Learning Objective

1. We will solve equations with squared variables involving fractions.

2. We will estimate radicals that are not perfect squares.

CFU

What are we going to do?

Exponential Expression

6^2 ← exponent

base

Activate Prior Knowledge

An **exponential expression** represents repeated multiplication.

- ***Bases*** *raised to an* ***exponent*** *of* ***2*** *are* ***squared****.*

Evaluate the squared expressions.

1. 9^2

2. 10^2

3. $(-9)^2$

4. $(-10)^2$

PERFECT SQUARES

$1^2 = 1$	$5^2 = 25$	$9^2 = 81$
$2^2 = 4$	$6^2 = 36$	$10^2 = 100$
$3^2 = 9$	$7^2 = 49$	$11^2 = 121$
$4^2 = 16$	$8^2 = 64$	$12^2 = 144$

Make Connection

Students, you already know how to evaluate squared expressions. Now, we will use squared expressions solve equations with squared variables.

Standard 7NS2.4 Use the inverse relationship between raising to a power and extracting the root of a perfect square; for an integer that is not square, determine without a calculator the two integers between which its square root lies and explain why.

A square root is a number that is **multiplied by itself** to form a product.

- *Taking the **square root** ($\sqrt{\ }$) is used to isolate[1] the variable in equations with **squared variables**.*
- *An equation with **squared variables** can have **two solutions**, one positive and one negative.*

Square Roots

$$x^2 = 144$$

$$\sqrt{x^2} = \pm\sqrt{12^2}$$

$$x = \pm 12$$

Perfect Squares
$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

Solutions

$$(12)^2 = 144 \qquad (-12)^2 = 144$$

x = **12** and x = **-12** both make the equation true.

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Which equation below can be solved by taking a square root? How do you know?

A $y^2 = 24$

B $y^2 = 16$

Explain why ± 7 are the solutions to the equation $z^2 = 49$.

Vocabulary

[1] separate (synonym)

Skill Development/Guided Practice

A **square root** is a number that is **multiplied by itself** to form a product.

- *Taking the **square root** ($\sqrt{\ }$) is used to isolate the variable in equations with **squared variables**.*
- *An equation with **squared variables** can have **two solutions**, one positive and one negative.*

Solve equations with squared variables.

1. Rewrite the numerical term as a squared expression.
2. Solve the equation by taking the square root of both sides of the equation.
3. Check and interpret[2] the solution(s).

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2. How did I/you solve the equation?
3. How did I/you check and interpret the solution(s)?

1. $a^2 = 64$

2. $k^2 = 144$

3. $q^2 = \frac{9}{25}$

$$\frac{\sqrt{\square}}{\sqrt{\square}}$$

4. $p^2 = \frac{49}{16}$

$$\frac{\sqrt{\square}}{\sqrt{\square}}$$

Perfect Squares
$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

Vocabulary

[2] explain (synonym)

Solving Math Problems

1. Determine what the question is asking.
2. Determine the math concept required.
3. Determine relevant information.
4. Solve the problem, then interpret the answer.
5. Check the reasonableness of your answer.

CFU

1. How did I/you determine what the question is asking?
2. How did I/you determine the math concept required?
3. How did I/you determine the relevant information?
4. How did I/you solve and interpret the problem?
5. How did I/you check the reasonableness of the answer?

5. Cameron is tiling his floor with square tiles. He knows the area of each tile is 121 in^2. What is the length of each side of the tile?

_____

Area = 121 in^2

6. Vanessa is starting a painting on a square canvas. The area of the canvas is 400 cm^2. What is the length of each side of the canvas?

_____

Area = 400 cm^2

Relevance

A **square root** is a number that is **multiplied by itself** to form a product.

- *Taking the **square root** ($\sqrt{\ }$) is used to isolate the variable in equations with **squared variables**.*
- *An equation with **squared variables** can have **two solutions**, one positive and one negative.*

I *Sometimes Square Roots are not Integers, but instead fall between integers.*

Estimate $\sqrt{54}$ to the nearest whole number.

The first perfect square less than 54 is ☐.

