AP Physics 1 – Summer Assignment

Welcome to AP Physics 1! I am very glad you are interested in physics, and I look forward to investigating energy, matter and the universe with you next year.

We will be spending most of next year investigating relationships between various properties of objects (what we call variables, because they constantly change.) We need to have a tool to describe these relationships, and to apply them to other situations. That tool is mathematics. In fact, one of the most famous physicists, Sir Isaac Newton, developed calculus along with his scientific work so he would have a way to describe his work and make predictions. Even though AP Physics 1 doesn't require that you know any calculus, it does require that you have mastered the fundamentals of algebra and geometry.

In the pages that follow, you will find review questions on mathematics and the basics of science, with which you should already be familiar.

Please complete the entire review over the summer. If you do not know how to complete a section, it does not mean that you are not cut out for physics. You just may need to do a little more review on that topic. Below are a few websites you can visit to help you review.

http://www.aplusphysics.com/courses/ap-1/AP1_Physics.html
https://sites.google.com/site/fregaphysics/physics/math-review
http://www.physicsphenomena.com/PhysicsMathReview.htm
http://www.rtmsd.org/cms/lib/PA01000204/Centricity/Domain/170/new%20math%20review.pdf

This assignment is worth 2 homework grades for the 1st marking period, and is due the first day of regular classes.

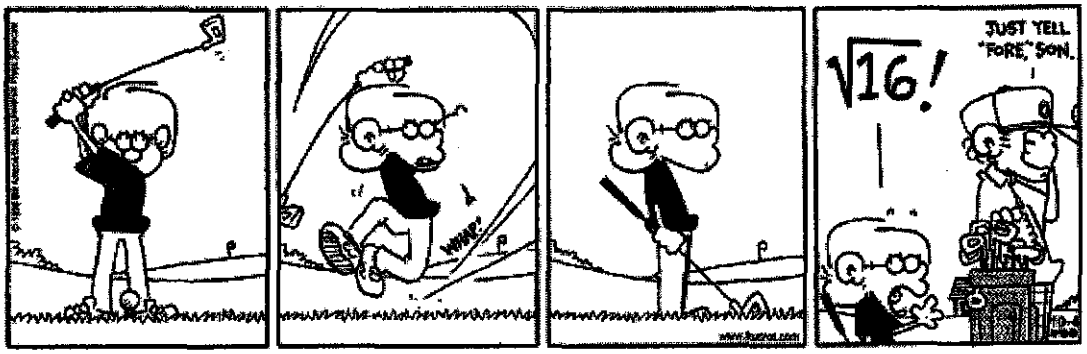
If you have any questions about this assignment you can come by and see me in room 219.

I look forward to seeing you in September,

Mrs. Donna Hofmann

Name:_____Period:_____Date:_____

AP Physics –Math Review



PART I. SOLVING EQUATIONS

Solve the following equations for the quantity indicated.

1. Often problems on the AP exam are done with variables only. Below are various physics formulas. Don't worry about what the variables mean. Just solve for the variable indicated. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers.

a. $v^2 = v_o^{\,2} + 2a(s - s_o)$, $a =$

b. $K = \frac{1}{2}kx^2$, $x =$

c. $T_p = 2\pi\sqrt{\frac{\ell}{g}}$, $g =$

d. $F_g = G\frac{m_1 m_2}{r^2}$, $r =$

e. $mgh = \frac{1}{2}mv^2$, $v =$

f. $x = x_o + v_o t + \frac{1}{2}at^2$, $t =$

g. $B = \frac{\mu_o}{2\pi}\frac{I}{r}$, $r =$

h. $x_m = \frac{m\lambda L}{d}$, $d =$

i. $pV = nRT$, $T =$

j. $\sin\theta_c = \frac{n_1}{n_2}$, $\theta_c =$

k. $qV = \frac{1}{2}mv^2$, $v =$

l. $\frac{1}{f} = \frac{1}{s_o} + \frac{1}{s_i}$, $s_i =$

PART III. FACTOR-LABEL METHOD FOR CONVERTING UNITS (Dimensional Analysis)

