

Square Roots

Title: Square Roots

Objectives: Students will be able to simplify square roots and perform operations using square roots

Materials:

Teacher notes and script (*This page and next*)

Student study guide (*1 copy per student*)

Student worksheet (*1 copy per student.*)

Overheads (*Make transparencies*)

Previous Knowledge Needed:

Important Concepts/Methods:

Know the square roots of perfect squares through 225.

$$\sqrt{1} = 1 \quad \sqrt{4} = 2 \quad \sqrt{9} = 3 \quad \sqrt{16} = 4 \quad \sqrt{25} = 5 \quad \sqrt{36} = 6 \quad \sqrt{49} = 7 \quad \sqrt{64} = 8 \quad \sqrt{81} = 9 \quad \sqrt{100} = 10 \quad \sqrt{121} = 11 \quad \sqrt{144} = 12$$

There are two ways to work out other square roots:

- 1) Divide the number by something that you know is a perfect square, then take the square root of the part you know. Leave the other part inside the root sign.
- 2) Make a factor tree. Take out pairs of factors. Leave the rest under the square root sign.

Script:

We'll simplify a difficult square root both ways. Let's read the first problem. (*Put up the overhead and read.*)

$$\sqrt{200}$$

a) $10\sqrt{2}$

b) $2\sqrt{10}$

c) 100

d) $2\sqrt{50}$

The first method you have is to find the biggest number that you know the square root of that goes into your number. So 200 is 2 times 100. (*Write problem on the overhead and have students do the same on their paper.*) We know the square root of 100 is 10, so we'll write that down. 2 doesn't have a square root, so we'll leave it inside the square root sign. (*Write answer on the overhead, and have students do the same.*) Any questions? (*Answer any questions that the students have.*)

This way is easy if you already know some square roots, but it's hard if you don't, so let's look at another way of getting the answer.

We need to find all the factors of 200. So let's make a factor tree. (*Work out the tree on the overhead and have students do it on their own paper.*) So our factors are $2 \cdot 2 \cdot 2 \cdot 5 \cdot 5$ (*Write this on overhead and have students answer on their papers.*) Now we need to take out pairs of numbers. We can take out a pair of 2's and a pair of 5's. We have one two left that doesn't have a match, so it will remain under the root sign. (*Write $2 \cdot 5\sqrt{2}$ on overhead and have students answer on their papers.*) All that's left is to multiply. (*Write answer on overhead and have students answer on their papers.*) So we have 10 root 2. Any questions? (*Answer any questions that the students have.*)

Common Mistakes:

Let's look at what mistakes were made in the other answers.

Answer b has the numbers reversed. They left the wrong number under the root.

Answer c just divided the number in half, instead of taking the square root.

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Answer d didn't find the biggest number or all the pairs they could take out, so their not finished all the way.

Student Problems:

Try the next three problems on your own. (*Give students time to try the problems.*)

(*Put overhead up and either work out problems or give students the opportunity to come up and explain them. Make sure they do all steps.*)

Assignment: (*Hand out assignment sheet. Either give students time to do and then discuss their problems, or give as homework and collect the next day.*)

Square Roots

1) $\sqrt{200}$

a) $10\sqrt{2}$

b) $2\sqrt{10}$

c) 100

d) $2\sqrt{50}$

2) $\sqrt{75}$

a) 37.5

b) $25\sqrt{3}$

c) $3\sqrt{5}$

d) $5\sqrt{3}$

3) $\sqrt{400}$

a) 200

b) 20

c) $2\sqrt{10}$

d) $10\sqrt{2}$

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4) $\sqrt{56}$

a) $14\sqrt{2}$

b) $2\sqrt{14}$

c) $7\sqrt{8}$

d) 28

Let me show what I know!

Take each square root using whatever method you choose. Show all your work.

1) $\sqrt{500}$

2) $\sqrt{90}$

3) $\sqrt{288}$

4) $\sqrt{36}$

5) $\sqrt{81}$

6) $\sqrt{47}$

7) $\sqrt{48}$

8) $\sqrt{60}$

Let me show what I know!

Take each square root using whatever method you choose. Show all your work.

$$1) \sqrt{500} = \sqrt{5 \cdot 10 \cdot 10} = 10\sqrt{5}$$

$\sqrt{500}$
 $\begin{array}{c} \wedge \\ 50 \quad 10 \\ \wedge \quad \wedge \\ 5 \quad 10 \end{array}$

$$2) \sqrt{90} = \sqrt{2 \cdot 3 \cdot 3 \cdot 5} = 3\sqrt{10}$$

$\sqrt{90}$
 $\begin{array}{c} \wedge \\ 45 \quad 2 \\ \wedge \quad \wedge \\ 9 \quad 5 \\ \wedge \quad \wedge \\ 3 \quad 3 \end{array}$

$$3) \sqrt{288} = \sqrt{2 \cdot 12 \cdot 12} = 12\sqrt{2}$$

$\sqrt{288}$
 $\begin{array}{c} \wedge \\ 2 \quad 144 \\ \wedge \quad \wedge \\ 12 \quad 12 \end{array}$

$$4) \sqrt{36} = \sqrt{6 \cdot 6} = 6$$

$\sqrt{36}$
 $\begin{array}{c} \wedge \\ 6 \cdot 6 \end{array}$

$$5) \sqrt{81} = \sqrt{9 \cdot 9} = 9$$

$\sqrt{81}$
 $\begin{array}{c} \wedge \\ 9 \quad 9 \end{array}$

$$6) \sqrt{47} \text{ cannot be simplified}$$

$$7) \sqrt{48} = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3} = 4\sqrt{3}$$

