Check Up

Simplify each of the following using exponent laws:

(1) $m^2 \times m^5 =$

$= m^7$

(2) $(5w^3)(4w^7) =$

$= 20w^{10}$

(3) $(-2a^3b^6)(3a^2b^8) =$

$= -6a^5b^{14}$

(4) $\frac{x^8}{x^4} = x^4$

(5) $15a^{10} \div 3a^4 =$

$= 5a^6$

(6) $-15p^7q \div -5p^6q =$

$= 3p$ or $3pq^0$

(7) $\frac{5^2 \times 5^8}{5 \times 5^1} =$

$\frac{5^{10}}{5^2}$

5^8

(8) $\frac{2w^5 \times 8w^{10}}{4w^{15}} =$

$= \frac{16w^{15}}{4w^{15}}$

$= 4w^0$

or

$= 4$

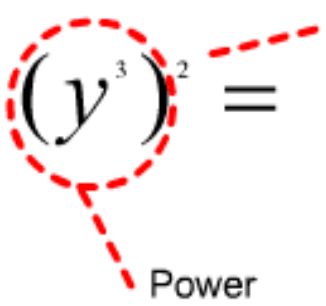
(9) $\frac{(5a^9b^1)(4b^7)}{3a^2 \times 4a^3b^5} =$

$= \frac{20a^9b^8}{12a^5b^5}$

$= \frac{5}{3}a^4b^3$

Power Law of Exponents

The power of a power rule states that when a power is placed to an exponent we multiply the two exponents.



$(y^3)^2 = y^3 \cdot y^3 = y^6$

$(x^{10})^7 = x^{20}$

$(y^3)^2 = y^6$

Multiply 3 x 2 = 6

Why does this work?

$(2^4)^5 = 2^{20}$

$(3^1w^4)^3 = 3w^4 \cdot 3w^4 \cdot 3w^4$

$= 9w^{12}$ $= 27w^{12} = 3^3w^{12}$

3^3w^{12} $27w^{12}$

Power Law:

① $(m^6)^4$

$= m^{24}$

② $(3^2)^5$

$= 3^{10}$

③ $(x^6y)^4$

$= x^{24}y^4$

④ $(2^1x^3)^3$

$= 8x^9$

⑤ $(3x^4y^5)^2$

$= 9x^8y^{10}$

⑥ $(x^2)^3 x^7$

$x^6 \cdot x^7$

$= x^{13}$

⑦ $m^7 \times (m^2)^4 \div (m^3)^2$

$= m^7 \times m^8 \div m^6$

$= m^{15} \div m^6$

$= m^9$

⑧ $\dfrac{(2x^3)^3(4x)^2}{(2x^3)^5(x^2)^7}$

$= \dfrac{(8x^9)(16x^2)}{(32x^{15})(x^{14})}$

$= \dfrac{128x^{11}}{32x^{29}}$

$= 4x^{-18}$

$= \dfrac{4}{x^{18}}$

Zero Exponent

$\frac{12^1}{12^1} = 12^0 = 1$

$\boxed{w^0 = 1}$

$\frac{w^{17}}{w^{17}} = w^0 = 1$

$w^7 \cdot w^{-7} = w^0$

$= 1$

$= 1 \times$

$3w^0 = 3(1)$

$= 3$

$(3w)^0 = 1$

4.4 Fractional Exponents and Radicals

LESSON FOCUS Relate rational exponents and radicals.

Make Connections

Coffee, tea, and hot chocolate contain caffeine. The expression $100(0.87)^{\frac{1}{2}}$ represents the percent of caffeine left in your body $\frac{1}{2}$ h after you drink a caffeine beverage.

Given that $0.87^1 = 0.87$ and $0.87^0 = 1$, how can you estimate a value for $0.87^{\frac{1}{2}}$?

Recall from past work with exponents...

Make Connections

Recall the exponent laws for integer bases and whole number exponents.

Product of powers:	$a^m \cdot a^n = a^{m+n}$
Quotient of powers:	$a^m \div a^n = a^{m-n}, a \neq 0$
Power of a power:	$(a^m)^n = a^{mn}$
Power of a product:	$(ab)^m = a^m b^m$
Power of a quotient:	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$

How about zero as an exponent?

$$b^0 =$$

Connecting Radicals and Exponents:

Time to continue our development of the properties of radicals...

What is the value of each of the following:

$\sqrt{5} \bullet \sqrt{5} =$ $\sqrt{25}$ $\sqrt{7} \times \sqrt{7} = 7^1$ $\sqrt[3]{3} \times \sqrt[3]{3} \times \sqrt[3]{3} =$

$\sqrt{12}$ $\sqrt{4} \times \sqrt{3}$ $= 5^1$ $\sqrt{\square} \cdot \sqrt{\square} = \square^1$

How about the following:

$x^{\frac{1}{2}} \bullet x^{\frac{1}{2}} =$ x^1

$\sqrt{x} \cdot \sqrt{x} = x^1$

$\pi^{\frac{1}{3}} \bullet \pi^{\frac{1}{3}} \bullet \pi^{\frac{1}{3}} =$

$3^{\frac{1}{2}} = \sqrt{3}$

QUIZ