A very useful method of converting one unit to an equivalent unit is called the **factor-label method** of unit conversion. You may be given the speed of an object as 25 **km/h** and wish to express it in **m/s.** To make this conversion, you must change **km** to **m** and **h** to **s** by multiplying by a series of factors so that the units you do not want will cancel out and the units you want will remain. Conversion: 1000 **m** = 1 **km** and 3600 **s** = 1 ***h***,

$$\left(\frac{25\ \text{km}}{\text{h}}\right)\left(\frac{1000\ \text{m}}{1\ \text{km}}\right)\left(\frac{1\ \text{h}}{3600\ \text{s}}\right) =$$

What is the conversion factor to convert km/h to m/s?

What is the conversion factor to convert m/s to km/h?

Carry out the following conversions using the factor-label method. Show all your work!

1. How many seconds are in a year?

2. Convert 28 km to cm.

3. Convert 45 kg to mg.

4. Convert 85 cm/min to m/s.

5. Convert the speed of light, $3x10^8$ m/s, to km/day.

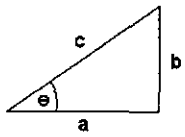
6. Convert 823 nm to m

7. 8.5 cm^3 to m^3

PART IV. TRIGONOMETRY AND BASIC GEOMETRY

Solve for all sides and all angles for the following triangles. Show all your work.

Example: *SOH CAH TOA*



$\sin\vartheta = \frac{opp}{hyp}$ $\cos\vartheta = \frac{adj}{hyp}$ $\tan\vartheta = \frac{opp}{adj}$

Your calculator must be in **degree** mode! **Show all your work.**

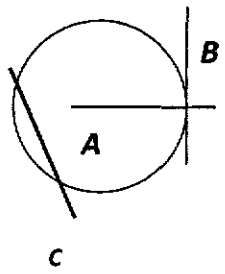
1. θ = 55° and *c* = 32 m, solve for *a* and *b*

2. θ = 45° and *a* = 15 m/s, solve for *b* and *c*.

3. *b*= 17.8 m and θ = 65°, solve for *a* and *c*.

4. Line ***B*** touches the circle at a single point. Line ***A*** extends through the center of the circle.

*What is line **B** in reference to the circle?*



How large is the angle between lines ***A*** and ***B***?

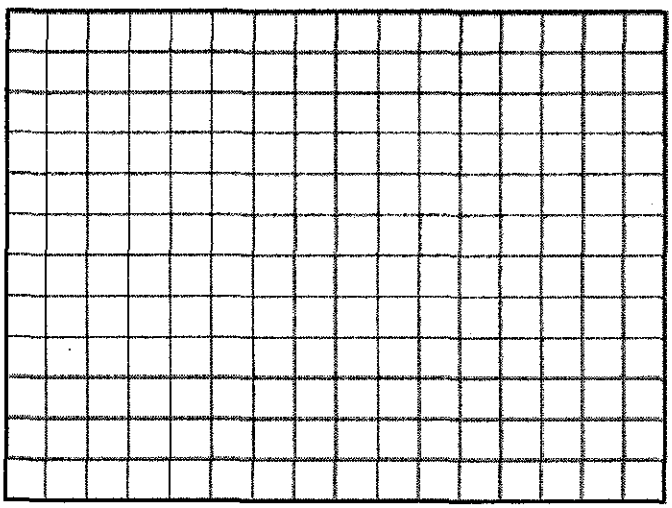
What is line ***C***?

PART V. GRAPHING TECHNIQUES

Graph the following sets of data using proper graphing techniques.

