# Exponents

## Convert radicals and exponents

Name:_____ Date:_____

### Formulas

**To convert a radical to an exponent with a fraction:**

$$\sqrt[n]{a} = a^{\frac{1}{n}}$$

**To convert an exponent with a fraction to a radical:**

$$a^{\frac{m}{n}} = \sqrt[n]{a^m}$$

### Examples

1. Convert $\sqrt[3]{x^2}$ to an exponent with a fraction.
   Solution: $\sqrt[3]{x^2} = x^{\frac{2}{3}}$
2. Convert $2^{\frac{3}{4}}$ to a radical.
   Solution: $2^{\frac{3}{4}} = \sqrt[4]{2^3}$
3. Convert $\sqrt{y}$ to an exponent with a fraction.
   Solution: $\sqrt{y} = y^{\frac{1}{2}}$
4. Convert $x^{\frac{5}{2}}$ to a radical.
   Solution: $x^{\frac{5}{2}} = \sqrt{x^5}$

### Practice

Convert expressions between radicals and exponents

1. $\sqrt[4]{x^3}$
2. $3^{\frac{2}{5}}$
3. $\sqrt[3]{a^5}$
4. $5^{\frac{3}{2}}$
5. $\sqrt[5]{x^6}$
6. $4^{\frac{3}{4}}$
7. $\sqrt{z^3}$
8. $2^{\frac{4}{3}}$
9. $\sqrt[6]{y^4}$
10. $7^{\frac{5}{3}}$
11. $\sqrt[3]{x^4}$
12. $6^{\frac{2}{5}}$
13. $\sqrt{a^6}$
14. $8^{\frac{5}{3}}$
15. $\sqrt[5]{y^7}$
16. $9^{\frac{3}{2}}$
17. $\sqrt{z^4}$
18. $10^{\frac{1}{2}}$
19. $\sqrt[6]{x^8}$
20. $11^{\frac{7}{3}}$

**Practice Problems with Detailed Solutions**

## 1. Convert $\sqrt[4]{x^3}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = x^3$ and $n = 4$, we get $x^{\frac{3}{4}}$.

**Explanation:** Taking the fourth root of $x^3$

is equivalent to raising $x^3$ to the power of $\frac{1}{4}$.

## 2. Convert $3^{\frac{2}{5}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$

Substituting $a = 3$, $m = 2$, and $n = 5$, we get $\sqrt[5]{3^2}$.

**Explanation:** Raising 3 to the power of $\frac{2}{5}$

is equivalent to taking the fifth root of $3^2$.

## 3. Convert $\sqrt[3]{a^5}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = a^5$ and $n = 3$, we get $(a^5)^{\frac{1}{3}}$.

**Explanation:** Taking the cube root of $a^5$

is equivalent to raising $a^5$ to the power of $\frac{1}{3}$.

## 4. Convert $5^{\frac{3}{2}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 5$, $m = 3$, and $n = 2$, we get $\sqrt{5^3}$.

**Explanation:** Raising 5 to the power of $\frac{3}{2}$

is equivalent to taking the square root of $5^3$.

## 5. Convert $\sqrt[5]{x^6}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = x^6$ and $n = 5$, we get $(x^6)^{\frac{1}{5}}$.

**Explanation:** Taking the fifth root of $x^6$

is equivalent to raising $x^6$ to the power of $\frac{1}{5}$.

## 6. Convert $4^{\frac{3}{4}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 4$, $m = 3$, and $n = 4$, we get $\sqrt[4]{4^3}$.

**Explanation:** Raising 4 to the power of $\frac{3}{4}$

is equivalent to taking the fourth root of $4^3$.

## 7. Convert $\sqrt{z^3}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = z^3$ and $n = 2$, we get $(z^3)^{\frac{1}{2}}$.

**Explanation:** Taking the square root of $z^3$

is equivalent to raising $z^3$ to the power of $\frac{1}{2}$.

## 8. Convert $2^{\frac{4}{3}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 2$, $m = 4$, and $n = 3$, we get $\sqrt[3]{2^4}$.

**Explanation:** Raising 2 to the power of $\frac{4}{3}$

is equivalent to taking the cube root of $2^4$.

## 9. Convert $\sqrt[6]{y^4}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = y^4$ and $n = 6$, we get $(y^4)^{\frac{1}{6}}$.

**Explanation:** Taking the sixth root of $y^4$

is equivalent to raising $y^4$ to the power of $\frac{1}{6}$.

## 10. Convert $7^{\frac{5}{3}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 7$, $m = 5$, and $n = 3$, we get $\sqrt[3]{7^5}$.

**Explanation:** Raising 7 to the power of $\frac{5}{3}$

is equivalent to taking the cube root of $7^5$.

## 11. Convert $\sqrt[3]{x^4}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = x^4$ and $n = 3$, we get $(x^4)^{\frac{1}{3}}$.

**Explanation:** Taking the cube root of $x^4$

is equivalent to raising $x^4$ to the power of $\frac{1}{3}$.

## 12. Convert $6^{\frac{2}{5}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 6$, $m = 2$, and $n = 5$, we get $\sqrt[5]{6^2}$.

**Explanation:** Raising 6 to the power of $\frac{2}{5}$

is equivalent to taking the fifth root of $6^2$.

## 13. Convert $\sqrt{a^6}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = a^6$ and $n = 2$, we get $(a^6)^{\frac{1}{2}}$.

**Explanation:** Taking the square root of $a^6$

is equivalent to raising $a^6$ to the power of $\frac{1}{2}$.

## 14. Convert $8^{\frac{5}{3}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 8$, $m = 5$, and $n = 3$, we get $\sqrt[3]{8^5}$.

**Explanation:** Raising 8 to the power of $\frac{5}{3}$

is equivalent to taking the cube root of $8^5$.

## 15. Convert $\sqrt[5]{y^7}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = y^7$ and $n = 5$, we get $(y^7)^{\frac{1}{5}}$.

**Explanation:** Taking the fifth root of $y^7$

is equivalent to raising $y^7$ to the power of $\frac{1}{5}$.

## 16. Convert $9^{\frac{3}{2}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 9$, $m = 3$, and $n = 2$, we get $\sqrt{9^3}$.

**Explanation:** Raising 9 to the power of $\frac{3}{2}$

is equivalent to taking the square root of $9^3$.

## 17. Convert $\sqrt{z^4}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = z^4$ and $n = 2$, we get $(z^4)^{\frac{1}{2}}$.

**Explanation:** Taking the square root of $z^4$

is equivalent to raising $z^4$ to the power of $\frac{1}{2}$.

## 18. Convert $10^{\frac{1}{2}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 10$, $m = 1$, and $n = 2$, we get $\sqrt{10}$.

**Explanation:** Raising 10 to the power of $\frac{1}{2}$

is equivalent to taking the square root of $10^1$.

## 19. Convert $\sqrt[6]{x^8}$ to an exponent with a fraction.

**Solution:** We use the formula $\sqrt[n]{a} = a^{\frac{1}{n}}$.

Substituting $a = x^8$ and $n = 6$, we get $(x^8)^{\frac{1}{6}}$.

**Explanation:** Taking the sixth root of $x^8$

is equivalent to raising $x^8$ to the power of $\frac{1}{6}$.

## 20. Convert $11^{\frac{7}{3}}$ to a radical.

**Solution:** We use the formula $a^{\frac{m}{n}} = \sqrt[n]{a^m}$.

Substituting $a = 11$, $m = 7$, and $n = 3$, we get $\sqrt[3]{11^7}$.

**Explanation:** Raising 11 to the power of $\frac{7}{3}$

is equivalent to taking the cube root of $11^7$.