## Unit INotes

## Exponents



Tentative Schedule

| Day | Date | Class Work | Assignment |
| :---: | :---: | :---: | :---: |
| 1 | Wed. 9/3 <br> Thurs. 9/4 | Problem Solving Group Work | Watch Video \#1.1 - Exponential <br> Notation, the Product of Powers and <br> the Quotient of Powers |
| 2 | Fri. 9/5 | P.S. \#1.1 | Watch Video \#1.2 - The Power of a <br> Power |
| 3 | Mon. 9/8 <br> Tues. 9/9 | P.S. \#1.2 | Watch Video \#1.3 - Zero and <br> Negative Exponents |
| 4 | Wed. 9/10 | Quiz \#1.1 <br> P.S. \#1.3 | Finish P.S. \#1.3 |
| 5 | Thurs. 9/11 <br> Fri. 9/12 | Activity | Review for Test \#1 |
| 6 | Mon. $9 / 15$ | Quiz \#1.2 |  |
| 7 | Tues. $9 / 16$ <br> Wed. 9/17 | Test \#1 | Watch Video \#2.1 |

## Notes I. - Exponential Notation and Product/Quotient of Dowers

Examples involving exponential notation. Also, identify the base and exponent in each expression.
1.) $5 \times 5 \times 5 \times 5 \times 5 \times 5=$

Base: $\qquad$ Exponent: $\qquad$
2.) $\frac{9}{7} \times \frac{9}{7} \times \frac{9}{7} \times \frac{9}{7}=$

Base: $\qquad$ Exponent: $\qquad$
3.) $\left(-\frac{4}{11}\right)^{3}=$

Base: $\qquad$ Exponent: $\qquad$
4.) $(-2)^{6}=$

Base: $\qquad$ Exponent: $\qquad$
5.) $3.8^{4}$

Base: $\qquad$ Exponent: $\qquad$

Try these exercises on your own. Then, compare with your partner.

Exercise 1
$\underbrace{4 \times \cdots \times 4}_{7 \text { times }}=$

## Exercise 6

$\underbrace{\frac{7}{2} \times \cdots \times \frac{7}{2}}_{21 \text { times }}=$

## Exercise 7

$\underbrace{(-13) \times \cdots \times(-13)}_{6 \text { times }}=$

## Exercise 8

$\underbrace{\left(-\frac{1}{14}\right) \times \cdots \times\left(-\frac{1}{14}\right)}_{10 \text { times }}=$

## Exercise 9

$\underbrace{x \cdot x \cdots x}_{185 \text { times }}=$

## Exercise 10

$\underbrace{x \cdot x \cdots x}_{\text {times }}=x^{n}$

## Exercise 11

Will these products be positive or negative? How do you know?

$$
(-1) \times(-1) \times \cdots \times(-1)=(-1)^{12}
$$

12 times

$\underbrace{(-1) \times(-1) \times \cdots \times(-1)}=(-1)^{13}$

## Exercise 12

Is it necessary to do all of the calculations to determine the sign of the product? Why or why not?
$(-5) \times(-5) \times \cdots \times(-5)=(-5)^{95}$
95 times
$(-1.8) \times(-1.8) \times \cdots \times(-1.8)=(-1.8)^{122}$
122 times


## Exercise 13

Fill in the blanks about whether the number is positive or negative.
If $n$ is a positive even number, then $(-55)^{n}$ is $\qquad$ .

If $n$ is a positive odd number, then $(-55)^{n}$ is $\qquad$ .

## Exercise 14

Josie says that $(-15) \times(-15) \times(-15) \times(-15) \times(-15) \times(-15)=-15^{6}$. Is she correct? How do you know?

## Exercise 15

Expand and evaluate $\left(-\frac{3}{4}\right)^{3}$.
1.) Expand $10^{6}$.
2.) Expand $10^{3}$.
3.) Expand $10^{6} \cdot 10^{3}$. What do you notice?
4.) Expand $a^{4}$.

5.) Expand $a^{5}$.
6.) Expand $a^{4} \cdot a^{5}$. What do you notice?

When you find the product of two algebraic expressions with the same base, you can $\qquad$ their exponents and use this exponent with the $\qquad$ base.

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

$\qquad$

Simplify each expression. Write your answer in exponential notation.
7.) $(-4)^{2} \cdot(-4)^{3}=$
8.) $3^{6} \cdot 3=$
9.) $a^{23} \cdot a^{9}=$
10.) Expand $5^{6}$.
12.) Expand $5^{6} \div 5^{2}$. What do you notice?
13.) Expand $y^{7}$.
14.) Expand $y^{4}$.

