

n^{th} Roots and Rational Exponents

Review:

Simplifying square roots:

$$1.) \sqrt{45}$$

$$\sqrt{9 \cdot 5}$$

$$3\sqrt{5}$$

$$2.) \sqrt{16}$$

$$4$$

Solving quadratic equations:

$$3.) \sqrt{x^2} = \sqrt{36}$$

$$x = \pm 6$$

$$4.) 2x^2 + 5 = 41$$

$$\quad -5 \quad -5$$

$$\frac{2x^2}{2} = \frac{36}{2}$$

$$\sqrt{x^2} = \sqrt{18} \quad x = \pm 3\sqrt{2}$$

Perfect Squares		Perfect Cubes	
$1^2 = 1$	$6^2 = 36$	$1^3 = 1$	$5^3 = 125$
$2^2 = 4$	$7^2 = 49$	$2^3 = 8$	$6^3 = 216$
$3^2 = 9$	$8^2 = 64$	$3^3 = 27$	$7^3 = 343$
$4^2 = 16$	$9^2 = 81$	$4^3 = 64$	
$5^2 = 25$	$10^2 = 100$		

Simplifying n^{th} Roots:

$$5.) \sqrt[3]{8}$$

$$2$$

$$6.) \sqrt[4]{81}$$

$$3$$

$$7.) \sqrt[5]{-32}$$

$$-2$$

$$8.) \sqrt[3]{8x^6}$$

$$2x^2$$

$$9.) \sqrt[4]{16x^4}$$

$$2x$$

$$10.) 5\sqrt[3]{-8}$$

$$5(-2)$$

$$-10$$

$$11.) \sqrt[3]{24}$$

$$\sqrt[3]{8 \cdot 3}$$

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

$$12.) 2\sqrt[4]{32}$$

$$2\sqrt[4]{16 \cdot 2}$$

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

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

Solving Equations Using n^{th} Roots:

13.) $\sqrt[3]{x^3} = \sqrt[3]{64}$

$x = 4$

14.) $2x^4 = 162$

$\sqrt[4]{x^4} = \sqrt[4]{81}$

$x = \pm 3$

15.) $\frac{1}{2}x^2 = 6$

$x^2 = 12$

$x = \pm \sqrt{12}$

$x = \pm 2\sqrt{3}$

16.) $(x-3)^3 = 8$

$x-3 = 2$
 $+3 \quad +3$

$x = 5$

17.) $(x-8)^4 = 16$

$x-8 = \pm \sqrt[4]{16}$

$x-8 = \pm 2$

$x-8 = 2$ $x-8 = -2$
 $+8 \quad +8$
 $x = 10$ $x = 6$

Rational Exponents

Use a calculator to evaluate each expression.

Radical Expression	Exponential Expression
$\sqrt{4} = 2$	$4^{\frac{1}{2}} = 2$
$\sqrt[3]{27} = 3$	$27^{\frac{1}{3}} = 3$
$\sqrt[4]{625} = 5$	$625^{\frac{1}{4}} = 5$
$\sqrt[5]{32} = 2$	$32^{\frac{1}{5}} = 2$

$a^{m/n} = (\sqrt[n]{a})^m$

Rewrite each expression in radical exponential form.

18.) $7^{1/5}$

$\sqrt[5]{7}$

19.) $3^{2/5}$

$(\sqrt[5]{3})^2$

20.) $f^{2/7}$

$(\sqrt[7]{f})^2$

Rewrite each expression in exponential form.

21.) $(\sqrt[4]{5})^3$

$5^{3/4}$

22.) $\sqrt[4]{11}$

$11^{1/4}$

23.) $(\sqrt[3]{x})^4$

$x^{4/3}$

Evaluating Expressions with Rational Exponents:

24.) $8^{4/3}$

$$(\sqrt[3]{8})^4$$

$$(2)^4$$

$$\boxed{16}$$

25.) $25^{3/2}$

$$(\sqrt{25})^3$$

$$(5)^3$$

$$\boxed{125}$$

26.) $81^{1/2}$

$$\sqrt{81}$$

$$\boxed{9}$$

★ 27.) $8^{-2/3}$

$$\frac{1}{(\sqrt[3]{8})^2}$$

$$\frac{1}{(2)^2} = \boxed{\frac{1}{4}}$$

28.) $16^{5/4}$

$$(\sqrt[4]{16})^5$$

$$(2)^5$$

$$\boxed{32}$$

29.) $32^{1/5}$

$$\sqrt[5]{32}$$

$$\boxed{2}$$

30.) $4^{3/2}$

$$(\sqrt{4})^3$$

$$(2)^3$$

$$8$$

★ 31.) $8^{-5/3}$

$$\frac{1}{(\sqrt[3]{8})^5}$$

$$\frac{1}{(2)^5}$$

$$\boxed{\frac{1}{32}}$$

★ 32.) $64^{-2/3}$

$$\frac{1}{(\sqrt[3]{64})^2}$$

$$\frac{1}{(4)^2}$$

$$\boxed{\frac{1}{16}}$$