-Step Solutions

Follow each calculation, then check your own work.

### Problem 1

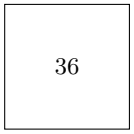
1. The nearby squares are $3^2 = 9$ and $4^2 = 16$.
2. The symbol asks for a nonnegative number with square $16$.
3. $4 \geq 0$ and $4 \times 4 = 16$, so $\sqrt{16} = 4$.

### Problem 2

1. The area is side times side: $s^2 = 25$.
2. $5 \times 5 = 25$, so the nonnegative side length is $\sqrt{25} = 5$ cm.
3. Four equal sides give $4 \times 5 = 20$ cm of perimeter.

### Problem 3

1. A square with side $x$ has $x \times x = 36$ square units.
2. $6 \times 6 = 36$, and $6$ is nonnegative.
3. Label a side $6$ units and write $36$ square units inside.




### Problem 4

1. $7^2 = 49$, so $\sqrt{49} = 7$.
2. $8^2 = 64$, so $\sqrt{64} = 8$.
3. $8 > 7$, and $8 - 7 = 1$.

### Problem 5

1. The nonnegative number $8$ satisfies $8 \times 8 = 64$.
2. Therefore $\sqrt{64} = 8$.
3. Start at $0$ and count eight one-unit ticks to the right. Place a mark at that tick.

### Problem 6

1. $9 \times 9 = 81$, so the principal square root is $9$.
2. Check the other sign: $(-9)(-9) = 81$.
3. Both $x = 9$ and $x = -9$ solve the equation. Only $9$ is the value of $\sqrt{81}$.

### Problem 7

1. $12 \times 12 = 144$.
2. The nonnegative root is $\sqrt{144} = 12$.
3. Its opposite is $-12$; both numbers square to $144$.

### Problem 8

1. $13 \times 13 = 169$.
2. The nonnegative root is $\sqrt{169} = 13$.
3. Thus $N = 13^2 = 169$; check $\sqrt{169} = 13$.

### Problem 9

1. Lower square $14^2 = 196$.
2. Upper square $15^2 = 225$.
3. $196 < 199 < 225$ gives the stated root bounds.

### Problem 10

1. $15 \times 15 = 225$.
2. The nonnegative root is $\sqrt{225} = 15$.
3. Two perimeters $= 2(4)(15) = 120$ cm.

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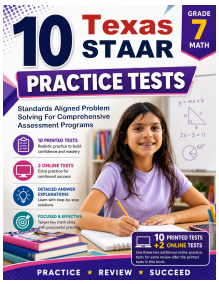


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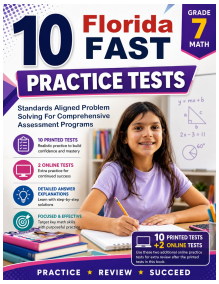


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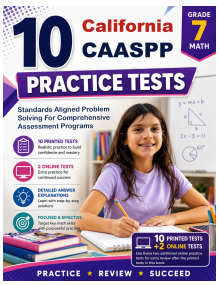


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