2-6-5 Roots

$\sqrt{9} = 3$ because 3 times 3 is 9 $\sqrt{25} = 5$ because 5 times 5 is 25

When working a square root problem, ask:
"What times itself is the number inside the root symbol?"

$\sqrt[3]{27} = 3$ because 3x3x3 is 27. The small 3 outside the root symbol tells how many times the answer must be multiplied to get the number inside the root.

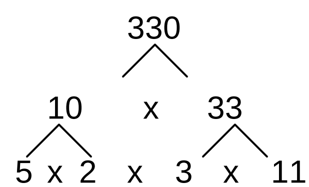
Prime number: a number with only factor of 1 and itself. 2 3, 5, 7,11,13,17, 19, 23... are prime numbers.
15 is not prime because 3 and 5 also divide it evenly. 15 is a **composite number.**

$\sqrt[5]{32} = 2$ because 2x2x2x2x2 or 2^5=32

Practice: Simplify.

a)	$\sqrt[3]{64} =$	$\sqrt[3]{125} =$	$\sqrt[3]{216}$
b)	$\sqrt[4]{81} =$	$\sqrt[5]{1024} =$	$\sqrt[6]{64} =$
c)	$\sqrt[4]{625} =$	$\sqrt[5]{243} =$	$\sqrt[5]{100000} =$
d)	$\sqrt[3]{8} =$	$\sqrt[4]{16} =$	$\sqrt[4]{256} =$

Prime factorization is writing a number using multiplication of only prime numbers.
12 can be written as 3x4 ,but 4 is not prime and can be written as 2x2,
so the prime factorization of 12 = 3x2x2 This can be written $3x2^2$.
To write 330 using its prime factorization, start breaking it up into smaller factors until there are no more composite numbers.
330=33x10=3x11x2x5



Practice: Write the prime factorization for the following.

a)	12	8	27	100
b)	56	28	36	32
c)	50	42	18	25
d)	75	48	360	72
e)	7875	50176	7200	3136
f)	405	432	5488	9375
g)	864	442368	3600	1225

Simplifying roots. You won't be using the root button on your calculator for these.

$\sqrt{45} = \sqrt{3 \cdot 3 \cdot 5}$
$= \sqrt{3^2} \cdot \sqrt{5} = 3\sqrt{5}$

First write the number as it's prime factorization.
Then, because this was a square root, a pair of 3s can be simplified to a 3 outside the root. To get an exact answer, leave the 5 inside the root rather than using a calculator.

$\sqrt[4]{19440}$ Prime factorization $\sqrt[4]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 5}$ four 2's and four 3's and fourth root so $\sqrt[4]{2^4} \cdot \sqrt[4]{3^4} \cdot \sqrt[4]{3 \cdot 5} = 2 \cdot 3\sqrt[4]{15} = 6\sqrt[4]{15}$ This is the simplest form of the root.

Practice: Write the roots in simplest form.

a) $\sqrt{75} = \sqrt{5 \cdot 5 \cdot 3} = 5\sqrt{3}$ $\quad \sqrt{245} =$ $\quad \sqrt{18} =$ $\quad \sqrt{28} =$

b) $\sqrt{300} = \sqrt{3 \cdot 2 \cdot 2 \cdot 5 \cdot 5} = 2 \cdot 5\sqrt{3} = 10\sqrt{3}$ $\quad \sqrt{360} =$ $\quad \sqrt{1125} =$ $\quad \sqrt{392} =$

c) $\sqrt{576} =$ $\quad \sqrt{968} =$ $\quad \sqrt{3600} =$ $\quad \sqrt{2700} =$

d) $\sqrt{2016} =$ $\quad \sqrt{3528} =$ $\quad \sqrt{70000} =$ $\quad \sqrt{1575} =$

e) $\sqrt[3]{500} = \sqrt[3]{5 \cdot 5 \cdot 5 \cdot 2 \cdot 2} = 5\sqrt[3]{4}$ $\quad \sqrt[3]{1080} =$ $\quad \sqrt[3]{576} =$ $\quad \sqrt[3]{2744} =$

f) $\sqrt[4]{400} = \sqrt[4]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5} = 2\sqrt[4]{25}$ $\quad \sqrt[4]{567} =$ $\quad \sqrt[4]{20000} =$ $\quad \sqrt[4]{1296} =$

Using a calculator will give an approximation.
In the example above $\sqrt[4]{19440} \approx 11.81$ rounded to the nearest hundredth.
To use your calculator, you need to learn another notation.

Rule: $\sqrt[y]{x} = x^{1/y}$

Example: $\sqrt[4]{52} = 52^{1/4} = 52^{0.25}$ On your calculator find the x^y button or y^x. Type 52 then hit the y^x button. Then type .25 = 2.69 (Rounded)

Practice: First, rewrite the root using a fractional exponent. Then use your calculator to find the answer rounded to the nearest hundredth.

g)	$\sqrt[4]{123} = 123^{1/4}$ type 123 y^x then .25 =	$\sqrt[5]{159} \approx$	$\sqrt[10]{100000} \approx$
h)	$\sqrt[3]{25} = 25^{1/3}$ type 25 y^x then (1/3)=	$\sqrt[4]{578} \approx$	$\sqrt[3]{951} \approx$
i)	$\sqrt[4]{5^3} = 5^{3/4} = 5^{.75} \approx$	$\sqrt[3]{5^2} = 5^{2/3} \approx$	$\sqrt[3]{8^5} =$
j)	$\sqrt{20} \approx$	$\sqrt{48} \approx$	$\sqrt{345} \approx$

All the rules that work for exponents work for these fractional exponents. This is learned and practiced in future math classes.