Warm Up Questions

Simplify by writing as a single power.

1. $$\frac{(b^{9} \cdot b^{-7} \cdot b^{3})^{2} \times (b^{4} \cdot b^{-3})^{2}}{b^{-14}}$$

2. $$\frac{(a^{3})^{2} \cdot (a^{1/2})^{3}}{(a^{3/2})^{4}}$$

3. $$\frac{(-3/5)^{-3/4} \cdot (-3/5)^{1/2}}{(-3/5)^{5/4}}$$

$$\frac{(b^9 \cdot b^{-7} \cdot b^3)^2 \quad x \quad (b^4 \cdot b^{-3})^2}{b^{-14}}$$

$$= \frac{(b^5)^2 \times (b^1)^2}{b^{-14}}$$

$$= \frac{b^{10} \times b^2}{b^{-14}}$$

$$= \frac{b^{12}}{b^{-14}}$$

$$= b^{26}$$

$$\frac{(a^3)^2 \cdot (a^{1/2})^3}{(a^{3/2})^4}$$

$$= \frac{a^6 \cdot a^{3/2}}{a^{12/2}}$$

$6/1 + 3/2$
$12/2 + 3/2$
$= 15/2$

$$= \frac{a^{15/2}}{a^{12/2}}$$

$15/2 - 12/2$
$= 3/2$

$$= a^{3/2}$$

$$\frac{(-3/5)^{-3/4} \cdot (-3/5)^{1/2}}{(-3/5)^{5/4}}$$

-3/4 + 1/2
-3/4 + 2/4
-1/4

$$= \frac{(-3/5)^{-1/4}}{(-3/5)^{5/4}}$$

-1/4 - 5/4
-6/4
Reduce !!
-3/2

$$= (-3/5)^{-3/2}$$

$$= (-5/3)^{3/2}$$

What happens when there's more than one base?

