June 14, 2018

GSMST Physics & Engineering Summer Assignment

Greetings!

All students enrolled in GSMST's Physics & Engineering class (PhysEng) in the upcoming year are required to complete the following worksheets before the first day of class on Monday, August 6, 2018. This summer assignment will be the first grade in the gradebook and students should be prepared for a quiz over the material. The worksheets include:

- Math Manipulations
- Trigonometry
- Scientific Notation
- Graphing Practice

These worksheets are representative of skills that students will need to be proficient in ***before*** the first day of class in GSMST PhysEng.

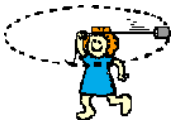
In addition, the following supplies will be required for the PhysEng class:

- 1 graph paper ruled composition notebook
- 1 scientific calculator (calculator must be able to handle basic trig functions)
- 1 whiteboard marker and eraser

We can't wait to see you in Physics & Engineering next year!

Mr. Patterson
Mr. McVeigh
Mr. Kastner
Mr. Hulme
Mr. Dart

PhysEng Math Manipulations



Name _____

You *can* do it!

Date _____

Solve each of the following equations for the indicated quantity (Show your work!):

1. $v = d/t$ Solve for d _____

2. $v = d/t$ Solve for t _____

3. $F_{net} = ma$ Solve for m _____

4. $F_{net} = ma$ Solve for a _____

5. $a = (v_f - v_o)/t$ Solve for t _____

6. $a = (v_f - v_o)/t$ Solve for v_f _____

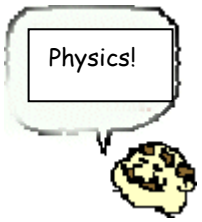
7. $d = (1/2)at^2$ Solve for t _____

8. $d = vt + (1/2)at^2$ Solve for v _____

9. $v = \sqrt{2as}$ Solve for s _____

*10. $T = 2\sqrt{L/g}$ Solve for g _____

*11. $\frac{1}{f} = \frac{1}{do} + \frac{1}{di}$ Solve for di _____



PhysEng Summer Trigonometry Assignment

When you start PhysEng in the fall you need to walk in the door with an understanding of right triangle trigonometry—it is essential to our first unit on vectors.

Part 1 : Fill in the definitions of sine, cosine, and tangent using the word bank below.

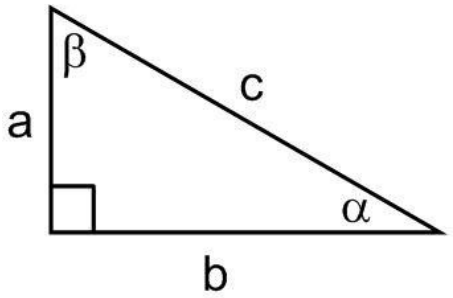
opposite	adjacent
opposite	hypotenuse
adjacent	hypotenuse

$\sin\theta$ = ----------

$\cos\theta$ = ----------

$\tan\theta$ = ----------

Part 2: Fill in the chart below for various right triangles. You will need a calculator that can do trig functions! Please show your work on the following page.



	Angle α	Angle β	Right angle	Side a	Side b	Side c
1			90°	3 inches	4 inches	
2	45°		90°	15 cm		
3		40°	90°			8 inches
4		63°	90°		2 meters	

PhysEng Summer Trigonometry Assignment

Triangle 1	Triangle 2
Triangle 3	Triangle 4

Name: _____

SKILL BUILDERS FOR SCIENTIFIC NOTATION

Writing numbers like 1,000,000,000,000 and 0.000001 can be challenging. It is difficult to work with and use these numbers because of all the zeros. Scientific notation helps simplify these numbers into a form that is easily recognized. Using this method, numbers are written as values between 1 and 10; and then multiplied times a power of 10. In this skill sheet, you will learn how to write numbers and how to perform calculations using scientific notation.

Writing numbers using scientific notation

Here's a step-by-step example of how to write numbers in scientific notation.

Table I: Using scientific notation

Step 1	Move the decimal until you get a value that is between 1 and 10. Count the number of times you move the decimal.
Step 2	Write down the new number without all of the zeros.
Step 3	Write x 10 after the number.
Step 4	Write the number of times you moved the decimal *as* the power of 10 (the exponent). If you moved the decimal to the left, the exponent will be positive. If you moved the decimal to the right, the exponent will be negative.

Using these steps, fill in the table by converting the numbers in the left column into scientific notation. The first two are examples for your review.

Number	Scientific Notation
1,000,000,000,000	1×10^{12}
0.000001	1×10^{-6}
5,000	
0.000098	
100	
6,500,000	
0.1	
0.000000000021	
10 x 10 x 10 x 10	

1. Writing out scientific notation

The following problems give you the scientific notation for a number. Write out each number as it would appear without using scientific notation.

1. The closest star to our sun, Alpha Centauri, is 4.1×10^{13} kilometers away. Write out this number.

2. Earth is approximately 1.5×10^{8} kilometers from the sun. Write out this number.

3. The wavelength of red light is 7×10^{-7} meters long. Write out this number.

3. Solving problems using scientific notation

Using scientific notation simplifies multiplying and dividing big and small numbers. If you are multiplying, you *add* the exponents. If you are dividing, you *subtract* the exponents. Use the examples below to help you solve the problems on the next page.