The first column refers to the *y*-axis and the second column to the *x*-axis

1. Plot a graph for the following data recorded for an object falling from rest:



Velocity (ft/s)	**Time** (s)
32	1
63	2
97	3
129	4
159	5
192	6
225	7

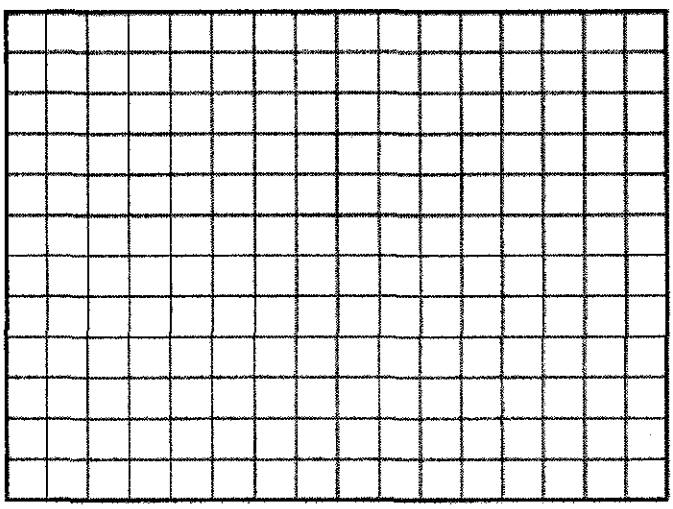
a. What kind of curve did you obtain?

b. What is the relationship between the variables?

c. What do you expect the velocity to be after 4.5 s?

d. How much time is required for the object to attain a speed of 100 ft/s?

2. Plot a graph showing the relationship between frequency and wavelength of electromagnetic waves:



Frequency (kHz)	Wavelength (m)
150	2000
200	1500
300	1000
500	600
600	500
900	333

a. What kind of curve did you obtain?

b. What is the relationship between the variables?

c. What is the wavelength of an electromagnetic wave of frequency 350 Hz?

d. What is the frequency of an electromagnetic wave of wavelength 375 m?

Vectors

Most of the quantities in physics are vectors. ***This makes proficiency in vectors extremely important.***

Magnitude: Size or extend. The numerical value.

Direction: Alignment or orientation of any position with respect to any other position.

Scalars: A physical quantity described by a single number and units. A quantity described by **magnitude only**.

Examples: time, mass, and temperature

Vector: A physical quantity with **both a magnitude and a direction**. A directional quantity.

Examples: velocity, acceleration, force

Notation: $\vec{A}$ or $\overrightarrow{A}$ Length of the arrow is proportional to the vectors magnitude. Direction the arrow points is the direction of the vector.

Negative Vectors

Negative vectors have the same magnitude as their positive counterpart. They are just pointing in the opposite direction.

$\vec{A}$ $-\vec{A}$

Vector Addition and subtraction

Think of it as vector addition only. The result of adding vectors is called the resultant. $\vec{R}$

$\vec{A}+\vec{B}=\vec{R}$ $\vec{A}$ + $\vec{B}$ = $\vec{R}$

So if A has a magnitude of 3 and B has a magnitude of 2, then R has a magnitude of 3+2=5.

