

NOTES: Nth Roots Name: _____

RATIONAL EXPONENTS:

$$X^{m/n} = \sqrt[n]{X^m}$$

NEGATIVE EXPONENTS:

$$X^{-n} = \frac{1}{X^n}$$

1. $100^{1/2} = \sqrt{100} = 10$	2. $16^{1/4} = \sqrt[4]{16} = 2$	3. $100,000^{1/5} = \sqrt[5]{100,000} = 10$	4. $27^{1/3} = \sqrt[3]{27} = 3$
5. $225^{1/2} = \sqrt{225} = 15$	6. $216^{1/3} = \sqrt[3]{216} = 6$	7. $1,000^{1/3} = \sqrt[3]{1000} = 10$	8. $1^{1/4} = \sqrt[4]{1} = 1$
1. $100^{3/2} = \frac{2\sqrt{100}}{10^3} = 1000$	2. $16^{3/4} = \frac{4\sqrt[4]{16}}{2^3} = 8$	3. $1000^{2/3} = \frac{3\sqrt[3]{1000}}{10} = 10$	4. $25^{3/2} = \frac{2\sqrt{25}}{5^3} = 125$
5. $8^{4/3} = \frac{3\sqrt[3]{8}}{2^4} = 16$	6. $64^{2/3} = \frac{3\sqrt[3]{64}}{4^2} = 16$	7. $64^{3/2} = \frac{2\sqrt{64}}{8^3} = 512$	8. $32^{3/5} = \frac{5\sqrt[5]{32}}{2^3} = 8$
1. $10^{-2} = \frac{1}{10^2} = \frac{1}{100}$	2. $16^{-1/2} = \frac{1}{16^{1/2}} = \frac{1}{\sqrt{16}} = \frac{1}{4}$	3. $1000^{-2/3} = \frac{1}{1000^{2/3}} = \frac{1}{\sqrt[3]{1000}^2} = \frac{1}{10^2} = \frac{1}{100}$	4. $\left(\frac{1}{4}\right)^{-1/2} = \left(\frac{4}{1}\right)^{1/2} = 4^{1/2} = \sqrt{4} = 2$
5. $6^{-3} = \frac{1}{6^3} = \frac{1}{216}$	6. $32^{-3/5} = \frac{1}{32^{3/5}} = \frac{1}{\sqrt[5]{32}^3} = \frac{1}{2^3} = \frac{1}{8}$	7. $7^{-2} = \frac{1}{7^2} = \frac{1}{49}$	8. $\left(\frac{9}{16}\right)^{-1/2} = \left(\frac{16}{9}\right)^{1/2} = \sqrt{\frac{16}{9}} = \frac{4}{3}$

NOTES: Simplifying Radicals and Operations

SIMPLEST FORM: if the radicand has no perfect nth powers as factors and any denominator is rationalized.
LIKE RADICALS: radical expressions with the same index and radicand (addition and subtraction)

$$(-2)(-2)(-2) = -8$$

Simplify all radicals.

1
8
27
64
125

1. $\sqrt[3]{-16}$ $\sqrt[3]{-8} \sqrt[3]{2}$ $(-2 \sqrt[3]{2})$	2. $3\sqrt[4]{256}$ $3(4)$ (12)
3. $\sqrt[3]{-8x^9y^{10}}$ $\sqrt[3]{-8x^3y^9} \sqrt[3]{y}$ $(-2xy^3 \sqrt[3]{y})$	4. $\sqrt[4]{16x^{12}y^{10}}$ $\sqrt[4]{16x^{12}y^8} \sqrt[4]{y^2}$ $(2x^3y^2 \sqrt[4]{y^2})$

Operations with all radicals.