$\sqrt{48}$
 $\begin{array}{c} \wedge \\ 4 \quad 12 \\ \wedge \quad \wedge \\ 2 \quad 2 \quad 6 \quad 2 \\ \wedge \quad \wedge \\ 3 \quad 2 \end{array}$

$$8) \sqrt{60} = \sqrt{2 \cdot 2 \cdot 3 \cdot 5} = 2\sqrt{15}$$

$\sqrt{60}$
 $\begin{array}{c} \wedge \\ 6 \quad 10 \\ \wedge \quad \wedge \\ 2 \quad 3 \quad 2 \quad 5 \end{array}$

Ideas that I'm going to study and learn.

Know the square roots of the perfect squares to 225.

$$\sqrt{1} = 1 \quad \sqrt{4} = 2 \quad \sqrt{9} = 3 \quad \sqrt{16} = 4 \quad \sqrt{25} = 5 \quad \sqrt{36} = 6 \quad \sqrt{49} = 7 \quad \sqrt{64} = 8 \quad \sqrt{81} = 9 \quad \sqrt{100} = 10 \quad \sqrt{121} = 11 \quad \sqrt{144} = 12$$

$$\sqrt{169} = 13 \quad \sqrt{196} = 14 \quad \sqrt{225} = 15$$

There are two ways to work out other square roots:

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2) Make a factor tree. Take out pairs of factors. Leave the rest under the square root sign.

1) $\sqrt{200}$

a) $10\sqrt{2}$

b) $2\sqrt{10}$

c) 100

d) $2\sqrt{50}$

2) $\sqrt{75}$

a) 37.5

b) $25\sqrt{3}$

c) $3\sqrt{5}$

d) $5\sqrt{3}$

3) $\sqrt{400}$

a) 200

b) 20

c) $2\sqrt{10}$

d) $10\sqrt{2}$

4) $\sqrt{56}$

a) $14\sqrt{2}$

b) $2\sqrt{14}$

c) $7\sqrt{8}$

d) 28

Ideas that I'm going to study and learn.

Know the square roots of the perfect squares to 225.

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$$\sqrt{169}=13 \quad \sqrt{196}=14 \quad \sqrt{225}=15$$

There are two ways to work out other square roots:

1) Divide the number by something that you know is a perfect square, then take the square root of the part you know. Leave the other part inside the root sign.

2) Make a factor tree. Take out pairs of factors. Leave the rest under the square root sign.

1) $\sqrt{200}$

$$\sqrt{200} = \sqrt{100 \cdot 2}$$

$$= \sqrt{100} \cdot \sqrt{2}$$

a) $10\sqrt{2}$

$$= 10\sqrt{2}$$

b) $2\sqrt{10}$

c) 100

d) $2\sqrt{50}$

$$\sqrt{200} = \sqrt{2 \cdot 2 \cdot 2 \cdot 5 \cdot 5}$$

$$2 \cdot 5 \sqrt{2}$$

$$= 10\sqrt{2}$$

2) $\sqrt{75}$

$$\sqrt{75} = \sqrt{25 \cdot 3}$$

a) 37.5

$$= \sqrt{25} \cdot \sqrt{3}$$

b) $25\sqrt{3}$

$$= 5\sqrt{3}$$

c) $3\sqrt{5}$

$$\sqrt{75} = \sqrt{5 \cdot 5 \cdot 3}$$

d) $5\sqrt{3}$

$$= 5\sqrt{3}$$

3) $\sqrt{400}$

$$\sqrt{400} = \sqrt{100 \cdot 4}$$

a) 200

$$= \sqrt{100} \cdot \sqrt{4}$$

b) 20

$$= 10 \cdot 2 = 20$$

c) $2\sqrt{10}$

d) $10\sqrt{2}$

$$\sqrt{400} = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5}$$

$$2 \cdot 2 \cdot 5$$

$$= 20$$

4) $\sqrt{56}$

$$\sqrt{56} = \sqrt{4 \cdot 14} = \sqrt{4} \cdot \sqrt{14}$$

a) $14\sqrt{2}$

$$= 2\sqrt{14}$$

b) $2\sqrt{14}$

c) $7\sqrt{8}$

d) 28

$$\sqrt{56} = \sqrt{2 \cdot 2 \cdot 2 \cdot 7}$$

$$2\sqrt{14}$$

