

# Homework Q5

Note Title

10/12/2015

4.1 #65

$$(3x^3)(2x)^4 = 3^3 x^6 \cdot 2^4 x^4$$

$$= 27x^6 \cdot 16x^4 = \boxed{432x^{10}}$$

$$\begin{array}{r} 27 \\ \times 16 \\ \hline 162 \\ 270 \\ \hline 432 \end{array}$$

4.1 Review:

Ex: Simplify.

$$(-2x^2y^3)^4 (-3x^4yz^2)^3$$

$$= (-2)^4 x^8 y^{12} (-3)^3 x^{12} y^3 z^6$$

$$= (16)(-27) x^{20} y^{15} z^6$$

$$= \boxed{-432x^{20}y^{15}z^6}$$

4.2: Division with Exponents and Negative Exponents

Definition of a negative exponent:

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



Note:  $x^{-n} = \frac{x^{-n}}{1} = \frac{1}{x^n}$

Also:  $\frac{1}{x^{-n}} = \frac{x^n}{1}$

why?

Also  $x^{-1} = \frac{x^{-1}}{1} = \frac{1}{x^1} = \frac{1}{x}$

$$\begin{aligned} \frac{1}{x^{-n}} &= \frac{1}{\frac{1}{x^n}} = 1 \cdot \frac{x^n}{1} \\ &= \frac{1}{1} \cdot \frac{x^n}{1} \\ &= \frac{x^n}{1} \end{aligned}$$

Examples: Simplify. Write answers without negative exponents.

Ex:  $5^{-2} = \frac{5^{-2}}{1} = \frac{1}{5^2} = \boxed{\frac{1}{25}}$

Ex:  $-3^{-4} = \frac{-3^{-4}}{1} = -\frac{3^{-4}}{1} = -\frac{1}{3^4}$

$-\frac{3^{-4}}{1}$  also ok

$= \boxed{-\frac{1}{81}}$

Ex:  $(-2)^{-4} = \frac{(-2)^{-4}}{1} = \frac{1}{(-2)^4} = \boxed{\frac{1}{16}}$

Ex:  $\left(\frac{3}{4}\right)^{-3} = \frac{3^{-3}}{4^{-3}} = \frac{4^3}{3^3} = \boxed{\frac{64}{27}}$

Ex:  $\frac{2}{5^{-3}} = \frac{2 \cdot 5^3}{1} = \frac{2 \cdot 125}{1} = \frac{250}{1} = \boxed{250}$

$$\underline{\text{Ex:}} \quad 3x^{-1}y^2 = \frac{3x^{-1}y^2}{1} = \boxed{\frac{3y^2}{x^1}}$$

$$\underline{\text{Ex:}} \quad (3x)^{-4} = \frac{(3x)^{-4}}{1} = \frac{3^{-4}x^{-4}}{1} = \frac{1}{3^4x^4} = \boxed{\frac{1}{81x^4}}$$

$$\underline{\text{OR}} \quad (3x)^{-4} = \frac{(3x)^{-4}}{1} = \frac{1}{(3x)^4} = \frac{1}{3^4x^4} = \boxed{\frac{1}{81x^4}}$$

$$\begin{aligned} \underline{\text{Ex:}} \quad 6^{-1} + 6^{-2} \\ &= \frac{6^{-1}}{1} + \frac{6^{-2}}{1} \\ &= \frac{1}{6^1} + \frac{1}{6^2} \\ &= \frac{1}{6} + \frac{1}{36} \\ &= \frac{1}{6} \cdot \frac{6}{6} + \frac{1}{36} \\ &= \frac{6}{36} + \frac{1}{36} = \boxed{\frac{7}{36}} \end{aligned}$$

Recall: Properties of Exponents:

$$x^a x^b = x^{a+b}$$

$$(x^a)^b = x^{ab}$$

$$\frac{x^a}{x^b} = x^{a-b}$$

$$\underline{\text{Ex:}} \quad \frac{x^{-3}y^4}{x^{-5}y^{-6}} = \frac{y^4x^5y^6}{x^3} = \frac{x^5y^{10}}{x^3} = \frac{x^2y^{10}}{1} = \boxed{x^2y^{10}}$$

$$\begin{aligned} \underline{\text{Ex:}} \quad \left( \frac{-2x^2}{y^4} \right)^{-3} &= \frac{(-2)^{-3}x^{-6}}{y^{-12}} = \frac{y^{12}}{(-2)^3x^6} \\ &= \boxed{\frac{y^{12}}{-8x^6}} = \boxed{-\frac{y^{12}}{8x^6}} \end{aligned}$$

