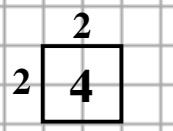
Square & Square Roots

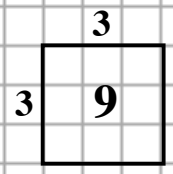
Objective: Students will be able to square a number and find the square root of a number.

Standards: 7NS 2.4

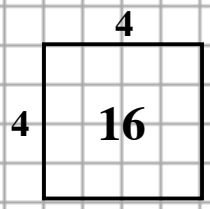
Squaring a Number



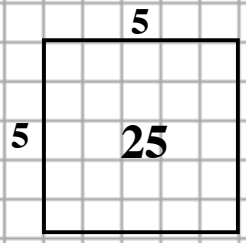
$2 \bullet 2$
$= 2^2$
$= 4$



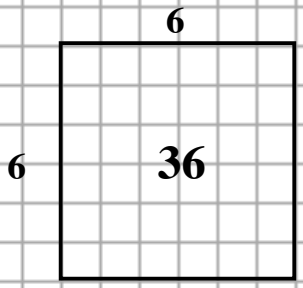
$3 \bullet 3$
$= 3^2$
$= 9$



$4 \bullet 4$
$= 4^2$
$= 16$



$5 \bullet 5$
$= 5^2$
$= 25$



$6 \bullet 6$
$= 6^2$
$= 36$

Taking a Square Root

$\sqrt{4}$
$= \sqrt{2 \bullet 2}$
$= 2$

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

$\sqrt{16}$
$= \sqrt{4 \bullet 4}$
$= 4$

$\sqrt{25}$
$= \sqrt{5 \bullet 5}$
$= 5$

$\sqrt{36}$
$= \sqrt{6 \bullet 6}$
$= 6$

Draw a rectangle (we are going to define a square and why its called square & square root).

This rectangle has an area of 4. What would be the dimensions? [2 & 2]

Show multiplying 2 times 2, writing it using exponents and getting 4.

This is called "squaring a number".

The inverse of squaring a number is taking the square root. We write like this $\sqrt{4}$. We need to think: "what number multiplied by it self equals 4? " We know that 2 times 2 is 4. Because 2 times 2 equals 4, then the square root of 4 is 2.

Think-Pair-Share:
* What shape did we draw in all the cases? [a square]

* Why do you think raising a number to the second power is called squaring a number?

*When we use the $\sqrt{\ }$ we only want the positive square root. This is called the **Principal Square Root**

Simplifying Expression with Square Roots

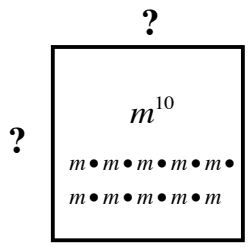
*Remember: the $\sqrt{}$ represents the Principal Square Root (a positive square root).

When we have $\sqrt{x^2}$, the square root must be $|x|$, since we don't know if *x* is a positive or negative

Example 1

Simplify.

Generic Square



Decomposition

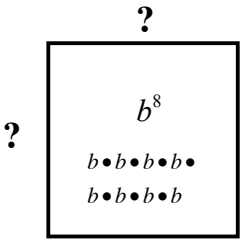
$$\sqrt{m^{10}}$$
$$= \sqrt{m \bullet m \bullet m \bullet m \bullet m \bullet m \bullet m \bullet m \bullet m \bullet m}$$
$$= \sqrt{(m \bullet m \bullet m \bullet m \bullet m) \bullet (m \bullet m \bullet m \bullet m \bullet m)}$$
$$= \sqrt{m^5 \bullet m^5}$$
$$= m^5$$

Traditional

$$\sqrt{m^{10}}$$
$$= \sqrt{m^5 \bullet m^5}$$
$$= \sqrt{\left(m^5\right)^2}$$
$$= m^5$$

You Try 1

Simplify.



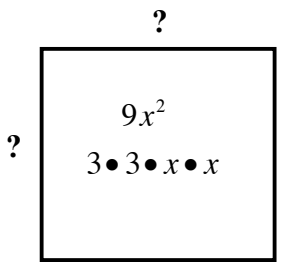
$$\sqrt{b^8}$$
$$= \sqrt{b \bullet b \bullet b \bullet b \bullet b \bullet b \bullet b \bullet b}$$
$$= \sqrt{(b \bullet b \bullet b \bullet b) \bullet (b \bullet b \bullet b \bullet b)}$$
$$= \sqrt{b^4 \bullet b^4}$$
$$= b^4$$

$$\sqrt{b^8}$$
$$= \sqrt{b^4 \bullet b^4}$$
$$= \sqrt{\left(b^4\right)^2}$$
$$= b^4$$

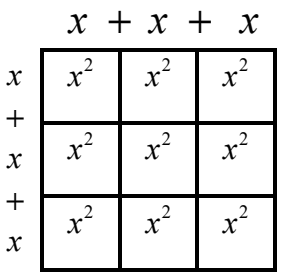
Example 2

Simplify.

