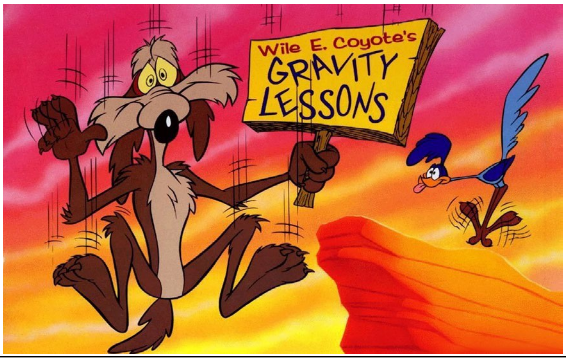
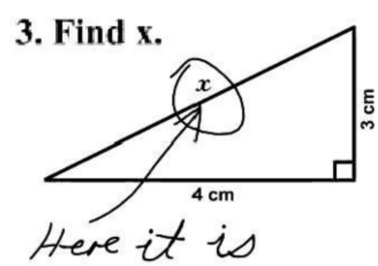
AP-1 Physics

Summer Assignment





I. This packet is a math review to brush up on valuable skills, and perhaps a means to assess whether you are correctly placed in Advanced Placement Physics 1.

II. AP Physics 1 requires a proficiency in algebra, trigonometry, and geometry. In addition to the science concepts Physics often seems like a course in applied mathematics. The following assignment includes mathematical problems that are considered routine in AP Physics. This includes knowing several key metric system conversion factors and how to employ them.

Enjoy the summer and I'll see you in August!

Unit Conversions Review

1.) Finish the SI prefix table below. Follow the example of the centi- prefix.

Symbol	Name	Numerical Equivalent
n		
μ		
m		
c	centi	10^{-2}
k		
M		
G		

2.) 16.7 kilograms is how many grams?

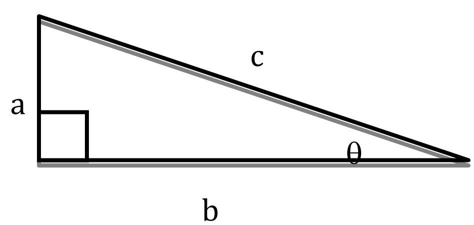
3.) 560 nm is how many meters?

4.) 15 years is how many seconds?

5.) 8.99×10^9 seconds is how many years?

6.) 2.998×10^8 m/s is how many kilometers per hour?

Trigonometry Review
Directions: Use the figure below to answer problems 7-16. Simplify as much as you can.



7.) Find *c* if given *a* and *b*.

8.) Find *a* if given *b* and *c*.

9.) Find *a* if given *c* and θ.

10.) Find *b* if given *a* and θ.

11.) Find *c* if given *b* and θ.

12.) Find θ if given *b* and *c*.

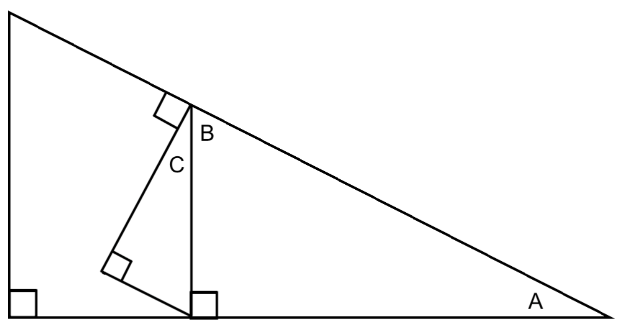
13.) Find θ if given a and b.

14.) If a = 2.0 and c = 7.0, what is b?

15.) If c = 10.0 and θ = 60°, what is b?

16.) If a = 12.0 and θ = 30°, what is b?

17.) Using the properties of triangles, prove that ∠A ≅ ∠C in the drawing below.



Answer:

18.) Complete the table below without using a calculator.

θ	0°	30°	45°	60°	90°
sin θ					
cos θ					
tan θ					

19.) 360 degrees = ________ radians.

26.) 4.5 revolutions = _______ radians.

20.) Find the length of an arc with a radius of 6.0 m swept across 2.5 radians.

21.) Find the length of an arc with a radius of 10.0 m swept across 100 degrees.

Algebra Review

Directions: Solve the following equations for the given variable and conditions. Simplify if needed.

Example: $2x + xy = z$. Solve for *x*.

$$x(2+y) = z$$

$$\boxed{x = \frac{z}{2+y}}$$

22.) $v_1 + v_2 = 0$. Solve for v_1.

23.) $a = \frac{v}{t}$. Solve for *t*.

24.) $v_f^2 = v_i^2 + 2ad$

A.) Solve for v_i.

B.) Solve for *d*.

25.) $d_f = d_i + v_o t + \frac{1}{2}at^2$

A.) Solve for v_o.

B.) Solve for t, if $v_o = 0$.

C.) Solve for t, if $d_i = d_f$.

26.) $F = m\frac{v_f - v_i}{t_f - t_i}$

A.) Solve for v_f, if $t_i = 0$.

B.) Solve for t_f, if $v_f = 0$ and $t_i = 0$.

