

Warm - up

You need paper and pencil

 negativeexponents.ppt

Working with Rational Exponents

Product of Powers

$$(a \cdot b)^n = a^n b^n$$

$$\begin{aligned} (5 \cdot 7)^2 &= 5^2 \cdot 7^2 \\ &= 35^2 &= 25 \cdot 49 \\ &= 1225 &= 1225 \end{aligned}$$

Quotient of Powers

$$\frac{a^n}{b^n} = \left(\frac{a}{b}\right)^n$$

$$\begin{aligned} \frac{6^3}{2^3} &= \left(\frac{6}{2}\right)^3 \\ &= \frac{216}{8} &= 3^3 \\ &= 27 &= 27 \end{aligned}$$

Roots of Negative Numbers

$$\sqrt{-16} \rightarrow \text{not Real}$$

\hookrightarrow imaginary

$$\sqrt[3]{-8} = -2$$

Rule:

Even roots of negative bases are **imaginary**

Odd roots of negative bases are **real**

Rational Exponents - exponents in a fraction form

What do fractional exponents mean?

$$9^{\frac{1}{2}} \cdot 9^{\frac{1}{2}} = 9^1$$

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

$$(3)^2 = 9^1$$

$$(9^{\frac{1}{2}})^2 = 9 = 3^2$$

$$8^{\frac{1}{3}} \cdot 8^{\frac{1}{3}} \cdot 8^{\frac{1}{3}} = 8^1$$

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

$$(2)^3 = 8^1$$

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

$$(8^{\frac{1}{3}})^2 = 8^{\frac{2}{3}}$$

$$= \sqrt[3]{8^2}$$

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

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

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4.3 Rational Exponents

Powers to help you

$2^1 = 2$	$3^1 = 3$	$4^1 = 4$	$5^1 = 5$
$2^2 = 4$	$3^2 = 9$	$4^2 = 16$	$5^2 = 25$
$2^3 = 8$	$3^3 = 27$	$4^3 = 64$	$5^3 = 125$
$2^4 = 16$	$3^4 = 81$	$4^4 = 256$	$5^4 = 625$
$2^5 = 32$	$3^5 = 243$	$4^5 = 1024$	$5^5 = 3125$
$2^6 = 64$	$3^6 = 729$	$4^6 = 6144$	$5^6 = 15625$

$2^0 = 1$	$3^0 = 1$	$4^0 = 1$	$5^0 = 1$
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$2^{-1} = \frac{1}{2}$	$3^{-1} = \frac{1}{3}$	$4^{-1} = \frac{1}{4}$	$5^{-1} = \frac{1}{5}$
$2^{-2} = \frac{1}{2^2}$	$3^{-2} = \frac{1}{3^2}$	$4^{-2} = \frac{1}{4^2}$	$5^{-2} = \frac{1}{5^2}$

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4.3 Rational Exponents

Rational Exponents Examples:

1. Rewrite the following radical format and then evaluate without a calculator:

(a) $25^{\frac{1}{2}}$ (d) $(-8)^{\frac{1}{3}}$

(b) $32^{\frac{1}{5}}$ (e) $(-16)^{\frac{1}{4}}$

(c) $81^{\frac{1}{4}}$ (f) $-16^{\frac{1}{4}}$

2. Evaluate the following powers:

(a) $8^{\frac{2}{3}}$ (b) $625^{\frac{3}{4}}$ (c) $\left(\frac{243}{32}\right)^{\frac{4}{5}}$

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Answers

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Rational Exponents Examples:

1. Rewrite the following radical format and then evaluate without a calculator:

(a) $25^{\frac{1}{2}}$ (d) $(-8)^{\frac{1}{3}}$
 $= 5$ $= -2$

(b) $32^{\frac{1}{5}}$ (e) $(-16)^{\frac{1}{4}}$
 $= 2$ $= \sqrt[4]{-16}$ ∴ imaginary

(c) $81^{\frac{1}{4}}$ (f) $-16^{\frac{1}{4}}$
 $= 3$ $= -\sqrt[4]{16}$
 $= -2$

2. Evaluate the following powers:

(a) $8^{\frac{2}{3}}$ (b) $625^{\frac{3}{4}}$ (c) $\left(\frac{243}{32}\right)^{\frac{4}{5}}$

$= \sqrt[3]{8^2}$ $= \sqrt[4]{625^3}$ $= \frac{\sqrt[5]{243^4}}{\sqrt[5]{32^4}}$
 $= \sqrt[3]{8^2}$ $= 5^3$ $= \frac{3^4}{2^4}$
 $= 2^2$ $= 125$ $= \frac{81}{16}$
 $= 4$

MCR 3U Lesson 4.1 Rational Exponents (no calculators, please!!)

