AP Physics 1 Summer Assignment

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

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

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

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

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

g. $\left(1.33\right)\sin 25.0^\circ = \left(1.50\right)\sin\theta$ θ=________________

2. Solving Equations:

Often problems on the AP exam are done with variables only. Solve for the variable indicated. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers.

a. $K = \frac{1}{2}kx^2$ $\quad , x =$ ______________

b. $T_p = 2\pi\sqrt{\frac{\ell}{g}}$ $\quad , g =$ ______________

c. $F_g = G\frac{m_1 m_2}{r^2}$ $\quad , r =$ ______________

d. $mgh = \frac{1}{2}mv^2$ $\quad , v =$ ______________

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

f. $B = \frac{\mu_o}{2\pi}\frac{I}{r}$ $\quad , r =$ ______________

g. $x_m = \frac{m\lambda L}{d}$ $\quad , d =$ ______________

h. $pV = nRT$ $\quad , T =$ ______________

i. $\sin\theta_c = \frac{n_1}{n_2}$ $\quad , \theta_c =$ ______________

j. $qV = \frac{1}{2}mv^2$ $\quad , v =$ ______________

3. Conversion

Science uses the ***KMS*** system (***SI***: System Internationale). ***KMS*** stands for kilogram, meter, second. These are the units of choice of physics. The equations in physics depend on unit agreement. So you must convert to ***KMS*** in most problems to arrive at the correct answer.

kilometers (*km*) to meters (*m*)	and meters to kilometers	gram (*g*) to kilogram (*kg*)
centimeters (*cm*) to meters (*m*)	and meters to centimeters	Celsius (^oC) to Kelvin (*K*)
millimeters (*mm*) to meters (*m*)	and meters to millimeters	atmospheres (*atm*) to Pascals (*Pa*)
nanometers (*nm*) to meters (*m*)	and metes to nanometers	liters (*L*) to cubic meters (m^3)
micrometers (μm) to meters (*m*)		

Other conversions will be taught as they become necessary.

What if you don't know the conversion factors? Colleges want students who can find their own information (so do employers). Hint: Try a good dictionary and look under "measure" or "measurement". Or the Internet? Enjoy.

a. 4008 *g* = ________________ *kg*

b. 1.2 *km* = ________________ *m*

c. 823 *nm* = ________________ *m*

d. 298 *K* = ________________ ^oC

e. 0.77 *m* = ________________ *cm*

f. $8.8\text{x}10^{-8}$ *m* = ________________ *mm*

g. 1.2 *atm* = ________________ *Pa*

h. 25.0 μm = ________________ *m*

i. 2.65 *mm* = ________________ *m*

j. 8.23 *m* = ________________ *km*

k. 40.0 *cm* = ________________ *m*

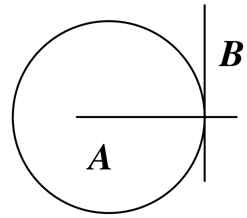
l. $6.23\text{x}10^{-7}$ *m* = ________________ *nm*

m. $1.5\text{x}10^{11}$ *m* = ________________ *km*

4. Geometry

Solve the following geometric problems.

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



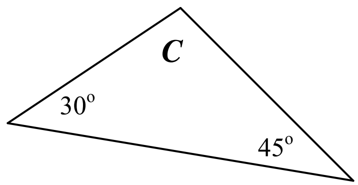
i. What is line ***B*** in reference to the circle?

____

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

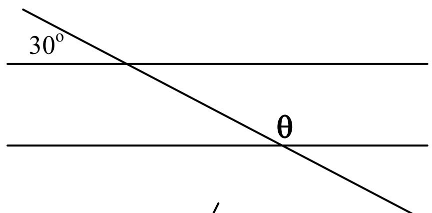
____

b. What is angle ***C***?



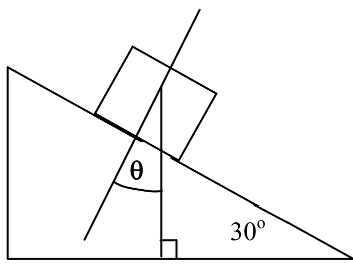
____

c. What is angle θ ?



____

d. How large is ***θ***?



____

e. The radius of a circle is 5.5 *cm*,

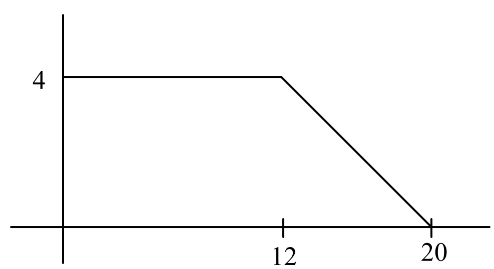
i. What is the circumference in <u>meters</u>?

____

ii. What is its area in <u>square meters</u>?