15.) Expand $y^{7} \div y^{4}$. What do you notice? same base, you can ___ their exponents and use this exponent with the ___ base.

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

$\qquad$

Simplify each expression. Write your answer in exponential notation.
16.) $2^{9} \div 2^{6}=$
17.) $(-7)^{5} \div(-7)=$
18.) $\frac{35 x^{4} y^{7}}{5 x^{2} y^{3}}$

## Notes 12 - Power of a Power

Simplify each expression. Write your answer in exponential notation.
1.) $\frac{4^{2} \cdot 4^{7} \cdot 4}{4^{3} \cdot 4 \cdot 4^{4}}$
2.) $\frac{\left(\frac{1}{4}\right)^{3} \cdot\left(\frac{1}{4}\right) \cdot\left(\frac{1}{4}\right)^{2}}{\left(\frac{1}{4}\right) \cdot\left(\frac{1}{4}\right) \cdot\left(\frac{1}{4}\right)}$
3.) $\frac{3 x^{4} \cdot 5 y^{3} \cdot 6 x^{6}}{2 y \cdot 3 x^{2} \cdot 5 y^{3}}$
4.) $\frac{6^{7} \cdot 6^{3} \cdot 6^{2}}{6 \cdot 6^{4} \cdot 6^{5}}$
5.) $\frac{b^{5} \cdot 4 a^{4} \cdot 9 a^{3}}{2 a^{2} \cdot b^{2} \cdot 6 a^{2}}$
6.) What does $\left(2^{4}\right)^{3}$ mean?

7.) What does $\left(n^{2}\right)^{5}$ mean?
8.) What do you notice?

When you raise a power to a power, keep the base and multiply the exponents.

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

Simplify each expression. Write your answer in exponential notation.
9.) $\left(15^{3}\right)^{9}$
10.) $\left((-2)^{5}\right)^{8}$
11.) $\left(a^{17}\right)^{4}$

## Notes I. 3 - Zero and Negative Exponents

1.) Use the power of a quotient property to simplify each expression. Write the quotient as an exponent.

| Expression | Exponent |
| :---: | :---: |
| $\frac{3^{5}}{3^{2}}$ | $3^{3}$ |
| $\frac{3^{5}}{3^{3}}$ |  |
| $\frac{3^{5}}{3^{4}}$ |  |
| $\frac{3^{5}}{3^{5}}$ |  |

What expression did you write for $\frac{3^{5}}{3^{5}}$ ? What exponent did you use?
2.) Using factored form, find the value of $\frac{3^{5}}{3^{5}}$.

3.) Based on your findings, what can you conclude about the value of $3^{0}$ ?
4.) Make a prediction about the value of any number raised to the zero power.
5.) Use a calculator to check your prediction for several numbers. Is your prediction right?

A nonzero number raised to the zero power is equal to $\qquad$ .

$$
a^{0}=
$$

expression and evaluate where applicable.
6.) $7^{3} \cdot 7^{0}$
7.) $3 \cdot 10^{2}+2 \cdot 10^{1}+8 \cdot 10^{0}$
8.) $\frac{4^{2} \cdot 4^{6}}{4^{8}}$
9.) $\left(a^{4} \div a^{0}\right) \cdot a^{3}$
10.) Use the quotient of powers property to simplify each expression. Write the quotient in exponential notation.

| Expression | Exponent |
| :---: | :---: | :---: |
| $\frac{4^{5}}{4^{3}}$ | $4^{2}$ |
| $\frac{4^{5}}{4^{4}}$ |  |
| $\frac{4^{5}}{4^{5}}$ |  |
| $\frac{4^{5}}{4^{6}}$ |  |
| $\frac{4^{5}}{4^{7}}$ |  |


11.) Using factored form, find the value of $\frac{4^{5}}{4^{6}}$.
12.) Using factored form, find the value of $\frac{4^{5}}{4^{7}}$.

$$
a^{-n}=
$$

13.) How would you write $a^{-3}$ using a positive exponent?

Simplify each expression. Write your answer using a positive exponent.
14.) $13^{-4} \cdot 13^{7}$
15.) $\frac{x^{-7}}{x^{4}}$
16.) $4^{8} \cdot 4^{-10}$
17.) $x^{-7} \div x^{-4}$
18.) $\left(\frac{8 n^{5}}{32 n^{0}}\right)^{-1}$
19.) $14 a^{-5} \div\left(7 a \cdot 2 a^{-4}\right)$

Simplify each expression and evaluate where applicable.
20.) $\frac{(-6)^{3}}{(-6)^{4}}$
21.) $\frac{3^{-5} \cdot 3}{5^{3} \cdot 5^{-8}}$