1. $a^4 \times a^{-4} \times b^3 \times a^2 \times b^{-4}$

$= a^{4+(-4)+2} b^{3+(-4)}$

$= a^2 b^{-1}$

$= \frac{a^2}{b^1}$

2. $(a^3b^2)^3$

$= a^{3(3)}b^{2(3)}$

$= a^9b^6$

3. $\dfrac{(a^5b^3)^2}{a^3b^{-2}}$

$= \dfrac{a^{5(2)}\,b^{3(2)}}{a^3\,b^{-2}}$

$= \dfrac{a^{10}\,b^{6}}{a^3\,b^{-2}}$

$= a^{10-3}\,b^{6-(-2)}$

$= a^7 b^8$

4. $\dfrac{10c^{8}d^{-2}}{2c^{4}d^{5}}$

$= 5c^{8-4}d^{-2-5}$

$= 5c^{4}d^{-7}$

$= \dfrac{5c^{4}}{d^{7}}$

5. $\dfrac{(4d^3c^{-3})(3d^6c^7)}{(2d^3c)^2}$

$= \dfrac{12d^{3+6}c^{-3+7}}{2^{1(2)}d^{3(2)}c^{1(2)}}$

$= \dfrac{12d^9c^4}{2^2d^6c^2}$

$= \dfrac{12d^9c^4}{4d^6c^2}$

$= 3d^{9-6}c^{4-2}$

$= 3d^3c^2$

6. $\left(\dfrac{(-10^{1}a^{2}b^{1})^{2}}{10a^{5}b^{11}}\right)^{-1}$

$= \left(\dfrac{(-10)^{1(2)}\,a^{2(2)}\,b^{1(2)}}{10a^{5}b^{11}}\right)^{-1}$

$= \left(\dfrac{(-10)^{2}a^{4}b^{2}}{10a^{5}b^{11}}\right)^{-1}$

$= \left(\dfrac{100a^{4}b^{2}}{10a^{5}b^{11}}\right)^{-1}$

$= \left(10a^{4-5}b^{2-11}\right)^{-1}$

$= (10^{1}a^{-1}b^{-9})^{-1}$

$= 10^{1(-1)}\,a^{(-1)(-1)}\,b^{(-9)(-1)}$

$= 10^{-1}a^{1}b^{9}$

$= \dfrac{a^{1}b^{9}}{10^{1}} = \dfrac{ab^{9}}{10}$

Homework

① $\dfrac{a^4b^3 \times 12ab^{-3}}{(2a^{-2}b^3)^2}$

$= \dfrac{12a^{4+1}b^{3+(-3)}}{2^{1\cdot 2}a^{-2\cdot 2}b^{3\cdot 2}}$

$= \dfrac{12a^5b^0}{2^2a^{-4}b^6}$

$= \dfrac{12a^5b^0}{4a^{-4}b^6}$

$= 3a^{5-(-4)}b^{0-6}$

$= 3a^9b^{-6}$

$= \dfrac{3a^9}{b^6}$

② $\left(\dfrac{4m^5n^{-2} \times 2m^{-3}}{2m^2}\right)^2$

$= \left(\dfrac{8m^{5+(-3)}n^{-2}}{2m^2}\right)^2$

$= \left(\dfrac{8m^2n^{-2}}{2m^2}\right)^2$

$= \left(4m^{2-2}n^{-2}\right)^2$

$= \left(4m^0n^{-2}\right)^2$ $\rightarrow m^0 = 1$

$= \left(\dfrac{4}{n^2}\right)^2$

$= \dfrac{(4)^2}{(n^2)^2}$

$= \dfrac{16}{n^4}$

③ $\left[\frac{x^3y^4 \cdot x^{-7}}{x^5(y^{-3})}\right]^3$

$= \left(\frac{x^{-4}y^4}{x^5y^{-6}}\right)^3$

$= \left(x^{-9}y^{10}\right)^3$

$= x^{-27}y^{30}$

$= \frac{y^{30}}{x^{27}}$

④ $\frac{5m^2n^{-3}}{1} \times \frac{9m^3n^2}{3m^{-2}}$

$= \frac{45m^5n^{-1}}{3m^{-2}}$

$= 15m^7n^{-1}$

$= \frac{15m^7}{n}$

⑤ $(a^5b^{-2})^3 \times 3b^4$

$= a^{15}b^{-6} \times 3b^4$

$= 3a^{15}b^{-2}$

$= \dfrac{3a^{15}}{b^2}$

⑥ $\dfrac{8a^2b^0}{a^{-3}b^5}$

$= 8a^5b^{-5}$

$= \dfrac{8a^5}{b^5}$

⑦ $\dfrac{(10ab^{-3})^2 \times (2a^{-1}b^2)^2}{10^2 a^4 b^{-2}}$

$= \dfrac{100a^2b^{-6} \times 4a^{-2}b^4}{100a^4b^{-2}}$

$= \dfrac{400a^0b^{-2}}{100a^4b^{-2}}$

$= 4a^{-4}b^0$ $\quad b^0 = 1$

$= \dfrac{4}{a^4}$

⑧ $\dfrac{(x^4y^4)^2}{(x^{-3})^2y^5}$

$= \dfrac{x^8y^8}{x^{-6}y^5}$

$= x^{14}y^3$

⑨ $\left(\frac{10a^2b^{-3}}{2a^{-3}b^2}\right)^2$

$= (5a^5b^{-5})^2$

$= 25a^{10}b^{-10}$

$= \frac{25a^{10}}{b^{10}}$

⑩ $\frac{4^2u^{-1}v^4}{(2u^3v)^3}$

$= \frac{16u^{-1}v^4}{8u^9v^3}$

$= 2u^{-10}v^1$

$= \frac{2v}{u^{10}}$

⑪ $\dfrac{4b^{-5} \times 2a^{7}}{2^{2}b^{-3}a^{5}}$

$= \dfrac{8a^{7}b^{-5}}{4a^{5}b^{-3}}$

$= 2a^{2}b^{-2}$

$= \dfrac{2a^{2}}{b^{2}}$

⑫ $\left(\dfrac{3x^{2}y^{3}}{x^{2}}\right)^{3}$

$= (3x^{0}y^{3})^{3}$

$= 27x^{0}y^{9}$

$= 27y^{9}$

(13) $x^{1/2} y^{3} \cdot x^{2/3} y^{1/3}$

$= x^{\frac{1}{2}+\frac{2}{3}} y^{\frac{3}{1}+\frac{1}{3}}$

$= x^{\frac{3}{6}+\frac{4}{6}} y^{\frac{9}{3}+\frac{1}{3}}$

$= x^{7/6} y^{10/3}$

(14) $\dfrac{a^{1/4} b^{2}}{a^{1/3} b^{1/2}}$

$= a^{1/4 - 1/3} b^{2 - 1/2}$

$= a^{3/12 - 4/12} b^{4/2 - 1/2}$

$= a^{-1/12} b^{3/2}$

$= \dfrac{b^{3/2}}{a^{1/12}}$