Topic 3.1: Squares & Square Roots

A square number is a product of two equivalent numbers. A perfect square number is the product of two equivalent integers.

ex) $3 \times 3 = 9 \leftarrow$ perfect square number, because 3 is an integer.

A square root is a number that when multiplied by itself equals a square. If the square root is an integer, the product is a perfect square.

ex) $5 \times 5 = 25$
$\qquad \uparrow \; \uparrow$
Square root is 5; 25 is a perfect square.

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You need to memorize these perfect squares/square roots!

Perfect Squares	1	4	9	16	25	36	49	64	81	100	121	144
	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕
Square Roots	1	2	3	4	5	6	7	8	9	10	11	12

**Using Prime Factorization to Determine Perfect Squares**

When you determine the prime factors of a number (use a factor tree), grouping the factors into two equal groups can produce a perfect square. For example:

$$81 = 3 \times 3 \times 3 \times 3$$
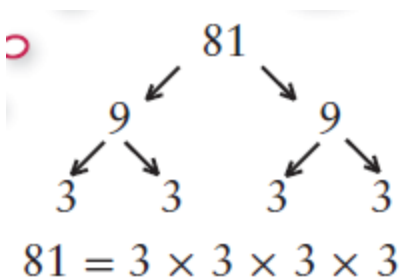
Explanation: 81 has four factors, all of them are 3s. We can make two groups with two 3s in each group:

$$(3 \times 3) \; and \; (3 \times 3)$$

Each group has a product of 9. Therefore, the square root of 81 is 9. **81 is a perfect square.**

$$24 = 2 \times 2 \times 2 \times 3$$
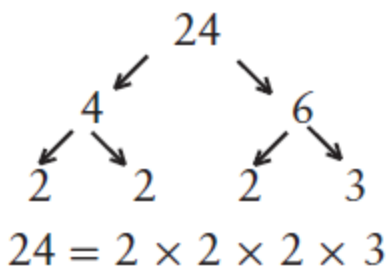
Explanation: 24 has four factors (three 2s and one 3). Even though we have an even number of factors, we cannot make two even groups with these factors. One group would have two 2s and the other would have one 2 and one 3.

Therefore, 24 is not a perfect square.