27.) $a_c = \frac{v^2}{r}$. Solve for v.

B.) $mg\sin\theta = \mu mg\cos\theta$. Solve for θ.

28.) $\frac{1}{2}mv_f^{\ 2} + mgh_f = \frac{1}{2}mv_i^{\ 2} + mgh_i$

A.) Solve for h_f, if $h_i = 0$ and $v_f = 0$.

B.) Solve for v_f, if $h_f = 0$.

29.) $Ft = mv_f - mv_i$. Solve for v_f.

30.) $m_1 v_{i,1} + m_2 v_{i,2} = (m_1 + m_2)v_f$. Solve for $v_{i,2}$.

31.) $m_1 v_{i,1} + m_2 v_{i,2} = m_1 v_{f,1} + m_2 v_{f,2}$. Solve for $v_{f,2}$ if $v_{i,1} = 0$.

32.) $(F_1 \sin\theta)r_1 + (-F_2 \sin\phi)r_2 = 0$. Solve for r_2.

33.) $-kx + m(-g) = 0$. Solve for m.

34.) $F_g = G\frac{m_1 m_2}{r^2}$. Solve for r.

35.) $L - L\cos\theta = \frac{v^2}{2}$ Solve for L

36.) $\frac{mv^2}{R} = G\frac{Mm}{R^2}$. Solve for *v*.

37.) $T = 2\pi\sqrt{\frac{L}{g}}$. Solve for *g*.

38.) $\frac{1}{2}mv_f^2 + \frac{1}{2}kx^2 = \frac{1}{2}mv_i^2 + mgh_i$. Solve for *x* if $v_f = 0$.

39.) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$. Solve for R_T.

Miscellaneous

Directions: Simplify without using a calculator. Remember to show all of your work.

40.) $\frac{1}{4} + \frac{1}{6}$

41.) $\frac{1}{3} + \frac{1}{18}$

42.) Consider $z = \frac{x}{y}$, $c = ab$, $l = m - n$, or $r = \frac{s^2}{t^2}$.

a.) As x increases and y stays constant, z ____________________.

b.) As y increases and x stays constant, z ____________________.

c.) As x increases and z stays constant, y ____________________.

d.) As a increases and c stays constant, b ____________________.

e.) As c increases and b stays constant, a ____________________.

f.) As b increases and a stays constant, c ____________________.

g.) As n increases and m stays constant, l ____________________.

h.) As l increases and n stays constant, m ____________________.

i.) If s is tripled and t stays constant, r is multiplied by ____________________.

j.) If t is doubled and s stays constant, r is multiplied by ____________________.

Systems of equations

Use the equations in each problem to solve for the specified variable in the given terms. Simplify.

43.) $F_f = \mu F_N$ and $F_N = mg\cos\theta$. Solve for μ in terms of F_f, m, g, and θ.

44.) $F_1 + F_2 = F_T$ and $F_1 \cdot d_1 = F_2 \cdot d_2$. Solve for F_1 in terms of F_T, d_1, and d_2.

45.) $F_c = ma_c$ and $a_c = \frac{v^2}{r}$. Solve for r in terms of F_c, m, and v.

46.) $T = 2\pi\sqrt{\frac{L}{g}}$ and $T = \frac{1}{f}$. Solve for L in terms of π, g, and f.

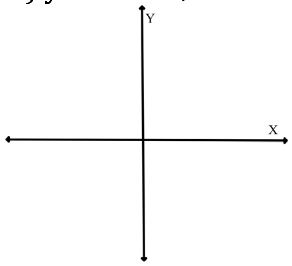
Graphing Equations

47.) If $r = c - x*t$ was graphed on an r vs. t graph, what would the following be?

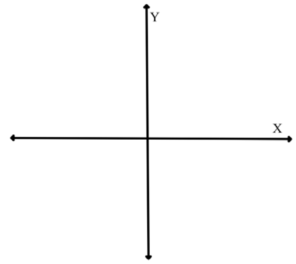
Slope: ____________ y-intercept: _______________

48.) On the y vs. x graphs below, sketch the relationships given.

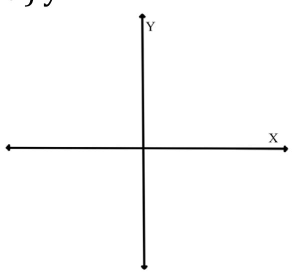
a.) $y = mx + b$, if $m > 0$ and $b = 0$.



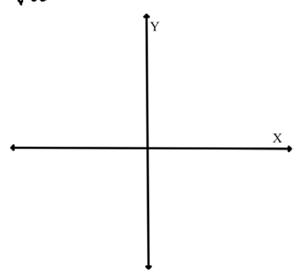
b.) $y = mx + b$, if $m < 0$ and $b > 0$.