$2^2 =$	$3^2 =$	$4^2 =$	$5^2 =$	$6^2 =$	$7^2 =$	$8^2 =$	$9^2 =$
$2^3 =$	$3^3 =$	$4^3 =$	$5^3 =$	$6^3 =$	$7^3 =$	$8^3 =$	$9^3 =$
$2^4 =$	$3^4 =$	$4^4 =$	$5^4 =$				
$2^5 =$	$3^5 =$	$4^5 =$					
$2^6 =$	$3^6 =$						
$2^7 =$							
$2^8 =$							
$2^9 =$							
$2^{10} =$							

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

Ex. 1 Evaluate

a) $\sqrt{81}$ b) $\sqrt[3]{8}$ c) $\sqrt[5]{243}$

Ex. 2 Evaluate

a) $64^{\frac{1}{2}}$ b) $49^{-\frac{1}{2}}$ c) $(-100)^{-0.5}$

Ex. 3 Evaluate

a) $64^{\frac{1}{3}}$ b) $(-8)^{\frac{1}{3}}$ c) $-125^{-\frac{1}{3}}$

Answers

MCR 3U Lesson 4.1 Rational Exponents (no calculators, please!!)

$2^2 =$	$3^2 =$	$4^2 =$	$5^2 =$	$6^2 =$	$7^2 =$	$8^2 =$	$9^2 =$
$2^3 =$	$3^3 =$	$4^3 =$	$5^3 =$	$6^3 =$	$7^3 =$	$8^3 =$	$9^3 =$
$2^4 =$	$3^4 =$	$4^4 =$	$5^4 =$				
$2^5 =$	$3^5 =$	$4^5 =$					
$2^6 =$	$3^6 =$						
$2^7 =$							
$2^8 =$							
$2^9 =$							
$2^{10} =$							

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

Ex. 1 Evaluate

a) $\sqrt{81}$	b) $\sqrt[3]{8}$	c) $\sqrt[5]{243}$
$= 9$	$= 2$	$= 3$

Ex. 2 Evaluate

a) $64^{\frac{1}{2}}$	b) $49^{-\frac{1}{2}}$	c) $(-100)^{-0.5}$
$= 8$	$= \frac{1}{7}$	$= \frac{1}{\sqrt{-100}}$ ↳ imaginary

Ex. 3 Evaluate

a) $64^{\frac{1}{3}}$	b) $(-8)^{\frac{1}{3}}$	c) $-125^{-\frac{1}{3}}$
$= 4$	$= -2$	$= -\frac{1}{5}$

Seatwork

Pg 229 # 4-7ace, 8-10, 11

4. Write as a single power, then evaluate. Express answers in rational form.

a) $\sqrt{5}\sqrt{5}$ b) $\frac{\sqrt[3]{-16}}{\sqrt{2}}$ c) $\frac{\sqrt{28}\sqrt{4}}{\sqrt{7}}$ d) $\frac{\sqrt[4]{18}(\sqrt[3]{9})}{\sqrt[3]{2}}$

5. Evaluate.

a) $49^{\frac{1}{2}} + 16^{\frac{1}{2}}$ d) $128^{-\frac{5}{7}} - 16^{0.75}$
 b) $27^{\frac{2}{3}} - 81^{\frac{1}{4}}$ e) $16^{\frac{3}{2}} + 16^{-0.5} + 8 - 27^{\frac{2}{3}}$
 c) $16^{\frac{3}{4}} + 16^{\frac{3}{4}} - 81^{-\frac{1}{4}}$ f) $81^{\frac{1}{2}} + \sqrt[3]{8} - 32^{\frac{4}{5}} + 16^{\frac{3}{4}}$

6. Write as a single power, then evaluate. Express answers in rational form.

a) $4^{\frac{1}{3}}(4^{0.3})$ c) $\frac{64^{\frac{4}{3}}}{64}$ e) $\frac{(16^{-2.5})^{-0.2}}{16^{\frac{1}{4}}}$
 b) $100^{0.2}(100^{\frac{-7}{10}})$ d) $\frac{27^{-1}}{27^{\frac{-2}{3}}}$ f) $\frac{(8^{-2})(8^{2.5})}{(8^6)^{-0.25}}$

7. Predict the order of these six expressions in terms of value from lowest to highest. Check your answers with your calculator. Express answers to three decimal places.

a) $\sqrt[4]{623}$ c) $\sqrt[10]{10.24}$ e) $17.5^{\frac{2}{3}}$
 b) $125^{\frac{2}{3}}$ d) $80.9^{\frac{1}{4}}$ f) $21.4^{\frac{3}{2}}$

8. The volume of a cube is 0.015625 m^3 . Determine the length of each side.

A

9. Use your calculator to determine the values of $27^{\frac{4}{3}}$ and $27^{1.3333}$. Compare the two answers. What do you notice?