Generic Square



Area Model



Decomposition

$$\sqrt{9x^2}$$
$$= \sqrt{3 \bullet 3 \bullet x \bullet x}$$
$$= \sqrt{3x \bullet 3x}$$
$$= 3x$$

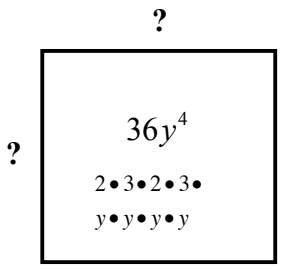
Traditional

$$\sqrt{9x^2}$$
$$= \sqrt{3^2 \bullet x^2}$$
$$= \sqrt{(3x)^2}$$
$$= 3x$$

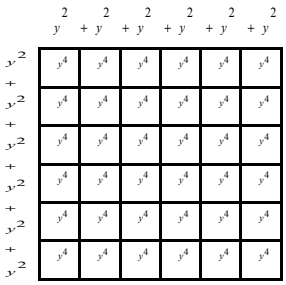
You Try 2

Simplify.

Generic Square



Area Model



Decomposition

$$\sqrt{36y^4}$$
$$= \sqrt{2 \bullet 2 \bullet 3 \bullet 3 \bullet y \bullet y \bullet y \bullet y}$$
$$= \sqrt{(2 \bullet 3 \bullet y \bullet y) \bullet (2 \bullet 3 \bullet y \bullet y)}$$
$$= \sqrt{6y^2 \bullet 6y^2}$$
$$= 6y^2$$

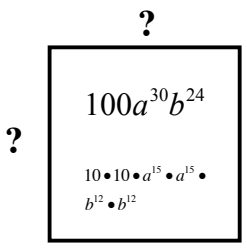
Traditional

$$\sqrt{36y^4}$$
$$= \sqrt{6y^2 \bullet 6y^2}$$
$$= \sqrt{(6y^2)^2}$$
$$= 6y^2$$

Example 3

Simplify.

Generic Square



Decomposition

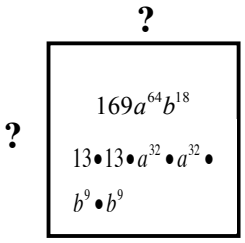
$$\sqrt{100a^{30}b^{24}}$$
$$= \sqrt{10 \bullet 10 \bullet a^{15} \bullet a^{15} \bullet b^{12} \bullet b^{12}}$$
$$= \sqrt{\left(10 \bullet a^{15} \bullet b^{12}\right)\left(10 \bullet a^{15} \bullet b^{12}\right)}$$
$$= 10a^{15}b^{12}$$

Traditional

$$\sqrt{100a^{30}b^{24}}$$
$$= \sqrt{\left(10a^{15}b^{12}\right)\left(10a^{15}b^{12}\right)}$$
$$= \sqrt{\left(10a^{15}b^{12}\right)^2}$$
$$= 10a^{15}b^{12}$$

You Try 3

Simplify.



$$\sqrt{169x^{64}y^{18}}$$
$$= \sqrt{13 \bullet 13 \bullet x^{32} \bullet x^{32} \bullet y^{9} \bullet y^{9}}$$
$$= \sqrt{\left(13 \bullet x^{32} \bullet y^{9}\right)\left(13 \bullet x^{32} \bullet y^{9}\right)}$$
$$= \sqrt{\left(13x^{32}y^{9}\right)\left(13x^{32}y^{9}\right)}$$
$$= 13x^{32}y^{9}$$

$$\sqrt{169x^{64}y^{18}}$$
$$= \sqrt{\left(13x^{32}y^{9}\right)\left(13x^{32}y^{9}\right)}$$
$$= \sqrt{\left(13x^{32}y^{9}\right)^2}$$
$$= 13x^{32}y^{9}$$

