

## 1 Exponents Tutorial

### 1.1 Notation

Write in either exponent form or as a repeated multiplication

1)  $2 \times 2 \times 2$

2)  $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$

3)  $6^4$

4)  $10^2$

**Note:**

When you have a repeated multiplication, you put the number of times you multiply as the exponent. For example:  $3 \times 3 \times 3 \times 3 = 3^4$

### 1.2 Multiplication Law

5)  $x^3 \times x^2$

6)  $g^{-1} \times g^{-5} \times g \times g^5$

7)  $t^2 \times t^6$

8)  $c^2 \times c^2 \times c^2$

9)  $a^3 \times b^2$

10)  $h \times k^2$

11)  $(m^{-4})(n^{12})(m^{10})$

12)  $a^3 \times b^9 \times c^4$

**Note:**

When we are multiplying two numbers with the same base, you can add the exponents. For example:  $a^3 \times a^2 = a^{3+2} = a^5$

**Note:**

When we are multiplying two numbers that DO NOT have the same base, we CANNOT add the bases.

### 1.3 Division Law

13)  $\frac{x^{10}}{x^9}$

14)  $\frac{a^2}{a^{10}}$

15)  $z^4 \div z^2$

16)  $\frac{c^3}{c^5}$

17)  $\frac{e^{-1}}{e^2}$

18)  $\frac{b^{-3}}{b^{-5}}$

19)  $t^9 \div t^5$

20)  $a^3 \div b^2$

21)  $\frac{h^4}{k^9}$

22)  $d^4 \div e^5$

23)  $j^5 \div \frac{k^4}{g^2}$

**Note:**

If two exponential numbers are being divide and they have the same, we subtract the exponent in the numerator by the exponent in the denominator. For example:  $\frac{x^8}{x^5} = x^{8-5} = x^3$

**Note:**

When we are dividing two numbers that DO NOT have the same base, we CANNOT subtract the bases.

## 1.4 Power Law

24)  $(a^2)^3$

25)  $(v^3)^3$

26)  $(6^2)^4$

27)  $2(m^5)^4$

28)  $(p^2q)^3$

29)  $(de)^7$

30)  $(\frac{1}{y})^{19}$

**Note:**

When we are taking the power of a base that already has an exponent, we multiply the two exponents. For example:  $(a^4)^2 = a^{4 \times 2} = a^8$

**Note:**

When we have two terms that are both being brought the power of some number, then we must bring both terms to that power. For example:  $(3a^4)^2 = 3^2 \times (a^4)^2 = 9a^8$

## 1.5 Inverse Law

31)  $a^{-3}$

32)  $-(k^{-1})^{-1}$

33)  $(g^{-2})^{-4}$

34)  $k^{-3}$

35)  $\frac{1}{h^{-2}}$

36)  $(\frac{a^3b^{-5}c^4}{x^3y^{-5}z^4})^{-1}$

**Note:**

When the exponent is a negative we place the base and the exponent at the bottom of a fraction. For example:  $a^{-1} = \frac{1}{a}$

## 2 Using all the Laws

37)  $(\frac{6m^3x^0}{3m^2n^3})^{-2}$

38)  $(-5x^{-5})(2xy^7)(-y^3)^2$

39)  $\frac{-x^{12}}{9y^9z^3} \times \frac{-12y^{-3}}{-x^{11}}$

40)  $\frac{12a^3}{5b^2} \times \frac{15a}{b}$

41)  $(\frac{a^4b^3}{c^3})(\frac{b^2c^3}{a^4})(\frac{a^4c^3}{b^2})$

42)  $\frac{(2x^2)^4}{9y^2z^2} \times \frac{(3yz)^2}{(4x^4)^2}$

43)  $(\frac{7}{-p^5q})(\frac{-9p^3q^8}{14})$

44)  $(-3m^2 \div 7n^4) \times (2n \div m)$

45)  $(\frac{s^{-3}t}{c^4})^{-2}$

46)  $\frac{x^3y^5}{6} \times \frac{x^{-2}z^2}{3} \times \frac{y^{-3}}{2}$

47)  $(\frac{3x^{12}y^8z^4}{v^{15}w^7})^0$

48)  $(x^{-2}y^2)^{-2}$

## Answers/Solutions

1)  $2^3$

2)  $5^7$

3)  $6 \times 6 \times 6 \times 6$

4)  $10 \times 10$

5)  $x^5$

6)  $g^0$  or 1

7)  $t^8$

8)  $c^6$

9)  $a^3 \times b^2$

10)  $hk^2$

11)  $(m^6)(n^{12})$

12)  $a^3 \times b^9 \times c^4$

13)  $x^1$  or  $x$

14)  $a^{-1}$

15)  $z^2$

16)  $\frac{1}{c^2}$  or  $c^{-2}$

17)  $\frac{1}{e^3}$  or  $e^{-3}$

18)  $b^2$

19)  $t^4$

20)  $\frac{a^3}{b^2}$

21)  $\frac{h^4}{k^9}$

22)  $\frac{d^4}{e^5}$

23)  $\frac{j^4 \times g^2}{k^4}$

24)  $a^6$

25)  $v^9$

26)  $6^8$

27)  $2m^{20}$

28)  $p^6q^3$

29)  $d^7e^7$

30)  $\frac{1}{y^{19}}$

31)  $\frac{1}{a^3}$

32)  $-k$

33)  $g^8$

34)  $\frac{1}{k^3}$

35)  $h^2$

36)  $\frac{a^{-3}b^5c^{-4}}{x^{-3}y^5z^{-4}}$  OR  $\frac{x^3b^5z^4}{a^3y^5c^4}$

37)  $\frac{n^6}{4m^2}$

38)  $\frac{-10y^{13}}{x^4}$

39)  $\frac{-4x}{3y^{12}z^3}$

40)  $\frac{36a^4}{b^3}$

41)  $a^4b^3c^3$

42) 1

43)  $\frac{9q^7}{2p^2}$

44)  $\frac{-6m}{7n^3}$

45)  $\frac{s^6c^8}{t^2}$

46)  $\frac{xy^2z^2}{36}$

47) 1

48)  $\frac{x^4}{y^4}$