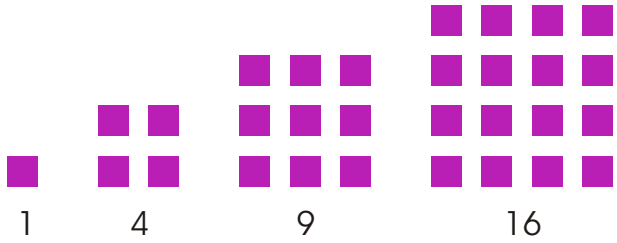
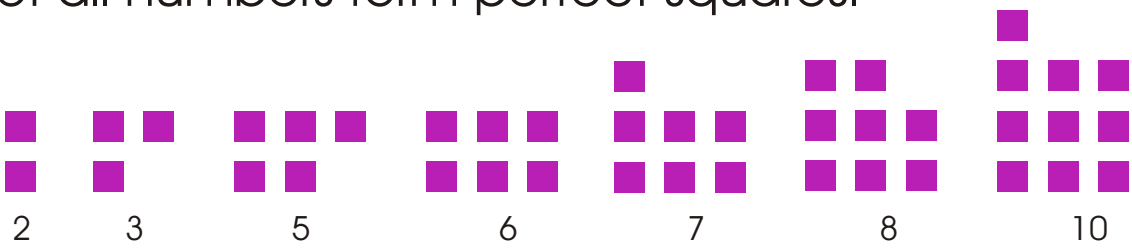
Perfect Squares and Square Roots

Positive integers can be represented using a square pattern or a pattern that is almost square. For example, the numbers 1, 4, 9, and 16 can be represented as shown:



These numbers are called perfect squares because they form a perfect square. (Technically a perfect square is any number formed by squaring an integer or by squaring a ratio of integers. For this lesson we will only square integers.)

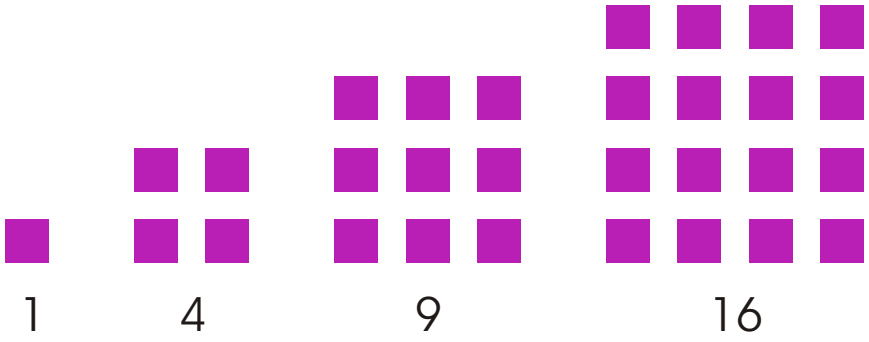
Not all numbers form perfect squares.



These numbers form shapes that are close to squares but not perfect squares.

Perfect Squares and Square Roots

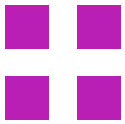
If a number forms a perfect square then all of its sides are the same length and the length of a side is the square root of the number