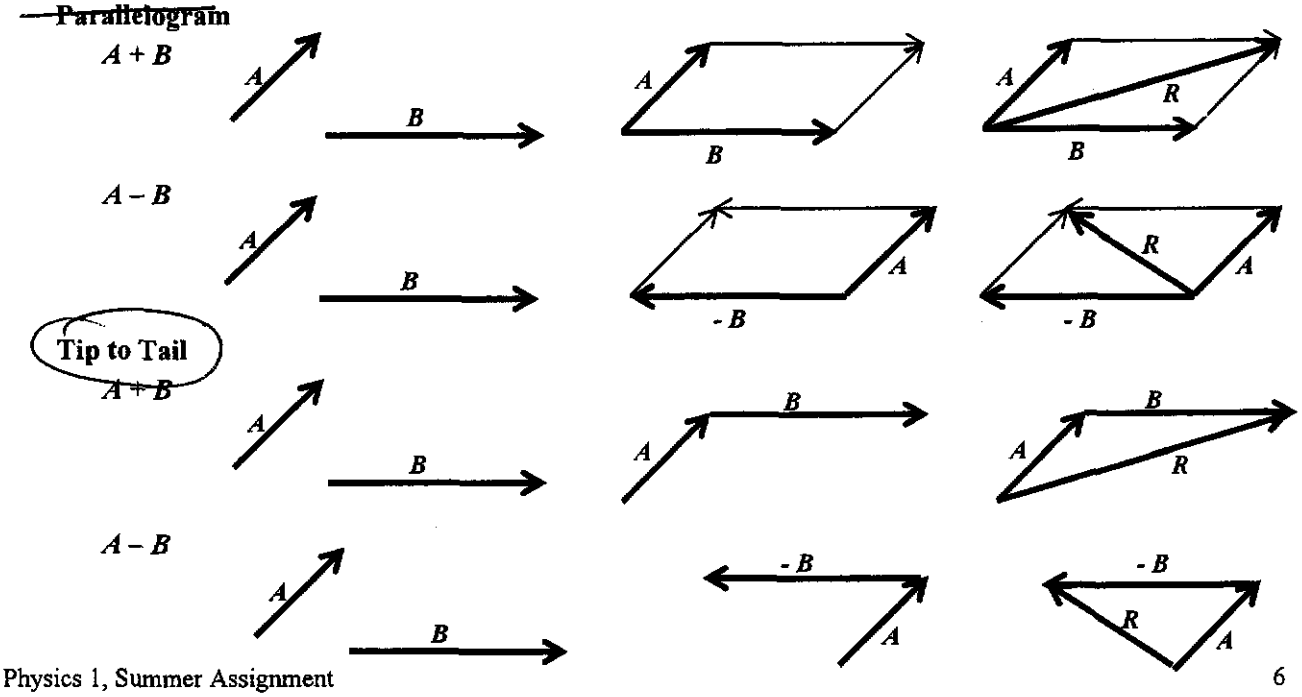
When you need to subtract one vector from another think of the one being subtracted as being a negative vector. Then add them.

A negative vector has the same length as its positive counterpart, but its direction is reversed.
So if A has a magnitude of 3 and B has a magnitude of 2, then R has a magnitude of 3+(-2)=1.

This is very important. In physics a negative number does not always mean a smaller number. Mathematically –2 is smaller than +2, but in physics these numbers have the same magnitude (size), they just point in different directions (180° apart).

There are two methods of adding vectors – We will only use "tip to tail" method

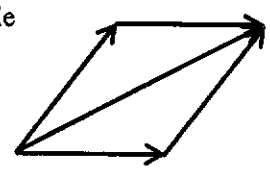
~~Parallelogram~~



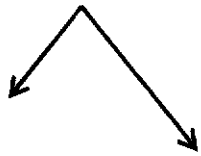
6. Drawing Resultant Vectors

Draw the resultant vector using the parallelogram method of vector addition.

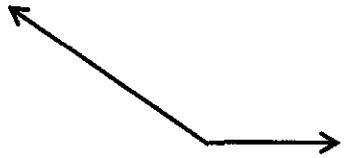
Do not do

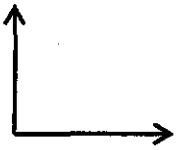
Example 

b. 

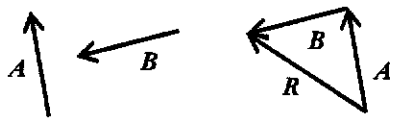
d. 

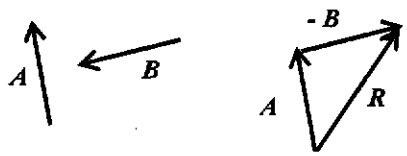
a. 

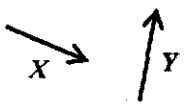
c. 

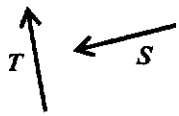
e. 

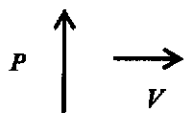
Draw the resultant vector using the tip to tail method of vector addition. Label the resultant as vector ***R***

