Introduction to Square Roots

Apply the skill to decisions and designs

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. A square garden covers 100 m^2. Leave a 3-m opening for a gate. Is a 36-m roll of fencing enough?

2. A square mat covers 81 dm^2. An alcove is 8 dm wide. Can the mat fit with its sides parallel to the walls? Explain.

3. A square design may use at most 60 cm^2 and must have whole-centimeter sides. Find the longest possible side and the unused area allowance.

4. A square room covers 82 m^2. Without rounding its side, decide whether a straight 9-m rug can fit along a wall.

5. Two square signs have areas 25 and 49 cm^2. A designer wants to put them side by side with a 1-cm gap on a 12-cm shelf. Does that fit?

6. A path runs along two full adjacent sides of a square field and is 18 m long. Find the side and field area. Check the side using a square root.

7. Signal record: a square has area 144 m^2. A fence roll has 46 m. Find the perimeter and extra fence needed.

8. Distance marker: a square panel has area 169 cm^2. Find its side and the total edge length for 2 panels.

9. Balance check: recover N from $\sqrt{N} = 14$. Verify by multiplication.

10. Reference scale: between which consecutive whole numbers is $\sqrt{228}$? Use nearby perfect squares.

Answer Key

1. No; 1 m more is needed.
2. No; the mat is 1 dm wider.
3. Side 7 cm; allowance left 11 cm^2.
4. Yes; the wall is longer than 9 m.
5. No; the signs and gap need 13 cm.
6. Side 9 m; area 81 m^2.
7. Perimeter 48 m; short 2 m.
8. Side 13 cm; total edges 104 cm.
9. $N = 196$.
10. $15 < \sqrt{228} < 16$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The side is $\sqrt{100} = 10$ m, since $10^2 = 100$.
2. The full perimeter is $4(10) = 40$ m. Leave 3 m open: $40 - 3 = 37$ m.
3. The roll falls short by $37 - 36 = 1$ m.

Problem 2

1. The mat side is $\sqrt{81} = 9$ dm because $9^2 = 81$.
2. It needs 9 dm across, but the alcove has 8 dm.
3. $9 - 8 = 1$ dm of additional width is needed.

Problem 3

1. Test nearby squares: $7^2 = 49$ and $8^2 = 64$.
2. Since $49 \le 60 < 64$, 7 cm is the largest allowed whole side.
3. That design uses 49 cm^2, leaving $60 - 49 = 11$ cm^2 of the allowance.

Problem 4

1. Compare with perfect squares: $9^2 = 81$ and $10^2 = 100$.
2. $81 < 82 < 100$, so $9 < \sqrt{82} < 10$.
3. The wall is strictly longer than the rug, even though its exact length is not a whole number.

Problem 5

1. The side lengths are $\sqrt{25} = 5$ cm and $\sqrt{49} = 7$ cm.
2. Their widths plus the gap total $5 + 1 + 7 = 13$ cm.
3. That is $13 - 12 = 1$ cm more than the shelf width.

Problem 6

1. Two equal sides make the path, so the side is $18 \div 2 = 9$ m.
2. The field area is $9 \times 9 = 81$ m^2.
3. $\sqrt{81} = 9$ confirms the positive side length.

Problem 7

1. $12 \times 12 = 144$.
2. The nonnegative root is $\sqrt{144} = 12$.
3. Perimeter $4(12) = 48$ m; shortage $48 - (46) = 2$ m.

Problem 8

1. $13 \times 13 = 169$.
2. The nonnegative root is $\sqrt{169} = 13$.
3. Two perimeters $= 2(4)(13) = 104$ cm.

Problem 9

1. $14 \times 14 = 196$.
2. The nonnegative root is $\sqrt{196} = 14$.
3. Thus $N = 14^2 = 196$; check $\sqrt{196} = 14$.

Problem 10

1. Lower square $15^2 = 225$.
2. Upper square $16^2 = 256$.
3. $225 < 228 < 256$ gives the stated root bounds.

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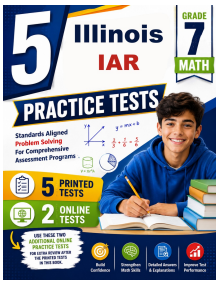

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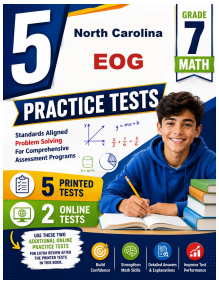

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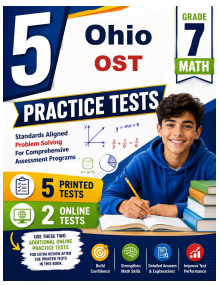

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