

Exponent Laws Part 1

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Mathematics 9 Exponents Exponent Laws Part 1

A. Exponent Laws

1) Product of Powers Law

$$a^m \times a^n \quad \text{or} \quad (a^m)(a^n) = a^{m+n}$$

$$\begin{aligned} \text{a) } & 2^3 \times 2^2 \\ & \quad \quad \quad \text{3+2} \\ & = 2^5 \\ & = \boxed{2^5} \end{aligned}$$

$$\begin{aligned} \text{b) } & \left(\frac{4}{7}\right)^5 \times \left(\frac{4}{7}\right)^{-2} \\ & \quad \quad \quad \text{5+(-2)} \\ & = \left(\frac{4}{7}\right)^3 \\ & = \boxed{\left(\frac{4}{7}\right)^3} \end{aligned}$$

$$\begin{aligned} \text{c) } & (m^5 n^2)(m^{-3} n^1) \\ & \quad \quad \quad \text{5+(-3) \quad 2+1} \\ & = m^2 n^3 \\ & = \boxed{m^2 n^3} \end{aligned}$$

$$\begin{aligned} \text{d) } & y^{\frac{7}{2}} \times y^{-\frac{3}{2}} \\ & \quad \quad \quad \text{7/2 + (-3/2)} \\ & = y^{\frac{4}{2}} \\ & = y^2 = \boxed{y^2 \times y^{\frac{2}{1}}} \end{aligned}$$

2) Quotient of Powers Law

$$a^m \div a^n \text{ or } \frac{a^m}{a^n} = a^{m-n}$$

$$\begin{aligned} \text{a) } & 4^5 \div 4^2 \\ & = 4^{5-2} \\ & = \boxed{4^3} \end{aligned}$$

$$\begin{aligned} \text{b) } & \frac{7^2}{7^{-4}} \\ & = 7^{2-(-4)} = 7^{2+4} \\ & = \boxed{7^6} \end{aligned}$$

$$\begin{aligned} \text{c) } & \frac{m^{-2}}{m^{-6}} \\ & = m^{-2-(-6)} = m^{-2+6} \\ & = \boxed{m^4} \end{aligned}$$

$$\begin{aligned} \text{d) } & \frac{x^3 y^5}{x y^2} \\ & = x^{3-1} y^{5-2} \\ & = \boxed{x^2 y^3} \end{aligned}$$

$$\begin{aligned} \text{e) } & \frac{a^{\frac{3}{2}}}{a^{\frac{5}{2}}} \\ & = a^{\frac{3}{2} - \frac{5}{2}} = a^{\frac{3-5}{2}} \\ & = a^{\frac{-2}{2}} = \boxed{a^{-1} \text{ or } a^{-\frac{1}{1}}} \end{aligned}$$

3) Zero Exponent Law

$$a^0 = 1$$

$$\frac{5^2}{5^2} \rightarrow \frac{25}{25} = \underline{\underline{1}} \quad \frac{5^2}{5^2} = 5^{2-2} = 5^0 = \underline{\underline{1}}$$

a) 5^0

$$= \boxed{1}$$

b) 4^0

$$= \boxed{1}$$

c) $(-y)^0$

$$= \boxed{1}$$

B. Practice Questions

$$\left(\frac{2}{3}\right)^{-2} \times \left(\frac{2}{3}\right)^{-1} \times \left(\frac{2}{3}\right)^{-1} \times \left(\frac{2}{3}\right)^5$$

1) Write the following as a **single power** and then **evaluate**.

a) $4^8 \div 4^6$
 $= 4^{8-6}$
 $= \boxed{4^2} = \boxed{16}$

b) $\frac{(-2)^2}{(-2)^{-2}}$
 $= (-2)^{2-(-2)} = (-2)^{2+2}$
 $= \boxed{(-2)^4} = \boxed{16}$

c) $\left(\frac{2}{3}\right)^{-2} \times \left(\frac{2}{3}\right)^{-1} \times \left(\frac{2}{3}\right)^5$
 $= \left(\frac{2}{3}\right)^{-2-1+5}$
 $= \left(\frac{2}{3}\right)^2 = \boxed{\frac{16}{9}}$ or $\boxed{\frac{16}{81}}$

2) Simplify the following.

a) $(m^3)(m^2)(m^{-1})$
 $= m^{3+2-1}$
 $= \boxed{m^4}$

b) $\frac{x^6 y^3}{x y^{-1}}$
 $= x^{6-1} y^{3-(-1)}$
 $= \boxed{x^5 y^4}$

c) $\frac{(a^2 b^{-3})(ab^5)}{(ab^{-1})(ab^{-2})}$
 $= \frac{a^{2+1} b^{-3+5}}{a^{1+1} b^{-1-2}}$
 $= \frac{a^3 b^2}{a^2 b^{-3}} = a^{3-2} b^{2-(-3)}$
 $= \boxed{ab^5}$

Assignment: Exponent Laws Part 1 Assignment

Name: _____

Exponent Laws Part 1 Assignment

1. Write the following as a single power.

a) $8^3 \times 8^4$

b) $(-3)^4 \times (-3)^{-1}$

c) $\left(\frac{2}{5}\right)^{-6} \times \left(\frac{2}{5}\right)^9$

d) $\frac{x^{-3}}{x^{-7}}$

e) $m^{\frac{8}{3}} \div m^{\frac{2}{3}}$

f) $(a^2b)(a^4b^2)$

g) $\frac{x^4y}{x^2y^{-5}}$

h) $(-3)^5 \times (-3) \times (-3)^{-3}$

i) $\frac{mn^{-2}p^3}{m^{-1}n^{-5}p^2}$

j) $-\left(-\frac{1}{4}\right)^3 \times \left(-\frac{1}{4}\right)^{-3}$

k) $(a^2bc^{-3})(a^4c^2)(bc^3)$

l) $\frac{x^5yz^{-2}}{x^2y^{-3}z^{-3}}$

2. Evaluate the following.

a) $(2^2)(2^3)$

b) $\frac{6^5}{6^5}$

c) $\frac{(3^3)(3^5)}{(3^2)(3^3)}$

d) $(-5)^5(-5)^{-2}$

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

f) $-(-5)^3 \times (-5)^0 \times (-5)^{-1}$

g) $(3)^{-5}(3)(3)^4$

h) $\frac{(2^{-2})(2^5)}{(2^2)(2^{-3})}$

i) $\frac{(-6)^4(-6)^{-2}}{(-6)^{-1}}$

j) $\frac{8^3 \times 8 \times 8^{-5}}{8^{-2} \times 8^{-1}}$

k) $\frac{(-2)^4(-2)^{-2}(-2)^{-1}}{(-2)^{-3}(-2)^{-2}}$

l) $\frac{\left(\frac{2}{5}\right)^{-2} \times \left(\frac{2}{5}\right)}{\left(\frac{2}{5}\right)^{-4}}$

Answers

1. a) 8^7 b) $(-3)^3$ c) $\left(\frac{2}{5}\right)^3$ d) x^4
- e) m^2 f) a^6b^3 g) x^2y^6 h) $(-3)^3$
- i) m^2n^3p j) -1 k) $a^6b^2c^2$ l) x^3y^4z
-
2. a) 32 b) 1 c) 27 d) -125
- e) $\frac{8}{27}$ f) -25 g) 1 h) 16
- i) -216 j) 64 k) 64 l) $\frac{8}{125}$