1 4 9 16

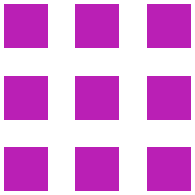
1

Side length = 1 $\sqrt{1} = 1$



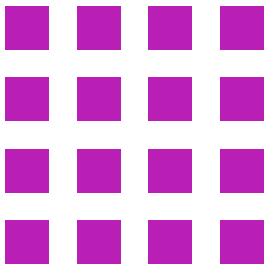
4

Side length = 2 $\sqrt{4} = 2$



9

Side length = 3 $\sqrt{9} = 3$

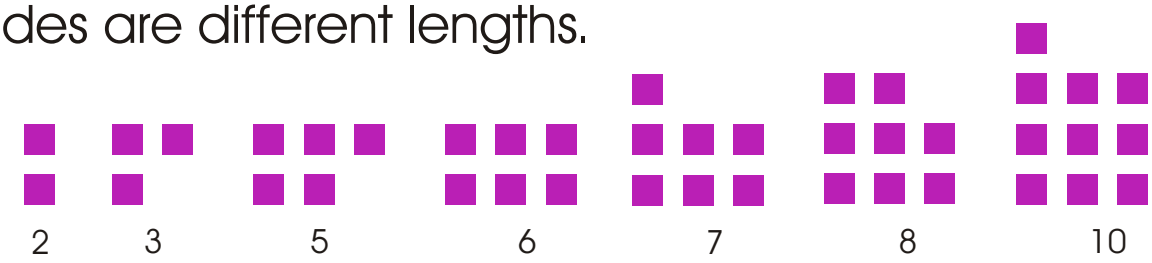


16

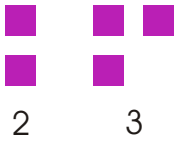
Side length = 4 $\sqrt{16} = 4$

Perfect Squares and Square Roots

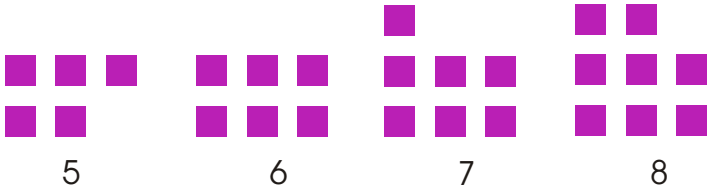
If a number dose not form a perfect square then its sides are different lengths.



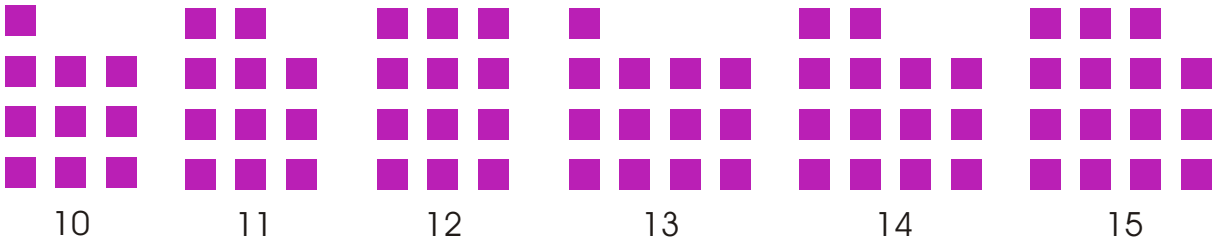
Which side is the square root? None of them are. The square root is between two of the sides, the longest side and the second longest side.



The square root of both of these is between 1 and 2 because the longest side is 2 for both of them and the second longest side is 1 for both of them.



The square root of each of these is between 2 and 3 because the longest side is 3 for each of them and the second longest side is 2 for each of them.



The square root of each of these is between 3 and 4 because the longest side is 4 for each of them and the second longest side is 3 for each of them.

Perfect Squares and Square Roots

Using pictures to find square roots works for small numbers like the ones shown here but it is not practical for large numbers like 84, or 300, or 5273. For large numbers you can use the definition of a square root to find the square root of a number.

The square root of a number **a** is the number **b** that you multiply by itself to get the number **a**. mathematically this looks like **b•b**= **a**.