10. Explain why $(-100)^{0.2}$ is possible to evaluate while $(-100)^{0.5}$ is not.

C

Answers

4. a) 5 b) -2 c) 4 d) 3

5. a) 11 c) $\frac{47}{3}$ e) $\frac{253}{4}$

b) -18 d) $-\frac{255}{32}$ f) 3

6. a) $4^{\frac{1}{2}} = 2$ c) 4 e) $16^{-\frac{1}{4}} = \frac{1}{2}$

b) $100^{\frac{-1}{2}} = \frac{1}{10}$ d) $\frac{1}{3}$ f) 64

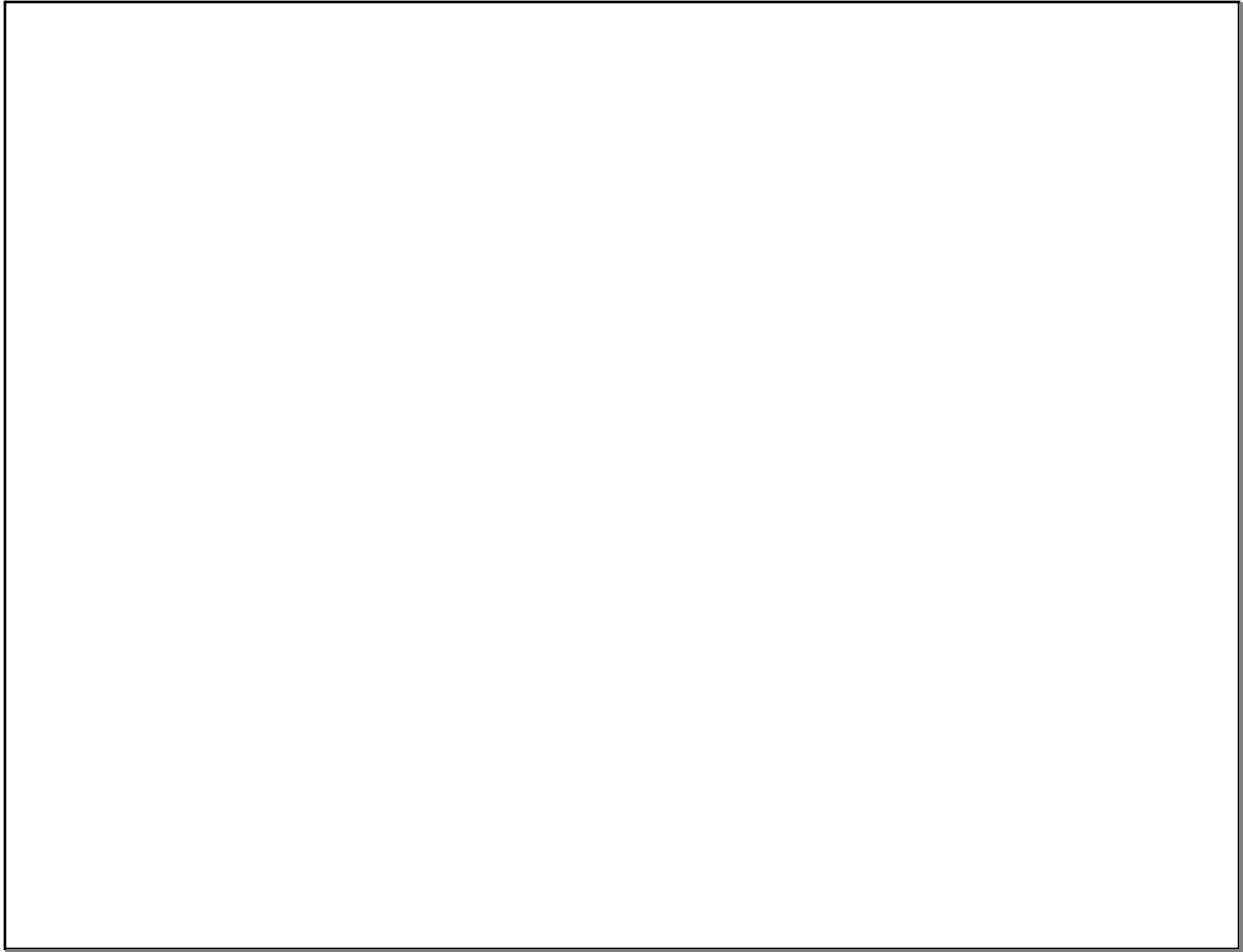
7. a) 4.996 c) 1.262 e) 5.983

b) 6.899 d) 2.999 f) 98.997

8. 0.25 m

9. $27^{\frac{4}{3}} = 81$, $27^{1.3333} \approx 80.99110173$ The values are not equal as $\frac{4}{3} \neq 1.3333$.

10. $0.2 = \frac{1}{5}$, an odd root, $0.5 = \frac{1}{2}$, an even root. Even root of a negative number is not real.



Attachments

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Presentation - negative exp.ppt