Sample Problem 1: Multiplying with exponents:

$(2.0 \times 10^{3}) \times 6.5 \times 10^{6}) = ?$

Step one - divide the numbers:

$2.0 \times 6.5 = 13.0$

Step two - add the exponents:

$10^{(3+6)} = 10^{9}$

Step three - move the decimal and adjust the exponent:

$13.0 \times 10^{9} = 1.3 \times 10^{10}$

Sample Problem 2: Dividing with exponents:

$(1.2 \times 10^{10}) + (6.0 \times 10^{5}) = ?$

Step one - divide the numbers:

$1.2 + 6.0 = 0.2$

Step two - subtract the exponents

$10^{[10-(-5)]} = 10^{19}$

Step three - move the decimal and adjust the exponent:

$0.2 \times 10^{15} = 2.0 \times 10^{14}$

1. $(1.5x10^7) \times (4.5 \times 10^3) =$

2. $(2x10^3) \div 3x10^2)$

3. $(3.6 \times 10^2) \times (2 \times 10^4) \times (1 \times 10^{-3}) =$

4. $(4 \times 10^5) \div (4 \times 10^6) =$

5. Multiply 46,000 by 100,000:
   a. Set up this problem using scientific notation.

   b. Write your answer in scientific notation.

6. Divide 0.1 by *200:*
   a Setup this problem using scientific notation.

   b Write your answer in scientific notation.

7. Divide 0.03 by 0.09.
   a. Setup up this problem using scientific notation.

   b. Place your answer in scientific notation.

8. Divide 6 million by 100. Write out this problem and its answer using scientific notation.

9. The speed of light travels at 186,000 miles per second. You want to find out how far light will travel in a million seconds and you do not have a calculator. Can you solve this problem anyway? How? What is the answer?

Name: _____ Date: _____

Making Line Graphs

PRACTICE 112m = 4 sec 1.2

READ

Graphs allow you to present data in a form that is easy to understand.

1. **Data pairs:** Graphs are made using pairs of numbers. Each pair of numbers represents one data point on a graph. The first number in the pair represents the independent variable and is plotted on the *x*-axis. The second number represents the dependent variable and is plotted on the *y*-axis.

2. **Axis labels:** The label on the *x*-(horizontal) axis is the name of the independent variable. The label on the *y*-(vertical) axis is the name of the dependent variable.

3. **Data range:** The range of numbers on each axis depends on the smallest and largest value for each variable. To find the range, subtract the smallest value from the largest value for a variable.

4. **Title:** The format for the title of a graph is: "Dependent variable name versus Independent variable name."

PRACTICE

1. Seven data pairs are listed in the table below. For each data pair, identify the independent and dependent variable. Then, rewrite the data pair according to the headings in the next two columns of the table The first two data pairs are done for you.

	Data pair (not necessarily in order)		Independent (x-axis)	Dependent (y-axis)
1	Temperature	Hours of heating	Hours of heating	Temperature
2	Stopping distance	Speed of a car	Speed of a car	Stopping distance
3	Number of people in a family	Cost per week for groceries		
4	Stream flow rate	Amount of rainfall		
5	Tree age	Average tree height		
6	Test score	Number of hours studying for a test		
7	Population of a city	Number of schools needed		

2. The lowest and highest values for a variable are listed in the table below. Use these values to find the data range for each variable. The first two are done for you.

Lowest value	Highest value	Range
0	28	28
10	87	77
0	4.2	
-5	23	
0	113	
100	1250	

3. Using the variable range and the number of lines, calculate the scale for an axis. The scale is the quantity represented per line on the graph. Often the calculated scale is not an easy-to-use value. To make the calculated scale easy-to-use, round the value and write this number in the column with the heading "Adjusted scale." Review the first two examples.

Variable range	Number of lines	Range 7 Number of lines	Calculated scale	Adjusted scale
13	24	13 ÷ 24 =	0.54	1
83	43	83 ÷ 43 =	1.93	2
31	35			
100	33			
300	20			
900	15			

4. Here is a data set for you to plot on a graph. Follow these steps to make the graph.

   a. Place this data set in the table below. Each data point is given in the format of (*x*, *y*). The *x*- values represent time in minutes. The *y*-values represent distance in kilometers.
   (0, 5.0), (10, 9.5), (20, 14.0), (30, 18.5), (40, 23.0), (50, 27.5), (60, 32.0).

Independent variable (x-axis)	Dependent variable (y-axis)

(Answer the following questions on a separate piece of paper if you need more room.)

   b. What is the range for the independent variable?

   c. What is the range for the dependent variable?

   d. Make your graph using the blank graph below. Each axis has twenty lines (boxes). Use this information to determine the adjusted scale for the *x*-axis and the *y*-axis.

   e. Label your graph. Add a label for the *x*-axis, *y*-axis, and provide a title.

   f. Draw a smooth line through the data points.

   g. Question: What is position value after 45 minutes? Use your graph to answer this question.

   h. Question: This graph is a position versus time graph. Do you think the position change is more representative of a person running, a person on a bicycle, or a person driving a car? Justify your answer.

Graph paper

PRACTICE
112m = 4 sec
1.2