3.2 notes

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Foundations and Precalculus 10

3.2 –Exponent Laws

apply exponent laws and leave answer with powers. ex $(-2)^2 \cdot (-2)^3 = (-2)^5$

vs

Evaluate

evaluate exponents where possible.

ex $(-2)^2 \cdot (-2)^3$
$= (-2)^5$
$= -32$

	Example	Expanded	Simplified	Exponent Rule
Multiplication	$a^3 \cdot a^5$	$(a \cdot a \cdot a)(a \cdot a \cdot a \cdot a \cdot a)$	a^8	① $a^m \cdot a^n = a^{m+n}$
Division	$\frac{a^6}{a^2}$	$\frac{a \cdot a \cdot a \cdot a \cdot a \cdot a}{a \cdot a}$	a^4	② $\frac{a^m}{a^n} = a^{m-n}$
Power Law	$(a^2)^4$	$(a^2)(a^2)(a^2)(a^2)$ $= (a \cdot a)(a \cdot a)(a \cdot a)(a \cdot a)$	a^8	③ $(a^m)^n = a^{m \times n}$
Power of a Product	$(a^2 b)^3$	$(a^2 b)(a^2 b)(a^2 b)$ $= aaaaaa \cdot bbb$	$a^6 b^3$	④ $(a^x b^y)^m = a^{xm} b^{ym}$
Power of a Quotient	$\left(\frac{a}{b^3}\right)^5$	$\left(\frac{a}{b^3}\right)\left(\frac{a}{b^3}\right)\left(\frac{a}{b^3}\right)\left(\frac{a}{b^3}\right)\left(\frac{a}{b^3}\right)$ $= \frac{aaaaa}{bbbbbbbbbbbbbbb}$	$\frac{a^5}{b^{15}}$	⑤ $\left(\frac{a^x}{b^y}\right)^m = \frac{a^{xm}}{b^{ym}}$

$\left[\left(-\frac{3}{2}\right)^{-2}\right]^2 \cdot \left[\left(-\frac{3}{2}\right)^2\right]^3 = 1$ ⑥

$a^0 = 1$

LATER: $a^{-m} = \frac{1}{a^m}$ $\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m$

$a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$ easier to evaluate.

Example 1: Simplify:

① a) $0.3^{-3} \cdot 0.3^5$
$= (0.3)^{-3+5}$
$= (0.3)^2$

BEDMAS

b) $\left[\left(-\frac{3}{2}\right)^{-2}\right]^2 \cdot \left[\left(-\frac{3}{2}\right)^2\right]^3$ (① and ③ 1st; ② 2nd)
$= \left(-\frac{3}{2}\right)^{-4} \cdot \left(-\frac{3}{2}\right)^6$
$= \left(-\frac{3}{2}\right)^{-4+6}$
$= \left(-\frac{3}{2}\right)^2$

c) $\frac{(1.4^3)(1.4^4)}{1.4^{-2}}$ (① and ②) simplify numerator & denominator before dividing.
$= \frac{(1.4)^{3+4}}{1.4^{-2}}$
$= \frac{1.4^7}{1.4^{-2}}$
$= 1.4^{7-(-2)}$
$= 1.4^9$

① d) $(x^3 y^4)(x^2 y^{-2})$
$= x^{3+2} \cdot y^{4+(-2)}$
$= x^5 y^2$

② e) $\frac{10a^5 b^3}{2a^2 b^{-2}}$
$= 5a^{5-2} b^{3-(-2)}$
$= 5a^3 b^5$

② f) $\frac{6x^4 y^{-3}}{14xy^{-4}}$
$= \frac{6}{14} x^{4-1} y^{-3-(-4)}$ (÷2)
$= \frac{3x^3 y}{7}$

To SIMPLIFY perform exponent laws following BEDMAS; leave answer with powers without negative exponents (cover later).

Example 2: Simplify:

a) $(25a^4b^2)^3$

$= 25^3 a^{(4)(3)} b^{(2)(3)}$

$= \boxed{25^3 a^{12} b^6}$

or

$= \boxed{15625a^{12}b^6}$

b) $\left(\dfrac{3x^3y^6}{4y^3x}\right)^2$ ← *simplify within the brackets first.

$= \left(\dfrac{3x^2y^3}{4}\right)^2$

$= \dfrac{(3)^2(x^2)^2(y^3)^2}{(4)^2}$

$= \boxed{\dfrac{9x^4y^6}{16}}$

BEDMAS ①,②,④,⑥

Example 3: Simplify: $u^0 = 1$

a) $\dfrac{(-2u^0v^3)^2 \cdot 2u^2}{-u^2v^2}$ ★simplify numerator first!

$= \dfrac{(-2)^2(1)^2(v^3)^2 \cdot 2u^2}{-u^2v^2}$

$= \dfrac{8u^{2-2}v^{6-2}}{-u^2v^2}$

$= \boxed{-8v^4}$

b) $\left(\dfrac{(2x^2y^4)^4}{-2xy^2 \cdot 2x^3}\right)^2$ ★simplify numerator and denominator first!

$= \left(\dfrac{(2)^4(x^{(2)(4)})(y^{(4)(4)})}{-2x^{1+3}y^2 \cdot 2x^3}\right)^2$

$= \left(\dfrac{16x^8y^{16}}{-4x^4y^2}\right)^2$

$= (-4x^{4}y^{14})^2$

$= (-4)^2(x^{(4)(2)})(y^{(14)(2)})$

$= \boxed{16x^8y^{28}}$

HW p241 #3-8(a,d only)