Quiz:

1. b) $(0.35)^5 = 5.25\ \begin{matrix}10^{-3}\\ E-3\end{matrix}\quad 10^8$

5.25×10^{-3}

0.00525

0.01

ex. c) $5\sqrt{72}$

$5(\sqrt{36} \times \sqrt{2})$

$5(6\sqrt{2})$

$= \underline{30\sqrt{2}}$

$5(\sqrt{9} \times \sqrt{8})$

$5(3\sqrt{8})$

$15\sqrt{8}$

$15(\sqrt{4} \times \sqrt{2})$

$15(2\sqrt{2})$

$30\sqrt{2}$

(e) $\sqrt[5]{486}$

$\sqrt[5]{243} \times \sqrt[5]{2}$

$3\sqrt[5]{2}$

$2^5 = 32$

$3^5 = 243$

5. a) $4\sqrt{5}$

$\sqrt{4^2 \cdot 5}$

$\sqrt{80}$

b) $-10\sqrt{6}$

$-\sqrt{10^2 \cdot 6}$

$-\sqrt{600}$

c) $5\sqrt[4]{3}$

$\sqrt[4]{5^4 \cdot 3}$

$\sqrt[4]{1875}$

NO CALCULATOR...Evalute the following:

$36^{\frac{1}{2}} = \sqrt{36}$

$= 6$

$16^{0.25} = \sqrt[4]{16}$ ($\frac{1}{4}$)

$= 2$

$27^{\frac{2}{3}} = (\sqrt[3]{27})^2$

$= 3^2$

$= 9$

$32^{\frac{6}{5}} =$

$(\sqrt[5]{32})^6$

$(2)^6$

$= 64$

$125^{\frac{4}{3}} =$

$= (\sqrt[3]{125})^4$

$= 5^4$

$= 625$

$4^{1.5} =$ ($\frac{3}{2}$)

$(\sqrt{4})^3$

$= 8$

Warm Up:

1. Evaluate each of the following without using a calculator:

$(a)\, 27^{\frac{1}{3}} = ?$ $\sqrt[3]{27}$ 27 1, 3

27 $\boxed{x^{\blacksquare}}$ 1 $\boxed{a^b/c}$ 3

$(b)\, 64^{\frac{3}{2}} = ?$ 512

$(c)\left(\frac{16}{81}\right)^{\frac{3}{4}} = ?\ \frac{16^{3/4}}{81^{3/4}} = \frac{8}{27}$

$(d)\, 32^{\frac{7}{5}} = ?$ 128

2. Evaluate each of the following using a calculator:

$(a) -32^{\frac{2}{7}} = ?$

$-\left(\sqrt[7]{32}\right)^2$

$-2.69...$

$(b)\, 20^{\frac{5}{8}} = ?$

$= 6.50..$

4.5 Negative Exponents and Reciprocals

LESSON FOCUS Relate negative exponents to reciprocals.

Reciprocals:

$\frac{2}{3} \times \frac{3}{2} = \frac{6}{6} = 1$

What are some properties of numbers classified as reciprocals?

Definition:

$\frac{4}{1} \cdot \frac{1}{4} = \frac{4}{4} = 1$

Two numbers with a product of 1 are reciprocals.

Since $4 \cdot \frac{1}{4} = 1$, the numbers 4 and $\frac{1}{4}$ are reciprocals.

Similarly, $\frac{2}{3} \cdot \frac{3}{2} = 1$, so the numbers $\frac{2}{3}$ and $\frac{3}{2}$ are also reciprocals.

Use the concept of reciprocals to deal with NEGATIVE exponents...

We define powers with negative exponents so that previously developed properties such as $a^m \cdot a^n = a^{m+n}$ and $a^0 = 1$ still apply.

How can we explain the meaning of negative exponents?

$$\frac{5^2}{5^5} \qquad \frac{5^{-3}}{1} = ? \quad \frac{1}{125} = \frac{1}{5^3}$$

$$= 5^{-3}$$

$$\frac{\cancel{5 \times 5}}{\cancel{5 \times 5} \times 5 \times 5 \times 5} = \frac{1}{5^3}$$

$$\frac{3^{-2}}{1} = \frac{1}{3^2} = \frac{1}{9} \qquad x^{-\frac{3}{4}} = \frac{1}{x^{3/4}}$$

$$\frac{1}{7^{-3}} = \frac{7^3}{1}$$

IMPORTANT PROPERTY!!

Powers with Negative Exponents

When x is any non-zero number and n is a rational number, x^{-n} is the reciprocal of x^n.

That is, $\boxed{x^{-n} = \frac{1}{x^n} \text{ and } \frac{1}{x^{-n}} = x^n}$, $x \neq 0$

Examples:

$6^{-2} = \frac{1}{6^2}$

$= \frac{1}{36}$

$\left(\frac{2}{5}\right)^{-3} = \left(\frac{5}{2}\right)^3$

$\frac{2^{-3}}{5^{-3}}$

$\frac{5^3}{2^3}$

$\frac{125}{8}$

$\frac{125}{8}$

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

$\frac{1}{9 \cdot 4}$

$= \frac{1}{36}$

$0.2^{-4} =$