Ex:

$$\frac{-3x^{-5}(x^{-1}y^3z^{-2})^{-4}}{(3x^2y^4)^{-2}(2xy^{-3}z)^4}$$
$$= \frac{-3x^{-5}x^4y^{-12}z^8}{3^{-2}x^{-4}y^{-8} \cdot 2^4x^4y^{-12}z^4}$$

$$= \frac{-3}{x^5} \frac{x^4}{y^{12}} \frac{z^8 \cdot 3^2 x^4 y^8}{\cdot 2^4 x^4 z^4} \frac{y^{12}}{y^4}$$

$$= \frac{-3x^8y^{20}z^8 \cdot 9}{16x^9y^{12}z^4}$$

$$= \frac{-27y^8z^4}{16x}$$

$$= -\frac{27y^8z^4}{16x}$$

Recall:  $x^0 = 1$   
for  $x \neq 0$

Ex:

$$\left( \frac{-2x^2y^4}{-3y^{-12}} \right)^0 = \boxed{1}$$

### Scientific Notation

In scientific notation, we write numbers so they have exactly 1 digit to the left of the decimal point, and they are multiplied by a power of 10.

Small numbers: (less than 1) negative powers of 10

Big numbers: (greater than 1) positive powers of 10

Note: Previous example could also be done this way:

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

$$= \frac{y^{12}}{(-2)^3 x^6} = \boxed{\frac{y^{12}}{-8x^6}}$$

Ex: write 21,243 in scientific notation:

$$2.1243 \times 10^4$$

21,243.  
4 slots

Ex: write: 0.001234 in scientific notation

$$1.234 \times 10^{-3}$$

0.001234  
3 slots

Ex: write the number <sup>in</sup> without scientific notation.

0.000000098765

$$9.8765 \times 10^{-8}$$

0.000000098765  
8 slots

Ex: write the number without scientific notation.

$$1.379 \times 10^{-5}$$

000,00001379  
5 slots

$$0.00001379$$

Ex: write the number without scientific notation.

$$2.31792 \times 10^8$$

2,317920000000000000  
8 slots

$$231,792,000$$

scientific notation.

Note: most calculators write this as  $2.31792 \text{E}8$

Previous Ex:  
 $1.379 \text{E}-5$

### 4.3: Operations with Monomials

Polynomial expression: composed of terms added together, in which each term has variables to positive integer powers only.

Examples of polynomials:

$$2x^4 - 5x^2 - 8$$

$$x^2 - 7x$$

$$\frac{1}{2}x^4 + \frac{5}{3}x^3 - \frac{1}{7}x^2 + \frac{12}{\pi}$$

Not polynomials:

$$2x^{-4} + 7x^{-1}$$

$$\frac{1}{x^2} + \frac{3}{x^4}$$

Note:

same as  $x^{-2} + 3x^{-4}$

$$\sqrt{x^2 + 7}$$

Degree of a polynomial:

\* If it has 1 variable, the degree is the highest power.

\* If it has 2 or more variables, the degree is the highest total exponent in a term

Ex: The degree of  $-2x^5 + 6x^4 - 3x^2 + 8$  is 5.

(It's a 5<sup>th</sup> degree polynomial)

Ex: What is the degree?

$$\underbrace{2x^2y^3}_{\text{total exponent} = 5} + \underbrace{5x^3y^4}_{\text{total exponent} = 7} - \underbrace{7xy^5}_{\text{total exponent} = 6} - \underbrace{8y^4}_{\text{total exponent} = 4}$$

Degree is 7

## Special names for certain polynomials:

Polynomial with 3 terms: trinomial

Polynomial with 2 terms: binomial

Polynomial with 1 term: monomial

Ex:  $3 - x^4$  is a 4th degree binomial

$5x^2 - 8x + 1$  is a 2nd degree trinomial.

## Multiplying monomials:

$$(-2x^1)(5x^7) = \boxed{-10x^8}$$

## Dividing:

$$\frac{\overset{5}{\cancel{15}}x^4y^2}{\cancel{3}x^7y} = \boxed{\frac{5y}{x^3}}$$