

SEC 3.1 : PROPERTIES OF EXPONENTS

AN EXPONENTIAL EXPRESSION INCLUDES A _____ RAISED TO AN _____ OR _____. THE PROPERTIES OF EXPONENTS HELP US SIMPLIFY EXPONENTIAL EXPRESSIONS.

① PRODUCT OF POWERS

$$a^n \cdot a^m =$$

(ex)

APPLICATION 1. SIMPLIFY.

① $(3a)(3a^2) =$

② $(ab^2)(2a^2b) =$

③ $(2x^4y)(3xy^2) =$

② POWER OF A PRODUCT

$$(ab)^m =$$

(ex)

APPLICATION 2. SIMPLIFY.

④ $(xy)^2 =$

⑤ $(3xy)^4 =$

⑥ $(4x)^2 =$

③ POWER OF A POWER

$$(a^n)^m =$$

(ex)

APPLICATION 3. SIMPLIFY.

⑦ $(w^3)^5 =$

⑧ $(2w^2)^3 =$

⑨ $(3w^2y^7)^2 =$

①

PRACTICE. SIMPLIFY

① $x^2 \cdot x^3 =$

⑥ $(2yk^2)^3 =$

② $(3x^2)^3 =$

⑦ $2x(12x^2y) =$

③ $(2y^4)^3 =$

⑧ $(3x^2)(2xy) =$

④ $2y^2 \cdot 2y^3 =$

⑨ $(-5z^3)(-2z^2) =$

⑤ $(3x)(3x) =$

⑩ $(4a)^3 =$

4 POWER OF ZERO

$a^0 =$

ex

APPLICATION 4. SIMPLIFY.

⑩ $4^0 =$

⑪ $3y^0 =$

⑫ $3(2)^0 =$

5 QUOTIENT OF POWERS

$\frac{a^n}{a^m} =$

ex

APPLICATION 5. SIMPLIFY.

⑬ $\frac{6c^8}{2c^4} =$

⑭ $\frac{12x^2y^3}{6x^2y} =$

⑮ $\frac{x^2yz^3}{xy z^3} =$

⑯ $\frac{8n^5}{4n^2} =$

PRACTICE. SIMPLIFY.

① $\left(\frac{3x^2y^7}{21xy^6}\right)^0 =$

② $x^2 \cdot 3x =$

③ $(2x^2)^3 =$

④ $(pq^5)^2 =$

②

CONTINUED.
→

$$\textcircled{5} (g^7)(h^7) =$$

$$\textcircled{6} (n^6 m^2)^0 =$$

$$\textcircled{7} (x^2)^2 (2xy^2)^3 =$$

$$\textcircled{8} \frac{12x^5 y^2 z^6}{4xy} =$$

6 POWER OF A QUOTIENT

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

ex

APPLICATION 6. SIMPLIFY.

$$\textcircled{17} \left(\frac{x^2}{y^3}\right)^5 =$$

$$\textcircled{18} \left(\frac{2x}{y^2}\right)^2 =$$

$$\textcircled{19} \left(\frac{2}{x^2}\right)^3 =$$

$$\textcircled{20} \left(\frac{2s}{t}\right)^4 =$$

7 NEGATIVE POWERS

$$a^{-n} = \frac{1}{a^n} =$$

ex

NO NEGATIVE EXPONENTS!

APPLICATION 7. SIMPLIFY.

$$\textcircled{21} x^{-7} =$$

$$\textcircled{22} \frac{1}{2x^{-7}} =$$

$$\textcircled{23} (x^2 y^{-5})^2 =$$

$$\textcircled{24} (x^{-4})(x^4) =$$

$$\textcircled{25} (-2x)^{-2} =$$

$$\textcircled{26} \frac{y^5}{-16x^2 y^2} =$$

PROPERTIES

① PRODUCT OF POWERS

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

② POWER OF A PRODUCT

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

③ POWER OF A POWER

$$(a^n)^m = a^{n \cdot m}$$

④ POWER OF ZERO

$$a^0 = 1$$

⑤ QUOTIENT OF POWERS

$$\frac{a^n}{a^m} = a^{n-m}$$

⑥ POWER OF A QUOTIENT

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

⑦ NEGATIVE POWERS

$$a^{-n} = \frac{1}{a^n} \quad \frac{1}{a^{-n}} = a^n$$

EXAMPLES

$$2x^4 \cdot 3x^3 = 6x^{4+3} = 6x^7$$

$$(3xy)^4 = 3^4 x^4 y^4 = 81x^4 y^4$$

$$(w^5)^2 = w^{5 \cdot 2} = w^{10}$$

$$(25k)^0 = 1$$

$$\frac{6c^8}{2c^4} = 3c^{8-4} = 3c^4$$

$$\left(\frac{2s}{r}\right)^4 = \frac{2^4 s^4}{r^4} = \frac{16s^4}{r^4}$$

$$w^{-6} = \frac{1}{w^6}, \quad \frac{1}{y^{-5}} = y^5$$

PRACTICE. SIMPLIFY.

$$\text{① } (2m^{-2}n^6)(-2m^{-2}n)^3 =$$

$$\text{② } 4x^5 \cdot \left(\frac{3x^{-3}}{x^7}\right)^2 =$$

④

Properties of Exponents

Simplify. Your answer should contain only positive exponents.

1) $2m^2 \cdot 2m^3$

2) $m^4 \cdot 2m^{-3}$

3) $4r^{-3} \cdot 2r^2$

4) $4n^4 \cdot 2n^{-3}$

5) $2k^4 \cdot 4k$

6) $2x^3y^{-3} \cdot 2x^{-1}y^3$

7) $2y^2 \cdot 3x$

8) $4v^3 \cdot vu^2$

9) $4a^3b^2 \cdot 3a^{-4}b^{-3}$

10) $x^2y^{-4} \cdot x^3y^2$

11) $(x^2)^0$

12) $(2x^2)^{-4}$

13) $(4r^0)^4$

14) $(4a^3)^2$

15) $(3k^4)^4$

16) $(4xy)^{-1}$

17) $(2b^4)^{-1}$

18) $(x^2y^{-1})^2$

19) $(2x^4y^{-3})^{-1}$

20) $(3m)^{-2}$

21) $\frac{r^2}{2r^3}$

22) $\frac{x^{-1}}{4x^4}$

23) $\frac{3n^4}{3n^3}$

24) $\frac{m^4}{2m^4}$

25) $\frac{3m^{-4}}{m^3}$

26) $\frac{2x^4y^{-4}z^{-3}}{3x^2y^{-3}z^4}$

27) $\frac{4x^0y^{-2}z^3}{4x}$

28) $\frac{2h^3j^{-3}k^4}{3jk}$

29) $\frac{4m^4n^3p^3}{3m^2n^2p^4}$

30) $\frac{3x^3y^{-1}z^{-1}}{x^{-4}y^0z^0}$

6