____

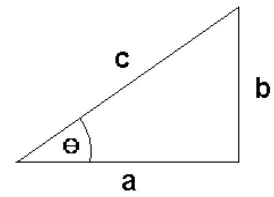
f. What is the area under the curve at the right?



____

5. Trigonometry

Using the generic triangle to the right, Right Triangle Trigonometry and Pythagorean Theorem solve the following. ***Your calculator must be in degree mode.***



g. $\theta = 55^{o}$ and ***c*** = 32 *m*, solve for ***a*** and ***b***.

____

h. $\theta = 45^{o}$ and ***a*** = 15 *m/s*, solve for ***b*** and ***c***.

____

i. ***b*** = 17.8 *m* and $\theta = 65^{o}$, solve for ***a*** and ***c***.

____

j. ***a*** = 250 *m* and ***b*** = 180 *m*, solve for θ and ***c***.

____

k. ***a*** =25 *cm* and ***c*** = 32 *cm*, solve for ***b*** and θ.

____

l. ***b*** =104 *cm* and ***c*** = 65 *cm*, solve for ***a*** and θ.

____

Vectors

Most of the quantities in physics are vectors. ***<u>This makes proficiency in vectors extremely important</u>***.

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 **<u>magnitude only</u>**.

Examples: time, mass, and temperature

Vector: A physical quantity with **<u>both a magnitude and a direction</u>**. A directional quantity.

Examples: velocity, acceleration, force

Notation: $\vec{A}$ or $\xrightarrow{\vec{A}}$ <u>Length</u> of the arrow is <u>proportional to the vectors magnitude</u>.
<u>Direction</u> the arrow points <u>is the direction of the vector</u>.

Negative Vectors

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

$\xrightarrow{\vec{A}}$ $\xleftarrow{-\vec{A}}$

Vector Addition and subtraction

Think of it as vector addition only. The result of adding vectors is called the <u>result</u>ant. $\vec{R}$

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

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.

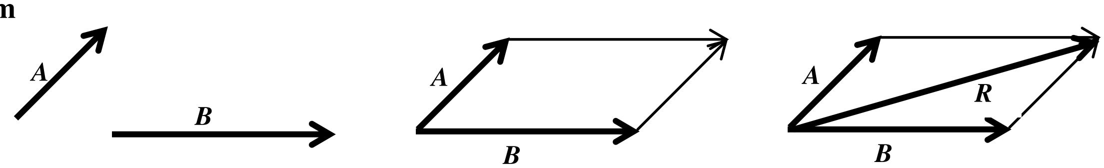
A negative vector has the same length as its positive counterpart, but its direction is reversed.
So if ***A*** has a magnitude of 3 and ***B*** has a magnitude of 2, then ***R*** has a magnitude of 3+(-2)=1.

<u>This is very important</u>. 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^{o} apart).

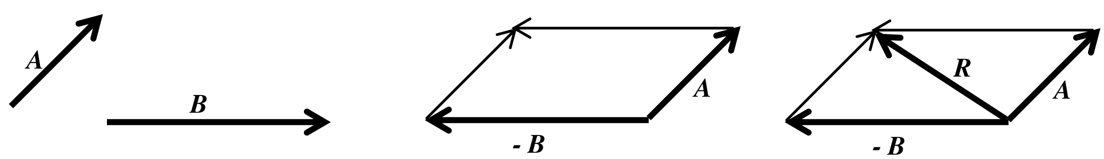
There are two methods of adding vectors

Parallelogram

A + ***B***

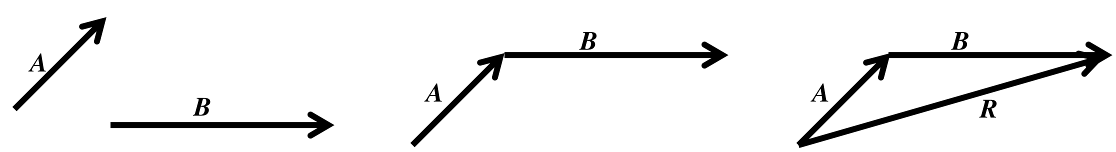


A – ***B***

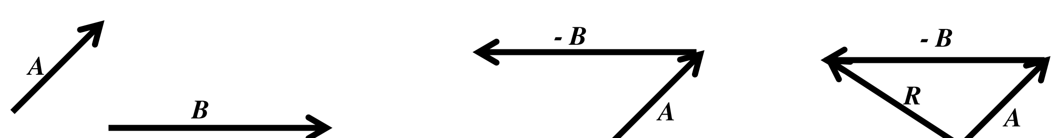


Tip to Tail

A + ***B***



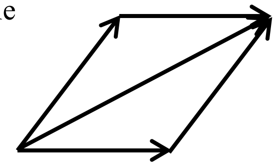
A – ***B***



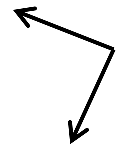
6. Drawing Resultant Vectors

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

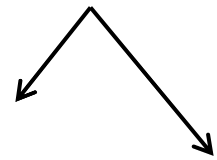
Example



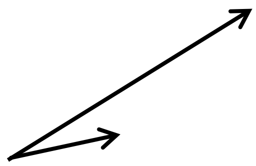
b.



