

7.1 n^{th} Roots and Rational Exponents

n^{th} Root Vocabulary:

- b is the square root of a if $b^2 = a$
 - **Example:** ____ is the square root of ____ if _____
 - **Written as:** _____
- b is the cube root of a if $b^3 = a$
 - **Example:** ____ is the cube root of ____ if _____
 - **Written as:** _____
- b is the fourth root of a if $b^4 = a$
 - **Example:** ____ is the fourth root of ____ if _____
 - **Written as:** _____
- b is the fifth root of a if $b^5 = a$
 - **Example:** ____ is the fifth root of ____ if _____
 - **Written as:** _____
- **In general,** b is the n^{th} root of a if $b^n = a$
 - The n^{th} root of a number a can be written as _____, where n is the index/root.

Examples:

Simplify.

1) $\sqrt{16} =$

2) $\sqrt{-196} =$

3) $\sqrt{60} =$

4) $\sqrt{-288} =$

5) $\sqrt[3]{125} =$

6) $\sqrt[3]{-1000} =$

7) $\sqrt[3]{216} =$

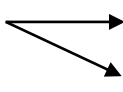
8) $\sqrt[3]{-8} =$

9) $\sqrt[4]{81} =$

10) $\sqrt[4]{625} =$

11) $\sqrt[4]{1} =$

12) $\sqrt[4]{-1} =$

If the index/root is: 

- even & radicand is negative, there is _____.
- odd & radical is negative, the solution follows the _____ of the _____.

No matter what the index/root is, if the radicand is POSITIVE, there is ALWAYS a solution!!!

Find the indicated root(s) of a .

13) $n = 3, a = -64$

14) $n = 4, a = 16$

15) $n = 2, a = 81$

16) $n = 3, a = 343$

17) $n = 4, a = -1296$

Instead of using a radical to write an n^{th} root, you can use a fractional exponent.



Examples:

18) $9^{\frac{1}{2}} =$

19) $16^{\frac{1}{4}} =$

20) $64^{\frac{1}{3}} =$

21) $(-32)^{\frac{1}{4}} =$

22) $(-8)^{\frac{1}{3}} =$

Practice:

23) $25^{\frac{1}{2}} =$

24) $(-81)^{\frac{1}{4}} =$

25) $125^{\frac{1}{3}} =$

26) $(-81)^{\frac{1}{2}} =$

27) $(-8)^{\frac{1}{3}} =$

Rational Exponents / Fractional Exponents:

- You can use a fraction as an exponent to write a combination of a power and an n^{th} root.



28) Rewrite $\sqrt[4]{5^3}$ using rational exponents.

29) Rewrite $\frac{1}{\sqrt[6]{4}}$ using rational exponents.

30) Rewrite $7^{\frac{2}{5}}$ using radicals.

31) Rewrite $2^{-\frac{2}{3}}$ using rational exponents.

Evaluate the expression:

32) $4^{\frac{3}{2}}$

33) $8^{-\frac{2}{3}}$

34) $25^{\frac{3}{2}}$

35) $16^{-\frac{5}{4}}$

36) $(-32)^{\frac{3}{5}}$