

8.3 WARM-UP: $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

1. Simplify $\frac{6^3 \cdot 6^5}{6^4} = \frac{6^8}{6^4} = 6^4$

2. Simplify $10^7 \cdot \left(\frac{-1}{10}\right)^4 = 10^7 \cdot \frac{(-1)^4}{10^4} = \frac{10^7}{10^4} = \frac{10^7}{10^4} = \frac{10^3}{1} = 10^3$

3. Simplify $\left(\frac{s^8}{3r}\right)^3 = \frac{s^8}{3r} \cdot \frac{s^8}{3r} \cdot \frac{s^8}{3r} = \frac{s^{24}}{27r^3}$

4. The order of magnitude of the power output of a nuclear-powered aircraft carrier is about 10^6 watts. The order of magnitude of peak power at Hoover Dam is about 10^9 watts. How many times as great is the power output of Hoover Dam as the power output of a nuclear-powered aircraft carrier?

$$10^9 = x \cdot 10^6 \quad 10^9 / 10^6 = 10^3$$

Exponent, n	Value of 2^n
4	$2^4 = 16$
3	$2^3 = 8$
2	$2^2 = 4$
1	$2^1 = 2$

∴

Exponent, n	Value of 3^n
4	$3^4 = 81$
3	$3^3 = 27$
2	$3^2 = 9$
1	$3^1 = 3$

WHAT HAPPENS AS YOU READ DOWN THE TABLE?

Exponent, n	Power, 2^n
3	$2^3 = 8$
2	$2^2 = 4$
1	$2^1 = 2$
0	$2^0 = 1$
-1	$2^{-1} = \frac{1}{2}$
-2	$2^{-2} = \frac{1}{4}$

$\left. \begin{array}{l} 2^3 = 8 \\ 2^2 = 4 \\ 2^1 = 2 \\ 2^0 = 1 \end{array} \right\} \div 2$
 $\left. \begin{array}{l} 2^1 = 2 \\ 2^0 = 1 \end{array} \right\} \div 2$
 $\left. \begin{array}{l} 2^0 = 1 \\ 2^{-1} = \frac{1}{2} \end{array} \right\} \div 2$
 $\left. \begin{array}{l} 2^{-1} = \frac{1}{2} \\ 2^{-2} = \frac{1}{4} \end{array} \right\} \div 2$

$$\frac{1}{2} \div 2 = \frac{1}{2} \cdot \frac{1}{2}$$

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

Exponent, n	Power, 3^n
3	$3^3 = 27$
2	$3^2 = 9$
1	$3^1 = 3$
0	$3^0 = 1$
-1	$3^{-1} = \frac{1}{3}$
-2	$3^{-2} = \frac{1}{9}$

$\left. \begin{array}{l} 3^3 = 27 \\ 3^2 = 9 \\ 3^1 = 3 \end{array} \right\} \div 3$
 $\left. \begin{array}{l} 3^1 = 3 \\ 3^0 = 1 \end{array} \right\} \div 3$
 $\left. \begin{array}{l} 3^0 = 1 \\ 3^{-1} = \frac{1}{3} \end{array} \right\} \div 3$

$$\frac{1}{3} \div 3 = \frac{1}{3} \cdot \frac{1}{3}$$

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

ANY # TO THE 0 POWER IS ... 1

$$5^0 = 1$$

$$1. \left(\frac{2}{3}\right)^0 = 1$$

~~1/3~~

$$4. (-1)^0 = 1$$

$$b. (-7)^0 = 1$$

USING NEGATIVE EXPONENTS:

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

a. $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$

c. $\left(\frac{1}{5}\right)^{-2} = \frac{1}{\left(\frac{1}{5}\right)^2} = \frac{1}{\frac{1}{25} \cdot \frac{25}{25}} = \frac{25}{1} = \frac{1}{5} \cdot \frac{1}{5} = \frac{1}{25}$

d. $0^{-5} = \frac{1}{0^5} = \frac{1}{0}$ No Sol

2. $(-8)^{-2} = \frac{1}{(-8)^2} = \frac{1}{64}$

3. $\frac{1}{2^{-3}} = \frac{2^3}{1} = 8$

Reciprocal
Change the
Sign of
exponent

TRY THESE:

reciprocal + change sign of exponent.

$$\text{a. } 6^{-2} = \frac{1}{6^2} = \frac{1}{36}$$

$$\text{b. } x^0 = 1$$

$$\text{c. } \left(\frac{2}{3}\right)^{-2} = \left(\frac{3}{2}\right)^2 = \frac{3^2}{2^2} = \frac{9}{4}$$

$$\text{d. } 0^{-7} = \emptyset$$

REVIEW OF PROPERTIES:

$$a^m \cdot a^n = a^{m+n}$$

$$2^3 \cdot 2^5 = 2^8$$

$$(a^m)^n = a^{mn}$$

$$(2^3)^5 = 2^{15}$$

$$(ab)^m = a^m b^m$$

$$(2 \cdot 5)^3 = 2^3 \cdot 5^3$$

$$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$$

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

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$$

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

EVALUATE EXPONENTIAL EXPRESSIONS

to get rid of neg. exp. - reciprocal & ^{exponent} change sign

$$\text{a. } 6^{-4} \cdot 6^4 = 6^{-4+4} = 6^0 = 1$$

$$\frac{6 \cdot 6 \cdot 6 \cdot 6}{6 \cdot 6 \cdot 6 \cdot 6} = 1$$

$$\text{b. } (4^{-2})^2 = 4^{-2 \cdot 2} = 4^{-4}$$

$$= \frac{1}{4^4} = \frac{1}{256}$$

$$\text{c. } \frac{1}{3^{-4}} = 3^4 = 81$$

$$3 \cdot 3 \cdot 3 \cdot 3$$

$$\text{d. } \frac{5^{-1}}{5^2} = 5^{-1+2} = 5^{-3}$$

$$= \frac{1}{5^3} = \frac{1}{125}$$

EVALUATE EXPONENTIAL EXPRESSIONS

$$5. \frac{1}{4^{-3}} = \frac{4^3}{1} = 64$$

$$6. (5^{-3})^{-1} = 5^{(-3)(-1)} = 5^3 = 125$$

$$7. (-3)^5 \cdot (-3)^{-5}$$
$$(-3)^{5+(-5)} = (-3)^0 = 1$$

$$8. \frac{6^{-2}}{6^2} = 6^{-2-2} = 6^{-4}$$
$$= \frac{1}{6^4} = \frac{1}{1296}$$

TRY THESE:

$$\text{a. } (-2)^5 \cdot (-2)^{-5} = (-2)^{5+(-5)} = (-2)^0 = 1$$

$$\text{b. } (3^3)^{-2} = 3^{3 \cdot (-2)} = 3^{-6} = \frac{1}{3^6} = \frac{1}{729}$$

$$\text{c. } \frac{1}{8^{-2}} = \frac{8^2}{1} = 64$$

$$\text{d. } \frac{7^3}{7^5} = 7^{3-5} = 7^{-2} = \frac{1}{7^2} = \frac{1}{49}$$

HOMEWORK:

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#'s 2-27