The first perfect square greater than 54 is ☐.

Perfect Squares
$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

$49 < 54 < 64$ Write an inequality.

☐ $< 54 <$ ☐ 49 = ☐ and 64 = ☐

$\sqrt{7^2} < \sqrt{54} < \sqrt{8^2}$ Take the square root of each number.

$7 < \sqrt{54} < 8$ Simplify.

So, $\sqrt{54}$ is between ☐ and ☐. Since 54 is closer to 49 than 64, the best whole number estimate for $\sqrt{54}$ is ☐

CFU

How can you estimate a square root of a number that is not a perfect square ? (Pair-Share)

Square roots can have how many solutions?

A **square root** is a number that is **multiplied by itself** to form a product.

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- *An equation with **squared variables** can have **two solutions**, one positive and one negative.*

Skill Closure

Solve equations with squared variables.

1. Rewrite the numerical term as a squared expression.
2. Solve the equation by taking the square root of both sides of the equation.
3. Check and interpret the solution(s).

1. $d^2 = 49$

2. $n^2 = \frac{25}{81}$

$$\frac{\sqrt{\square}}{\sqrt{\square}}$$

Perfect Squares
$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

Access Common Core

Which equation below can be solved by taking a square root? Explain your answer. Explain why the other equations cannot be solved by taking a square root.

A $x = 49$ B $y^2 = 16$

Word Bank

equation
square root
solution

Summary Closure

What did you learn today about solving equations with squared variables? (Pair-Share)

Use words from the word bank.

Independent Practice

Name: _____

10.31.13

A **square root** is a number that is **multiplied by itself** to form a product.

- *Taking the **square root** ($\sqrt{\ }$) is used to isolate the variable in equations with **squared variables**.*
- *An equation with **squared variables** can have **two solutions**, one positive and one negative.*

Solve equations with squared variables.

1. Rewrite the numerical term as a squared expression.
2. Solve the equation by taking the square root of both sides of the equation.
3. Check and interpret the solution(s).

1. $g^2 = 36$

2. $u^2 = 169$

3. $c^2 = \frac{4}{81}$

$$\frac{\sqrt{\square}}{\sqrt{\square}}$$

4. $v^2 = \frac{1}{9}$

$$\frac{\sqrt{\square}}{\sqrt{\square}}$$

Perfect Squares
$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

Periodic Review I

1. $p^2 = 1$

2. $x^2 = 64$

3. $b^2 = \frac{1}{25}$

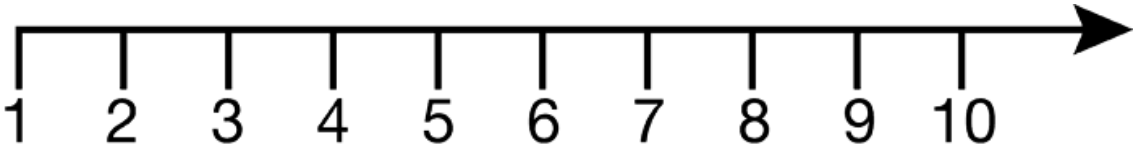
$$\frac{\sqrt{\square}}{\sqrt{\square}}$$

4. $y^2 = \frac{36}{121}$

$$\frac{\sqrt{\square}}{\sqrt{\square}}$$

Estimation

Approximately where does $\sqrt{38}$ fall on the number line to the right?



Access Common Core

1. Choose Yes or No to indicate whether each statement is true about the equation $\boldsymbol{p^2 = 9}$.

A	The equation cannot be solved by taking a square root.	O Yes	O No
B	$p = 81$	O Yes	O No
C	$p = \pm 3$	O Yes	O No
D	There is more than one solution to the equation.	O Yes	O No

2. Choose Yes or No to indicate whether each statement is true about the equation $\boldsymbol{w^2 = \frac{9}{4}}$.

A	The equation cannot be solved by taking a square root.	O Yes	O No
B	$w = -\frac{3}{2}$	O Yes	O No
C	$w = \pm \frac{81}{16}$	O Yes	O No
D	There are exactly two solutions to the equation.	O Yes	O No