Math-2A

Lesson #2-4: Powers (part 1)

Multiplication: is repeated addition

$$2x \rightarrow x + x$$

Coefficient → Tells us how many times 'x' is used as an addend

$3y$ → How many times is 'y' used as an addend?

Rewrite '3y' as an equivalent expression that uses addition instead of multiplication

$$y + y + y$$

Multiplication: is repeated addition

-4 What equivalent way can you write a negative number?

$-1(4)$ → Negative 1 "times" 4, OR: the "opposite" of positive 4

Rewrite the following expressions in an equivalent form

$$-5m \rightarrow -1(5m) \rightarrow -1(m+m+m+m+m)$$
$$\rightarrow -m-m-m-m-m$$

$$-2x \rightarrow -1(2x) \rightarrow -1(x+x) \rightarrow -x-x$$

$$-3x+2 \rightarrow -1(3x)+2 \rightarrow -x-x-x+2$$

Simplify: perform all possible operations (+, ÷, – , *, exponents, etc.)

$$3x-4x \quad \rightarrow x+x+x-x-x-x-x$$

$$-x$$

$$5y-2x+3y-3x$$

$$\rightarrow y+y+y+y+y-x-x+y+y+y-x-x-x$$

$$8y-5x$$

Now you see the expression written as "repeated addition" can you visualize the concept of LIKE TERMS?

Do you have to convert terms involving multiplication into repeated addition in order to tell which terms are "like terms"?

$$-2k+3x-4k-5x+2k \quad \rightarrow (-2-4+2)k+(3-5)x$$

$$\rightarrow -4k-2x$$

Simplify the following

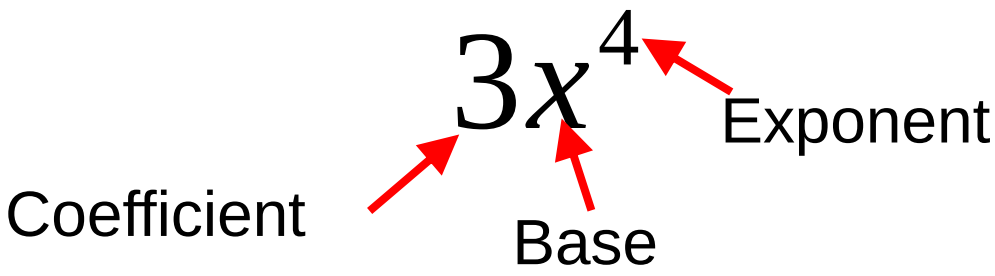
$-4(m-4)+3m$

$6x-(x+4)$

$-10n+2(-2n-3)$

$3x-(-3-7x)$

Power: An expression formed by repeated multiplication of the same factor.



Base: the number that is repeatedly multiplied

Exponent: the number of times the base is used as a factor

The exponent applies to the number or variable immediately to its left, not to the coefficient !!!

$$3x^4 \rightarrow 3*x^4 \rightarrow 3*x*x*x*x$$

PEMDAS: the exponent applies to the base BEFORE we multiply by the coefficient.

Like terms: look exactly the same when you convert

1) Powers to repeated multiplication and
2) Coefficients to repeated addition.

$x + y$ not "like terms"

$2x + 3x \rightarrow x + x + x + x + x$ Like terms

$2x + 2y \rightarrow x + x + y + y$ not "like terms"

$x^2 + x^2 \rightarrow (x * x) + (x * x)$ Like terms

$2x^3 + x^3 \rightarrow (x * x * x) + (x * x * x) + (x * x * x)$ "like terms"

$x^2 + x^3 \rightarrow (x * x) + (x * x * x)$ not "like terms"

What is a power?

How can you convert powers to repeated multiplication?

An exponent means what?

How can you convert repeated multiplication into a power?

A coefficient means what?

How can you tell if any terms in an expression (or equation) are “like terms”?

Convert the following to Powers

$x*x*x$

$\rightarrow x^3$

$(x*x)+(y*y*y)$

$\boxed{\rightarrow x^2+y^3}$

$2*x*x*x$

$\boxed{\rightarrow 2x^3}$

$3*x*x+2*y*y*y$

$\boxed{\rightarrow 3x^2+2y^3}$

Simplify the following. If you cannot, explain, why not?

$x + y$ Can't simplify: Obviously not "like terms"

$2x + 3x$ CAN simplify, because the terms are repeated addition of the same unknown value.

$\rightarrow 5x$

$\rightarrow x + x + x + x + x$

$x^2 + x$ Can't simply; by converting repeated multiplication we see they are not "like terms"

$\rightarrow (x * x) + x$

$x^2 + 2x$ Can't simply; by converting to repeated multiplication and repeated addition we see they are not "like terms"

$\rightarrow (x * x) + x + x$

Monomial: a single term x 3 7y

Binomial: the addition (or subtraction) of a pair of “unlike” terms

x + 2 $7x^2 - 2x$

Trinomials: the addition of 3 “unlike” terms

$3x^2 + 2x - 3$ $-4x^2 + 2x + 5$

Simplify

$$x^3 - x^3 + 4x - 4x^3 - 6x$$

$$3x^5 - 2x^3 - 4x - 4x^5 - 6x$$

$$(2x^5 - 4x^3 - x + 4) - (-2x^5 - 5x)$$

Multiplying Powers $x^2(x^3) \rightarrow x^2 * x^3$

Not an addition problem → convert to repeated multiplication

$x * x * x * x * x$ How many times is 'x' used as a factor?

5 times → "x used as a factor 5 times"

What does the exponent of a power tell us?

How many times the base is used as a factor

What is the base for this expression?

→ convert repeated multiplication into a power.

$$x^2 * x^3 \rightarrow x^5$$

Multiplying Powers $y^4(3y^3) \rightarrow 3*y^3*y^4$

Not an addition problem → convert to repeated multiplication

$$3*y*y*y*y*y*y*y$$

How many times is 'y' used as a factor?

7 times → "y used as a factor 7 times"

What does the exponent of a power tell us?

How many times the base is used as a factor

What is the base for this expression?

→ convert repeated multiplication into a power.

$$3*y^3*y^4$$

Multiplying Powers

$x^2(x^3)$ "x" used as a factor 2 times
multiplied by
"x" used as a factor 3 times.

$\rightarrow x^5$ Simplifies to:
"x" used as a factor 5 times.

$y^4(3y^3)$ "3"
multiplied by
"y" used as a factor 3 times
Multiplied by
"y" used as a factor 4 times.

$\rightarrow 3y^7$ Simplifies to:
"3 multiplied by "y" used as a factor 7 times.

Does it help to say it that way?

Simplify

$y^2(y^3) \rightarrow y^5$

$4x^3(x^5) \rightarrow 4x^8$

$3m^2(4m^6) \rightarrow 12m^8$

$-3x^3(2x^4 - 4x^2) \rightarrow (-6x^7 + 12x^5)$

$m^5 - 2m^3(3m^2 + 5) \rightarrow (-m^5 - 10m^3)$

What do you notice when you multiply “same-base powers”?

Add the exponents

$$(x^2)(x^3) \rightarrow x*x*x*x*x \rightarrow x^{2+3} \rightarrow x^5$$

'x' used as a factor five times

Add the exponents

Properties of Exponents

1) Product of Powers: when you multiply "same based powers" you just add the exponents.

Properties are "short-cuts" that give you an equivalent expression (or equation)