$\sqrt{1} = 1$ because $1 \cdot 1 = 1$

$\sqrt{4} = 2$ because $2 \cdot 2 = 4$

$\sqrt{9} = 3$ because $3 \cdot 3 = 9$

$\sqrt{16} = 4$ because $4 \cdot 4 = 16$

$\sqrt{25} = 5$ because $5 \cdot 5 = 25$

$\sqrt{36} = 6$ because $6 \cdot 6 = 36$

$\sqrt{49} = 7$ because $7 \cdot 7 = 49$

$\sqrt{64} = 8$ because $8 \cdot 8 = 64$

$\sqrt{81} = 9$ because $9 \cdot 9 = 81$

$\sqrt{100} = 10$ because $10 \cdot 10 = 100$

Perfect Squares and Square Roots

1

$\sqrt{1} = 1$

2

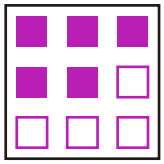
$\sqrt{2}$ is between 1 and 2

3

$\sqrt{3}$ is between 1 and 2

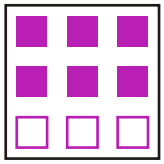
4

$\sqrt{4} = 2$



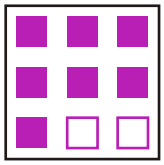
5

$\sqrt{5}$ is between 2 and 3



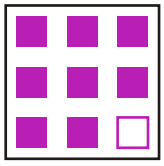
6

$\sqrt{6}$ is between 2 and 3



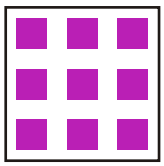
7

$\sqrt{7}$ is between 2 and 3



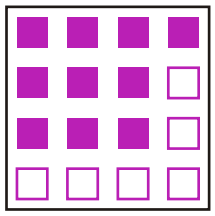
8

$\sqrt{8}$ is between 2 and 3



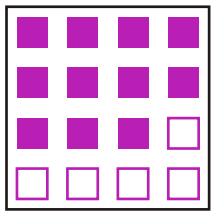
9

$\sqrt{9} = 3$



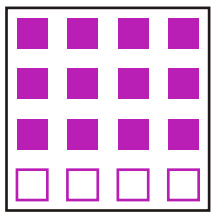
10

$\sqrt{10}$ is between 3 and 4



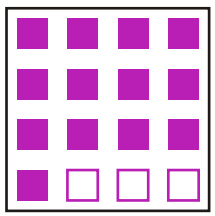
11

$\sqrt{11}$ is between 3 and 4



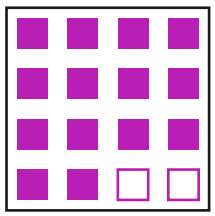
12

$\sqrt{12}$ is between 3 and 4



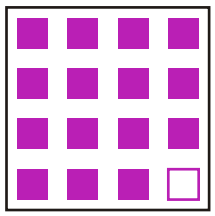
13

$\sqrt{13}$ is between 3 and 4



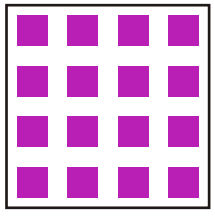
14

$\sqrt{14}$ is between 3 and 4



15

$\sqrt{15}$ is between 3 and 4



16

$\sqrt{16} = 4$

Perfect Squares and Square Roots

$1^2 = 1 \cdot 1 = 1$	$\sqrt{1} = 1$
$2^2 = 2 \cdot 2 = 4$	$\sqrt{4} = 2$
$3^2 = 3 \cdot 3 = 9$	$\sqrt{9} = 3$
$4^2 = 4 \cdot 4 = 16$	$\sqrt{16} = 4$
$5^2 = 5 \cdot 5 = 25$	$\sqrt{25} = 5$
$6^2 = 6 \cdot 6 = 36$	$\sqrt{36} = 6$
$7^2 = 7 \cdot 7 = 49$	$\sqrt{49} = 7$
$8^2 = 8 \cdot 8 = 64$	$\sqrt{64} = 8$
$9^2 = 9 \cdot 9 = 81$	$\sqrt{81} = 9$
$10^2 = 10 \cdot 10 = 100$	$\sqrt{100} = 10$
$11^2 = 11 \cdot 11 = 121$	$\sqrt{121} = 11$
$12^2 = 12 \cdot 12 = 144$	$\sqrt{144} = 12$
$13^2 = 13 \cdot 13 = 169$	$\sqrt{169} = 13$
$14^2 = 14 \cdot 14 = 196$	$\sqrt{196} = 14$
$15^2 = 15 \cdot 15 = 225$	$\sqrt{225} = 15$
$16^2 = 16 \cdot 16 = 256$	$\sqrt{256} = 16$
$17^2 = 17 \cdot 17 = 289$	$\sqrt{289} = 17$
$18^2 = 18 \cdot 18 = 324$	$\sqrt{324} = 18$
$19^2 = 19 \cdot 19 = 361$	$\sqrt{361} = 19$
$20^2 = 20 \cdot 20 = 400$	$\sqrt{400} = 20$
$21^2 = 21 \cdot 21 = 441$	$\sqrt{441} = 21$
$22^2 = 22 \cdot 22 = 484$	$\sqrt{484} = 22$
$23^2 = 23 \cdot 23 = 529$	$\sqrt{529} = 23$
$24^2 = 24 \cdot 24 = 576$	$\sqrt{576} = 24$
$25^2 = 25 \cdot 25 = 625$	$\sqrt{625} = 25$
$26^2 = 26 \cdot 26 = 676$	$\sqrt{676} = 26$
$27^2 = 27 \cdot 27 = 729$	$\sqrt{729} = 27$
$28^2 = 28 \cdot 28 = 784$	$\sqrt{784} = 28$
$29^2 = 29 \cdot 29 = 841$	$\sqrt{841} = 29$
$30^2 = 30 \cdot 30 = 900$	$\sqrt{900} = 30$
$31^2 = 31 \cdot 31 = 961$	$\sqrt{961} = 31$