5. $\sqrt[4]{6} \cdot \sqrt[4]{8}$ $\sqrt[4]{48}$ $\sqrt[4]{16} \sqrt[4]{3}$ → $(2 \sqrt[4]{3})$	6. $3\sqrt[4]{8} \cdot 5\sqrt[4]{2}$ $15 \sqrt[4]{16}$ $15(2)$ → (30)
7. $\frac{\sqrt[3]{-256}}{\sqrt[3]{2}}$ $\sqrt[3]{128}$ $\sqrt[3]{64} \sqrt[3]{2}$ → $(4 \sqrt[3]{2})$	8. $\sqrt{-45} - \sqrt{-125}$ or $\sqrt{-9\sqrt{5}} - \sqrt{-25\sqrt{5}}$ $i\sqrt{45} - i\sqrt{125}$ $3i\sqrt{5} - 5i\sqrt{5}$ $i\sqrt{9\sqrt{5}} - i\sqrt{25\sqrt{5}}$ $(-2i\sqrt{5})$ $3i\sqrt{5} - 5i\sqrt{5}$ $(-2i\sqrt{5})$
9. $\sqrt[3]{128} - \sqrt[3]{250}$ $\sqrt[3]{64} \sqrt[3]{2} - \sqrt[3]{125} \sqrt[3]{2}$ $4 \sqrt[3]{2} - 5 \sqrt[3]{2}$ $1 \sqrt[3]{2}$	10. $6\sqrt[3]{5} + 2\sqrt[3]{5}$ $(8 \sqrt[3]{5})$

$$(\sqrt[3]{2})$$

1. Convert.

$$x^{2/3}$$

$$\sqrt[3]{x^2}$$

2. Simplify.

$$125^{-2/3} = \frac{1}{125^{2/3}} = \frac{1}{\sqrt[3]{125^2}} = \frac{1}{5^2} = \frac{1}{25}$$

3. Multiply.

$$\sqrt[4]{80} \cdot \sqrt[4]{2}$$

$$\sqrt[4]{160}$$

$$\sqrt[4]{16} \cdot \sqrt[4]{10}$$

$$2\sqrt[4]{10}$$

4. Divide.

$$\frac{\sqrt[5]{-160}}{\sqrt[5]{5}} = \sqrt[5]{-32} = -2$$

5. Add.

$$\sqrt[3]{36} + \sqrt[3]{100}$$

6. Subtract.

$$5\sqrt[4]{32} - \sqrt[4]{1}$$

$$5\sqrt[4]{16}\sqrt[4]{2} - 1$$

$$5(2)\sqrt[4]{2} - 1$$

$$10\sqrt[4]{2} - 1$$

7. Simplify.

$$\sqrt[3]{108x^7}$$

$$\sqrt[3]{27x^6} \sqrt[3]{4x}$$

$$3x^2 \sqrt[3]{4x}$$

8. Simplify.

$$\sqrt[3]{-56a^8b^{21}c^4}$$

$$\sqrt[3]{-8a^6b^{21}c^3} \sqrt[3]{7a^2c}$$

$$-2a^2b^7c \sqrt[3]{7a^2c}$$

PRACTICE: RADICAL PROPERTIES

Simplify the radicals.

1. $\sqrt{48}$ $\sqrt{16} \sqrt{3}$ $4\sqrt{3}$	2. $\sqrt{75} = \sqrt{25} \sqrt{3}$ $5\sqrt{3}$	3. $5^3 \sqrt{64}$ $5(4)$ 20
4. $3^4 \sqrt{32}$ $3^4 \sqrt{16} \sqrt{2}$ $3(2)^4 \sqrt{2} = 6^4 \sqrt{2}$	5. $10^5 \sqrt{32}$ $10(2)$ 20	6. $\sqrt[3]{x^3}$ x
7. $\sqrt[3]{x+4}^3$ $x+4$	8. $\sqrt[7]{x^7}$ x	9. $2\sqrt{x^7}$ $\sqrt{x^6} \sqrt{x} = x^3 \sqrt{x}$
10. $\sqrt{100x^6}$ $10x^3$	11. $\sqrt{32x^{13}}$ $\sqrt{16x^{12}} \sqrt{2x}$ $4x^6 \sqrt{2x}$	12. $\sqrt[4]{x^{19}}$ $\sqrt[4]{x^{16}} \sqrt[4]{x^3}$ $x^4 \sqrt[4]{x^3}$
13. $\sqrt{64x^4 y^{100}}$ $8x^2 y^{50}$	14. $\sqrt[3]{16x^{11}}$ $\sqrt[3]{16x^9} \sqrt[3]{x^2}$ $2x^3 \sqrt[3]{x^2}$	15. $\sqrt[4]{64x^4 y^{100}}$ $\sqrt[4]{16x^4 y^{100}} \sqrt[4]{4}$ $2xy^{25} \sqrt[4]{4}$

Simplify the radicals by adding, subtracting, multiplying, or dividing.

