#### Created by Mr. Lischwe





• Decide whether each value is rational or irrational, and explain why.

1)  $\sqrt{20}$  Invational

2) 0.343434 ... Rational

3) 6.7128334952 ... Irrational

 $4)\frac{17}{13}$  Rational

## p. 57 (24-26)

24) Hydrogen, Carbon, Oxygen, Silver, Gold
25) 2.2 x 10<sup>3</sup>; 310,000; 3.1 x 10<sup>7</sup>; 216,000,000
26) 4.56 x 10<sup>-3</sup>, 4.56 x 10<sup>-2</sup>, 4.56 x 10<sup>2</sup>, 4.56 x 10<sup>3</sup>

#### Table of Contents (2<sup>nd</sup> Semester)

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**Calculating with Scientific Notation** 

**Objective:** 

Add, subtract, multiply, and divide numbers in scientific notation WITHOUT THE USE OF A CALCULATOR

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# • Use these two numbers: $4 \times 10^5 \text{ and } 2 \times 10^2$

#### <u>PREDICT (Individually - write down your</u> <u>predictions somewhere):</u>

- 1)  $(4 \times 10^5) \cdot (2 \times 10^2)$  will be:  $\times 10^{\Box}$
- 2)  $(4 \times 10^5) \div (2 \times 10^2)$  will be:  $\times 10^{\square}$
- 3)  $(4 \times 10^5) + (2 \times 10^2)$  will be:  $\times 10^{\square}$
- 4)  $(4 \times 10^5) (2 \times 10^2)$  will be:  $\times 10^{\square}$

GROUP TASK (GIANT WHITEBOARD -ONE PER GROUP)

• Use these two numbers:  $4 \times 10^5$  and  $2 \times 10^2$ 

YOUR JOB:

- 1) Convert both numbers into standard notation.
- 2) Multiply the numbers.
- 3) Divide the numbers.
- 4) Add the numbers.
- 5) Subtract the numbers.
- 6) Convert each answer back into scientific notation. Then compare these answers with the original numbers. Which of your predictions were correct? What patterns do you notice?

## EXPANDING OUT SCIENTIFIC NOTATION...

1)  $(4 \times 10^5) \cdot (2 \times 10^2)$ = $(4 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10) \cdot (2 \cdot 10 \cdot 10)$ =  $8 \times 10^7$ 

2) 
$$(4 \times 10^5) \div (2 \times 10^2)$$
  
=  $\frac{(4 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10)}{(2 \cdot 10 \cdot 10)}$   
=  $2 \times 10^3$ 

## EXPANDING OUT SCIENTIFIC NOTATION...

 $(4 \times 10^5) + (2 \times 10^2)$   $(4 \times 10^5) - (2 \times 10^2)$ 

 $(4 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10) + (2 \cdot 10 \cdot 10)$  $(4 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10) - (2 \cdot 10 \cdot 10)$ 

Not like terms, cannot combine, must calculate separately!

### WITH VARIABLES ....

- 1.  $a^6 \cdot a^2$  $a^6$
- 2.  $\frac{a^6}{a^2}$
- 3.  $a^6 + a^2$
- 4.  $a^6 a^2$ 
  - $\frac{(a \cdot a \cdot a \cdot a \cdot a \cdot a) \cdot (a \cdot a)}{\frac{a \cdot a \cdot a \cdot a \cdot a}{a \cdot a}} = a^{4}$

 $(a \cdot a \cdot a \cdot a \cdot a \cdot a) + (a \cdot a)$ : No way to simplify this  $(a \cdot a \cdot a \cdot a \cdot a \cdot a) - (a \cdot a)$ : No way to simplify this

### WITH COEFFICIENTS...

1.  $5x^2 \cdot 3x^4 = 15x^6$ 

 $2. \quad \frac{12y^6}{4y^2} \qquad \qquad = 3y^4$ 

## SCIENTIFIC NOTATION: SAME RULES AS OTHER EXPONENT PROBLEMS!!! $(4 \times 10^3)(2 \times 10^4)$

 $= (4 \times 10 \times 10 \times 10)(2 \times 10 \times 10 \times 10 \times 10)$ 

## $= 8 \times 10^{7}$

#### **Multiplying in Scientific Notation**

- Multiply the Coefficients
- Keep the base (10)
- Add the exponents!

SCIENTIFIC NOTATION: SAME RULES AS OTHER EXPONENT PROBLEMS!!!

 $\frac{9\times10^5}{3\times10^2}$ 

9×10×10×10×10×10

 $3 \times 10 \times 10$ 

 $= 3 \times 10^{3}$ 

#### **Dividing in Scientific Notation**

- Divide the Coefficients
- Keep the base (10)
- Subtract the exponents!

Adding & Subtracting in Scientific Notation
 No shortcut: convert both to standard notation, then add or subtract

(There is an exception to this rule - there IS a shortcut sometimes. When do you think that is?)



You cannot combine these:  $4x^3 + 7x^2$ 

However, you <u>can</u> combine these:  $4x^{5} + 7x^{5}$   $= 11x^{5}$ 

If the exponents are the same, you <u>can</u> use a shortcut for adding/subtracting scientific notation. (Think of them as "combining like terms")

 $(6 \times 10^7) + (2 \times 10^7)$ = 8×10<sup>7</sup>



## In this scenario ONLY, the 6 and the 2 digits WOULD line up!

 $(6 \times 10^{7}) + (2 \times 10^{7})$  $\begin{array}{r} 60,000,000 \\ +20,000,000 \\ \hline 80,000,000 \\ \hline = 8 \times 10^{7} \end{array}$ 

### Adding & Subtracting in Scientific Notation

 No shortcut: convert both to standard notation, then add or subtract

### • EXCEPTION: IF EXPONENTS ARE THE SAME

- Add/subtract coefficients
- Keep the base AND keep the exponent

OVERALL MAIN IDEA IN MATH...You can multiply or divide anything.

• However, you can only add or subtract things that are <u>like terms</u>.

- Fractions work this way.
- Calculating with variables works this way.
- Scientific notation also works this way!



#### WRITE YOUR ANSWER IN SCIENTIFIC NOTATION. **Examples** 23000 $(7.4 \times 10^{9})(1.2 \times 10^{-3})$ 6500 1. 129500 $(6.5 \times 10^3) + (1.23 \times 10^5)$ 2. 8.8 8 9.72×10<sup>81</sup> 3. 2.7×10<sup>77</sup> 2.7 )9.72 $(9 \times 10^5) - (2.5 \times 10^2)$ 27/97.2 81 37 62 <u>8|</u> [62 1. 8.88×10<sup>6</sup>

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- **2.**  $1.295 \times 10^5$
- **3.**  $3.6 \times 10^4$
- **4.** 8. 9975 × 10<sup>5</sup>



p.63 (1, 2, 4, 8) and
p.65 (19, 21, 22)

## No calculator allowed! NO WORK SHOWN = NO CREDIT!