Write each expression in radical form.

1) $(5n)^{\frac{3}{4}}$

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

2) $(10m)^{\frac{5}{4}}$

$\sqrt[4]{(10m)^5}$ $(\sqrt[4]{10m})^5$

3) $(6k)^{\frac{5}{2}}$

$(\sqrt{6k})^5$

$\sqrt{(6k)^5}$

4) $(p^3)^{\frac{1}{6}}$

$\sqrt[6]{p^3}$

Write each expression in exponential form.

5) $\left(\sqrt{6n}\right)^5$

$(6n)^{\frac{5}{2}}$

6) $\left(\sqrt{7x}\right)^3$

$(7x)^{\frac{3}{2}}$

7) $\left(\sqrt[3]{7r}\right)^5$

$(7r)^{\frac{5}{3}}$

8) $\left(\sqrt{n}\right)^3$

$n^{\frac{3}{2}}$

Simplify.

9) $(81p^2)^{\frac{1}{2}}$

$9p$

$\sqrt{81p^2}$

$9p$

10) $(64v^6)^{\frac{1}{6}}$

$2v$

$\sqrt[6]{64v^6}$

64

8 8

4 2 4 2

2 2 2 2

11) $(36n^6)^{\frac{1}{2}}$

$6n^3$

$\sqrt{36n^6}$

$6n^3$

nn nn nn

12) $(64b^3)^{\frac{5}{3}}$

$1024b^5$

$(\sqrt[3]{64b^3})^5$

64

8 8

4 2 4 2

2 2 2 2

2^5

$(4b)^5$

4^5b^5

KEY CONCEPT *For Your Notebook*

Rational Exponents

Let $a^{1/n}$ be an nth root of a, and let m be a positive integer.

$$a^{m/n} = (a^{1/n})^m = (\sqrt[n]{a})^m$$

$$a^{-m/n} = \frac{1}{a^{m/n}} = \frac{1}{(a^{1/n})^m} = \frac{1}{(\sqrt[n]{a})^m}, \; a \neq 0$$

EXAMPLE 2 Evaluate expressions with rational exponents

Evaluate (a) $16^{3/2}$ and (b) $32^{-3/5}$.

Solution

	Rational Exponent Form	Radical Form
a.	$16^{3/2} = (16^{1/2})^3 = 4^3 = 64$	$16^{3/2} = (\sqrt{16})^3 = 4^3 = 64$
b.	$32^{-3/5} = \frac{1}{32^{3/5}} = \frac{1}{(32^{1/5})^3} = \frac{1}{2^3} = \frac{1}{8}$	$32^{-3/5} = \frac{1}{32^{3/5}} = \frac{1}{(\sqrt[5]{32})^3} = \frac{1}{2^3} = \frac{1}{8}$

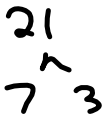
EXAMPLE 4 Solve equations using *n*th roots

Solve the equation.

a. $4x^5 = 128$

$x^5 = 32$	Divide each side by 4.
$x = \sqrt[5]{32}$	Take fifth root of each side.
$x = 2$	Simplify.

b. $(x - 3)^4 = 21$



$x - 3 = \pm\sqrt[4]{21}$	Take fourth roots of each side.
$x = \pm\sqrt[4]{21} + 3$	Add 3 to each side.
$x = \sqrt[4]{21} + 3$ or $x = -\sqrt[4]{21} + 3$	Write solutions separately.
$x \approx 5.14$ or $x \approx 0.86$	Use a calculator.

Discuss why it is + or - for b and not a.

Solve the equation. Round the result to two decimal places when appropriate.

13. $\sqrt[3]{x^3} = \sqrt[3]{64}$ $= 4$

64
8 8
4 2 4 2
2 2 2 2

14. $\frac{1}{2}x^5 = 512 \cdot 2$

$1024^{1/5}$

$x^5 = (512)2$

$\sqrt[5]{1024}$

math #x√

5 math #5 $\sqrt{1024}$

$x = 4$

15. $\frac{3x^2}{3} = \frac{108}{3}$

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

$x = \pm 6$

APPROXIMATING ROOTS Evaluate the expression using a calculator. Round the result to two decimals places when appropriate.

34. $\sqrt[5]{32{,}768}$

35. $\sqrt[7]{1695}$

38. $25^{-1/3}$

39. $20{,}736^{1/4}$

42. $\left(\sqrt[5]{-8}\right)^8$

Evaluating n^{th} Roots
Demonstration of Knowledge:

Rational Exponents WS #2

Write each expression in exponential form.

1) $(\sqrt[5]{m})^7$

2) $(\sqrt{5n})^3$

Write each expression in radical form.

3) $(5p)^{\frac{3}{4}}$

4) $(6x)^{\frac{5}{3}}$

Simplify.

5) $\sqrt{72m^3}$

6) $\sqrt[3]{54r^3}$

7) $(16x^4)^{\frac{5}{4}}$

8) $(27x^6)^{\frac{4}{3}}$