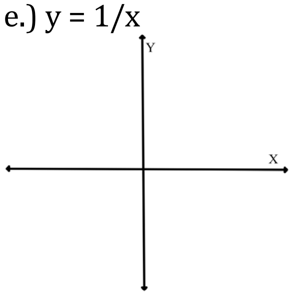
c.) $y = x^2$



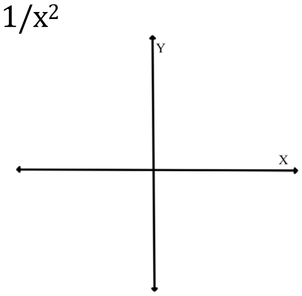
d.) $y = \sqrt{x}$



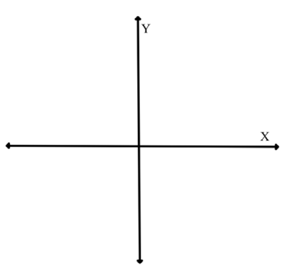
e.) $y = 1/x$



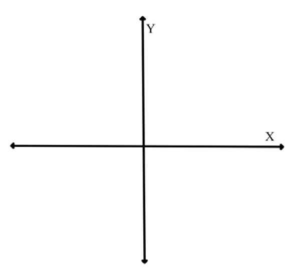
f.) $y = 1/x^2$



g.) $y = \sqrt{\frac{1}{x}}$



h.) $y = \sin(x)$



GRAPHING TECHNIQUES

Frequently an investigation will involve finding out how changing one quantity affects the value of another. The quantity that is deliberately manipulated is called the *independent variable.* The quantity that changes as a result of the independent variable is called the *dependent variable.* The relationship between the independent and dependent variables may not be obvious from simply looking at the written data. However, if one quantity is plotted against the other, the resulting graph gives evidence of what sort of relationship, if any, exists between the variables.

When plotting a graph, take the following steps.

1. Identify the independent and dependent variables.

2. Choose your scale carefully. Make your graph as large as possible by spreading out the data on each axis. Let each space stand for a convenient amount. For example, choosing three paces equal to ten is not convenient because each space does not divide evenly into ten. Choosing five spaces equal to ten would be better. Each axis must show the numbers you have chosen as your scale. However, to avoid a cluttered appearance, you do not need to number every space.

3. All graphs do not go through the origin (0,0). Think about your experiment and decide if the data would logically include a (0,0) point. For example, if a cart is at rest when you start the timer, then your graph of speed versus time would go through the origin. If the cart is already in motion when you start the timer, your graph will not go through the origin.

4. Plot the independent variable on the horizontal (x) axis and the dependent variable on the vertical (y) axis. Plot each data point.

5. If the data points appear to lie roughly in a straight line, draw the best straight line you can with a ruler and a sharp pencil. Have the line go through as many points as possible with approximately the same number of points above the line as below. **Never connect the dots**. If the points do not form a straight line, draw the best smooth curve possible.

6. Title your graph. The title should dearly state the purpose of the graph and include the independent and dependent variables.

7. Label each axis with the name of the variable and the unit. The graph shown on the next page was prepared using good graphing techniques.

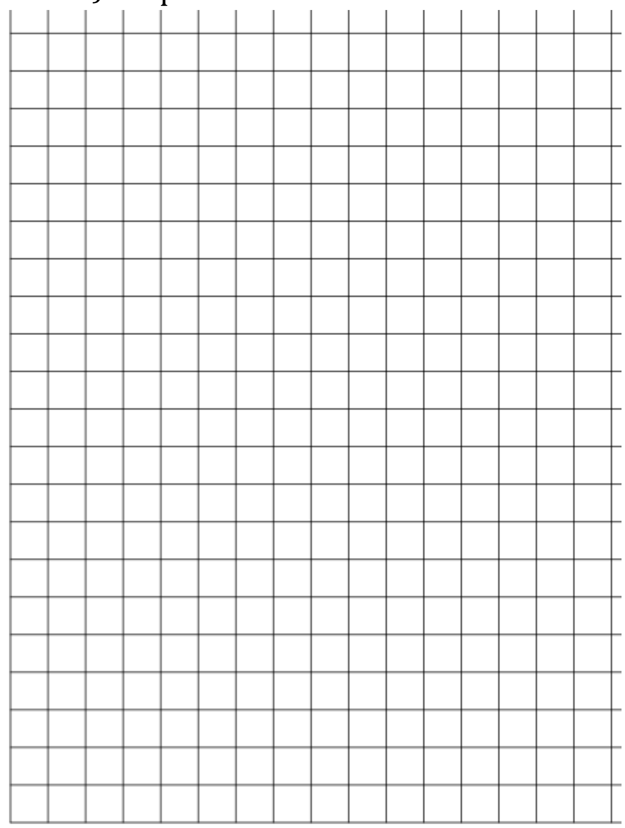
Marbles in Cylinder Lab

You received a graduated cylinder with three identical marbles and an unknown amount of water already in it. You placed extra identical marbles in the cylinder and obtained the data below. Use the data to graph a best-fit line showing the relationship between the water level and the number of marbles. The y-intercept should be visible on the graph. Label your axes and include units.

From the graph, determine a mathematical formula for the water level for any number of marbles.

Number of Marbles in Water	Water level (mL)
3	58
4	61
5	63
6	65
7	68

49.) Graph below



50. Draw the line of best fit then write the equation that represents the graph.