Squares and Square Roots

Number	Squaring a Number	Expanded Notation	Perfect Square	Taking the Square Root	Identify Factor Pairs	Square Root (Principle)
2	2^2	$=2\bullet2$	$=4$	$\sqrt{4}$	$=\sqrt{2\bullet2}$	$=2$
3	3^2	$=3\bullet3$	$=9$	$\sqrt{9}$	$=\sqrt{3\bullet3}$	$=3$
4	4^2	$=4\bullet4$	$=16$	$\sqrt{16}$	$=\sqrt{4\bullet4}$	$=4$
5	5^2	$=5\bullet5$	$=25$	$\sqrt{25}$	$=\sqrt{5\bullet5}$	$=5$
6	6^2	$=6\bullet6$	$=36$	$\sqrt{36}$	$=\sqrt{6\bullet6}$	$=6$
7	7^2	$=7\bullet7$	$=49$	$\sqrt{49}$	$=\sqrt{7\bullet7}$	$=7$
8	8^2	$=8\bullet8$	$=64$	$\sqrt{64}$	$=\sqrt{8\bullet8}$	$=8$
9	9^2	$=9\bullet9$	$=81$	$\sqrt{81}$	$=\sqrt{9\bullet9}$	$=9$
10	10^2	$=10\bullet10$	$=100$	$\sqrt{100}$	$=\sqrt{10\bullet10}$	$=10$
11	11^2	$=11\bullet11$	$=121$	$\sqrt{121}$	$=\sqrt{11\bullet11}$	$=11$
12	12^2	$=12\bullet12$	$=144$	$\sqrt{144}$	$=\sqrt{12\bullet12}$	$=12$
13	13^2	$=13\bullet13$	$=169$	$\sqrt{169}$	$=\sqrt{13\bullet13}$	$=13$
14	14^2	$=14\bullet14$	$=196$	$\sqrt{196}$	$=\sqrt{14\bullet14}$	$=14$
15	15^2	$=15\bullet15$	$=225$	$\sqrt{225}$	$=\sqrt{15\bullet15}$	$=15$
16	16^2	$=16\bullet16$	$=256$	$\sqrt{256}$	$=\sqrt{16\bullet16}$	$=16$
17	17^2	$=17\bullet17$	$=289$	$\sqrt{289}$	$=\sqrt{17\bullet17}$	$=17$
18	18^2	$=18\bullet18$	$=324$	$\sqrt{324}$	$=\sqrt{18\bullet18}$	$=18$
19	19^2	$=19\bullet19$	$=361$	$\sqrt{361}$	$=\sqrt{19\bullet19}$	$=19$
20	20^2	$=20\bullet20$	$=400$	$\sqrt{400}$	$=\sqrt{20\bullet20}$	$=20$
25	25^2	$=25\bullet25$	$=625$	$\sqrt{625}$	$=\sqrt{25\bullet25}$	$=25$

Squares and Square Roots

Number	Squaring a Number	Expanded Notation	Perfect Square	Taking the Square Root	Identify Factor Pairs	Square Root (Principle)
2	2^2	$=2\bullet 2$	$=4$	$\sqrt{4}$	$=\sqrt{2\bullet 2}$	$=2$
3	3^2	$=3\bullet 3$		$\sqrt{9}$	$=\sqrt{3\bullet 3}$	
4	4^2	$=4\bullet 4$		$\sqrt{16}$		
5	5^2			$\sqrt{25}$		
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
25						

CAHSEE Released Test Questions:

29. $\left(3^8\right)^2 =$

A 3^4

B 3^6

C 3^{10}

D 3^{16}

34. The square of a whole number is between 1500 and 1600. The number must be between—

A 30 and 35.

B 35 and 40.

C 40 and 45.

D 45 and 50.

M00313

35. Between which two integers is the value of $\sqrt{61}$?

A 6 and 7

B 7 and 8

C 8 and 9

D 9 and 10

M22059

87. Which expression is equal to $\sqrt{100a^2}$?

A $10a$

B $50a$

C $10a^2$

D $50a^2$

M206

CST Math 7 Released Test Questions:

10 **Which is an irrational number?**

A $\sqrt{5}$

B $\sqrt{9}$

C -1

D $-\frac{2}{3}$

CSM00335

28 $\sqrt{225} =$

A 15

B 25

C 35

D 45

CSM01839

29 If $x = 100$, what is the value of $4\sqrt{x}$?

A 20

B 40

C 100

D 200

30 The value of $\sqrt{85}$ is between which two integers?

A 8 and 9

B 9 and 10

C 41 and 42

D 42 and 43

CSM40231

Warm-Up

CST: Grade 7NS1.2

3 $\left(\frac{2}{3}\right)^4 =$

A $\frac{8}{81}$

B $\frac{16}{81}$

C $\frac{8}{3}$

D $\frac{16}{3}$

CSM10434

Review: Grade 7

Classify each expression as rational or irrational.

a. $\sqrt{96}$

b. $\sqrt{70}$

c. $\sqrt{40}$

Current: Grade 7

Simplify.

$(3x^3)^2$

Other: Grade 4MG 1.4

Find the area of the square.