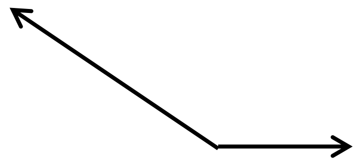
d.



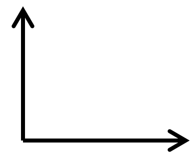
a.



c.

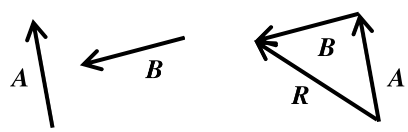


e.

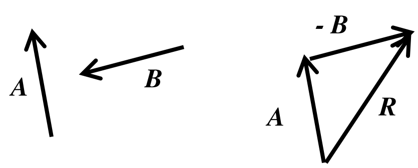


Draw the resultant vector using the tip to tail method of vector addition. Label the resultant as vector ***R***

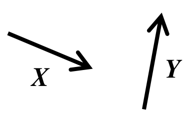
Example 1: ***A*** + ***B***



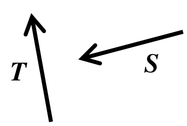
Example 2: ***A*** – ***B***



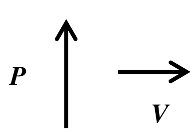
f. ***X*** + ***Y***



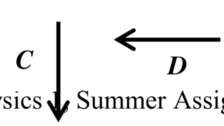
g. ***T*** – ***S***



h. ***P*** + ***V***



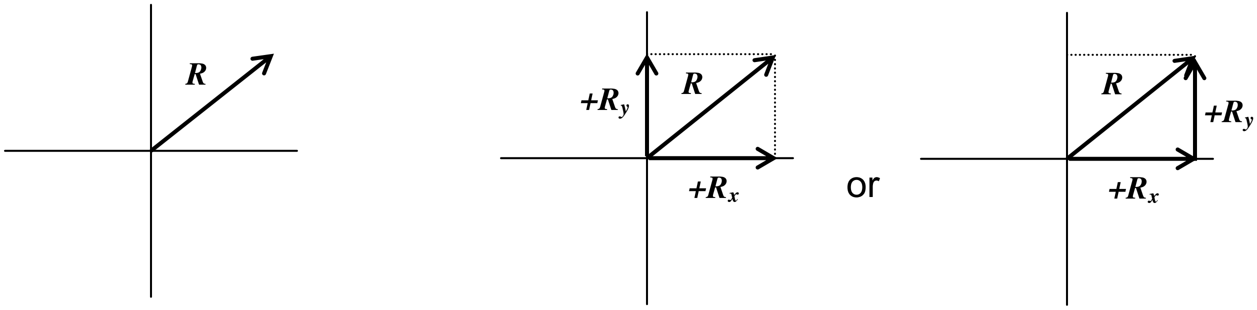
i. ***C*** – ***D***



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.

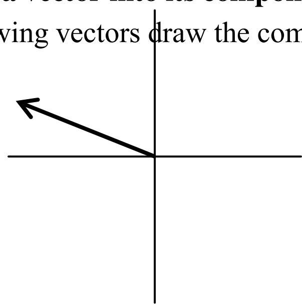


Any vector can be described by an ***x*** axis vector and a ***y*** axis vector which summed together mean the exact same thing. The advantage is you can then use plus and minus signs for direction instead of the angle.

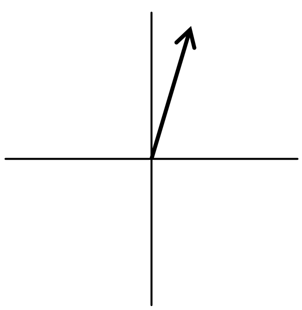
7. Resolving a vector into its components

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

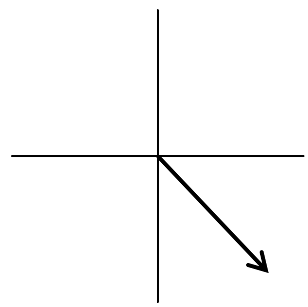
a.



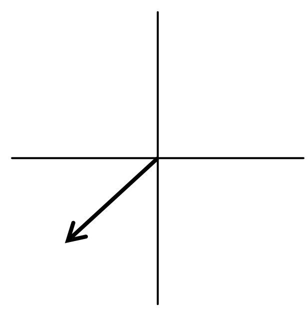
b.



c.



d.



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