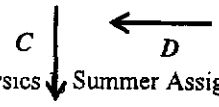
Example 1: $A + B$ 

Example 2: $A - B$ 

f. $X + Y$ 

g. $T - S$ 

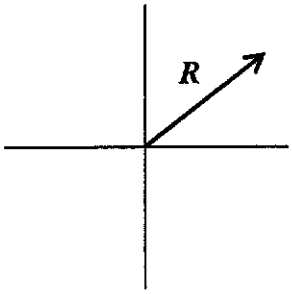
h. $P + V$ 

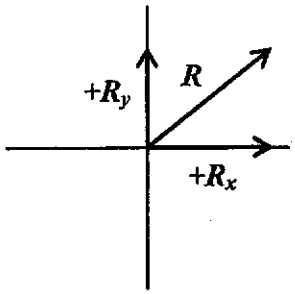
i. $C - D$ 

Component Vectors

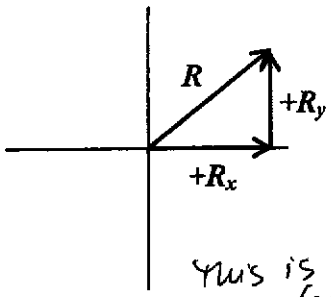
A resultant vector is a vector resulting from the sum of two or more other vectors. Mathematically the resultant has the same magnitude and direction as the total of the vectors that compose the resultant. Could a vector be described by two or more other vectors? Would they have the same total result?

This is the reverse of finding the resultant. You are given the resultant and must find the component vectors on the coordinate axis that describe the resultant.





or



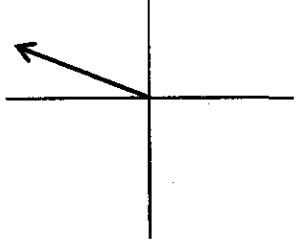
This is preferred

Any vector can be described by an x axis vector and a y axis vector which summed together mean the exact same thing. The advantage is you can then use plus and minus signs for direction instead of the angle.

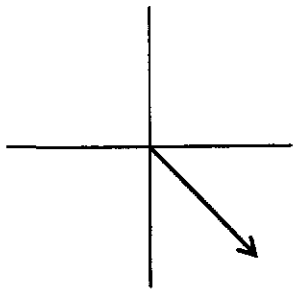
7. *Resolving a vector into its components*

For the following vectors draw the component vectors along the x and y axis.

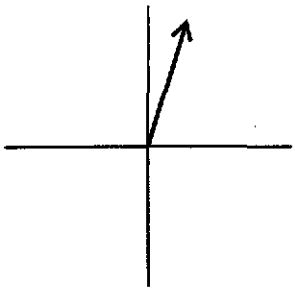
a.



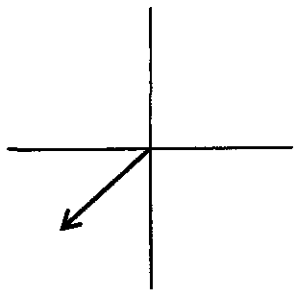
c.



b.



d.



Obviously the quadrant that a vector is in determines the sign of the x and y component vectors.

* * EXTRA CREDIT * *

AP Physics 1 Summer Assignment

I. Scientific Notation:

The following are ordinary physics problems. Write the answer in scientific notation and simplify the units (π=3).

a. $T_s = 2\pi\sqrt{\dfrac{4.5\times10^{-2}\,kg}{2.0\times10^{3}\,kg/s^2}} =$ T_s=_____

b. $F = \left(9.0\times10^{9}\,\dfrac{N\cdot m^2}{C^2}\right)\dfrac{(3.2\times10^{-9}C)(9.6\times10^{-9}C)}{(0.32m)^2}$ F=_____

c. $\dfrac{1}{R_p} = \dfrac{1}{4.5\times10^{2}\Omega} + \dfrac{1}{9.4\times10^{2}\Omega}$ R_p=_____

d. $K_{max} = (6.63\times10^{-34}J\cdot s)(7.09\times10^{14}s) - 2.17\times10^{-19}J$ K_{max}=_____

e. $\gamma = 1\Big/\sqrt{1-\dfrac{2.25\times10^{8}\,m/s}{3.00\times10^{8}\,m/s}}$ γ=_____

f. $K = \dfrac{1}{2}(6.6\times10^{2}\text{ kg})(2.11\times10^{4}\text{ m/s})^2 =$ K=_____

g. $(1.33)\sin 25.0^\circ = (1.50)\sin\theta$ θ=_____