16. $\sqrt{3} \cdot \sqrt{5}$ $\sqrt{15}$	17. $6\sqrt{3} \sqrt{3} =$ $6\sqrt{9}$ $6(3)$ 18	18. $3\sqrt{20} \cdot 6\sqrt{5}$ $18\sqrt{100}$ $18(10)$ 180
19. $\sqrt{32} + 3\sqrt{2}$ $\sqrt{16} \sqrt{2} + 3\sqrt{2}$ $4\sqrt{2} + 3\sqrt{2}$ $7\sqrt{2}$	20. $2\sqrt{27} - 3\sqrt{48}$ $2\sqrt{9} \sqrt{3} - 3\sqrt{16} \sqrt{3}$ $2(3)\sqrt{3} - 3(4)\sqrt{3}$ $6\sqrt{3} - 12\sqrt{3}$ $-6\sqrt{3}$	21. $6^3 \sqrt{32} - 5^3 \sqrt{4}$ $6^3 \sqrt{8} \sqrt{4} - 5^3 \sqrt{4}$ $6(2) \sqrt[3]{4} - 5^3 \sqrt{4}$ $12 \sqrt[3]{4} - 5^3 \sqrt{4}$ $7 \sqrt[3]{4}$

CHOOSE 5 of the 8 questions to simplify.

<p>1. $\sqrt[4]{2} \cdot \sqrt[4]{8}$</p> <p>$\sqrt[4]{16}$</p> <p>(2)</p>	<p>2. $\frac{\sqrt[4]{32}}{\sqrt[4]{2}}$</p> <p>$\sqrt[4]{16}$</p> <p>(2)</p>
<p>3. $\frac{\sqrt[4]{192}}{\sqrt[4]{6}}$</p> <p>$\sqrt[4]{32}$</p> <p>$\sqrt[4]{16} \sqrt[4]{2}$</p> <p>(2 $\sqrt[4]{2}$)</p>	<p>4. $(3^{3/2})^2$</p> <p>$3 \cdot \frac{2}{1} = 3$</p> <p>3^3</p> <p>(27)</p>
<p>5. $\sqrt[3]{7} \cdot \sqrt[3]{49}$</p> <p>$\sqrt[3]{7} \cdot \sqrt[3]{7^2}$</p> <p>$\sqrt[3]{7^3}$</p> <p>(7)</p> <p>or</p> <p>$\sqrt[3]{343}$</p> <p>(7)</p>	<p>6. $(\frac{54}{64})^{1/3}$</p> <p>$(\frac{27}{32})^{1/3}$</p> <p>$\sqrt[3]{\frac{27}{32}}$</p> <p>$\frac{\sqrt[3]{27}}{\sqrt[3]{32}}$</p> <p>$\frac{3}{\sqrt[3]{8} \sqrt[3]{4}}$</p> <p>$\frac{3}{2 \sqrt[3]{4}}$</p> <p>($\frac{3}{2 \sqrt[3]{4}}$)</p>
<p>7. $\frac{11}{\sqrt[4]{11}}$</p> <p>$\frac{11^1}{11^{1/4}}$</p> <p>($11^{3/4}$)</p> <p>$1 - \frac{1}{4}$</p> <p>$\frac{4}{4} - \frac{1}{4}$</p> <p>$\frac{3}{4}$</p>	<p>8. $5^{1/4} \cdot 5^{3/2}$</p> <p>$5^{1/4 + 3/2}$</p> <p>($5^{7/4}$)</p> <p>$\frac{1}{4} + \frac{3}{2}$</p> <p>$\frac{1}{4} + \frac{6}{4}$</p> <p>$\frac{7}{4}$</p>