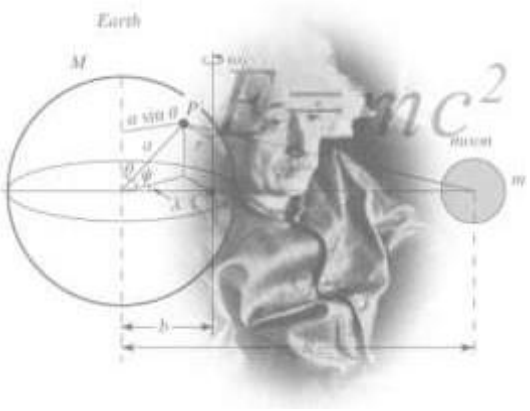
AP Physics 1 Summer Assignment

Welcome to AP Physics 1! It is a college level physics course that is fun, interesting and challenging on a level you may not have experienced.



In order to understand the concepts we will be covering, you will need to use the math you have learned in various courses up until now - in many cases you will be using this math in a new way or from a different perspective.

This assignment is a bit of review and a bit of an introduction to how you will be using some math concepts throughout the course. Most of the questions will be review. There are some that you may not know, but do your best and see what you can figure out. Don't let yourself get frustrated if you don't know an answer right away. Persistence and "figuring it out" are key to success in Physics.

You may print the packet and put your answers on the packet, or if you prefer, write your answers on a separate sheet of paper. The assignment will be due on the first day of class. Good luck!

Part 1: A quick review of some of the concepts you will need for this packet.

One of the great things with this subject is that there are tons of resources for extra review, more explanations and sample problems on the internet. This portion of the assignment gives you some great review and also introduces you to a website called FlippingPhysics.com. An excellent resource you can use throughout the course!

Click on each link, watch the video and answer the questions in the google form:

Intro to Base Dimensions (Dimensions are your friends!)

Conversions in Physics

SOHCAHTOA and the Pythagorean Theorem

Part 2: Scientific Notation and Dimensional Analysis

Many numbers in physics will be provided in scientific notation. You need to be able to work with numbers in scientific notation.

Express the following the numbers in scientific notation. Keep the same unit as provided. ALL answers in physics need their appropriate unit to be correct. Do these problems without a calculator.

1. 7,640,000 kg

2. 0.000000003 m

3. 8327.2 s

4. 0.0093 km/s

Fill in the power and the symbol for the following unit prefixes. Look them up as necessary. Kilo- has been completed as an example.

Prefix	Power	Symbol
Giga-		
Mega-		
Kilo-	10^3	k
Centi-		
Milli-		
Micro-		
Nano-		
Pico-		

Convert the following numbers into the specified unit. Use scientific notation when appropriate. Remember if there is an exponent on the unit, the conversion should be raised to the same exponent as well.

1. 24 g =_____kg
2. 94.1 MHz =_____Hz
3. 6 Gb =_____kb
4. 640 nm =_____m
5. 3.2 m^2 =_____cm^2
6. 40 mm^3 =_____m^3
7. 1 g/cm^3 =_____kg/m^3
8. 20 m/s =_____km/hr

It is important that you know how to use your calculator for scientific notation. Use your calculator to answer the questions below.

The easiest method is to use the "EE" button. An example is included below to show you how to use the "EE" button.

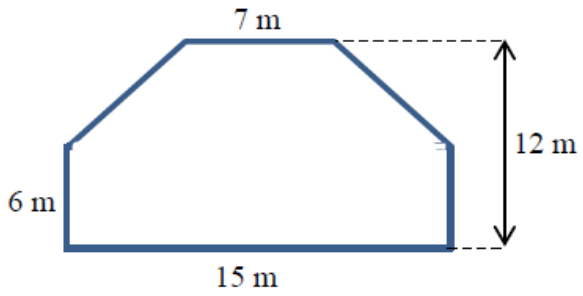
Ex: $7.8x10^{-6}$ would be entered as 7.8"EE"-6

9. $(3.67x10^3)(8.91x10^{-6})$ =
10. $(5.32x10^{-2})(4.87x10^{-4})$ =
11. $(9.2x10^6) / (3.6x10^{12})$ =
12. $(6.12x10^{-3})^3$

Part 2: Geometry

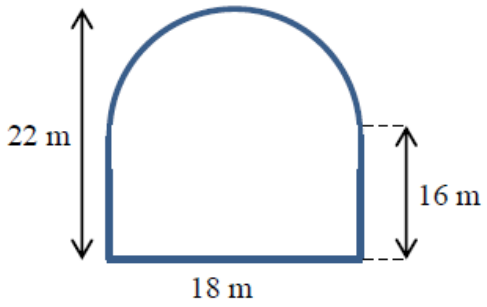
Calculate the area of the following shapes. It may be necessary to break up the figure into common shapes.

1.



Area = _____

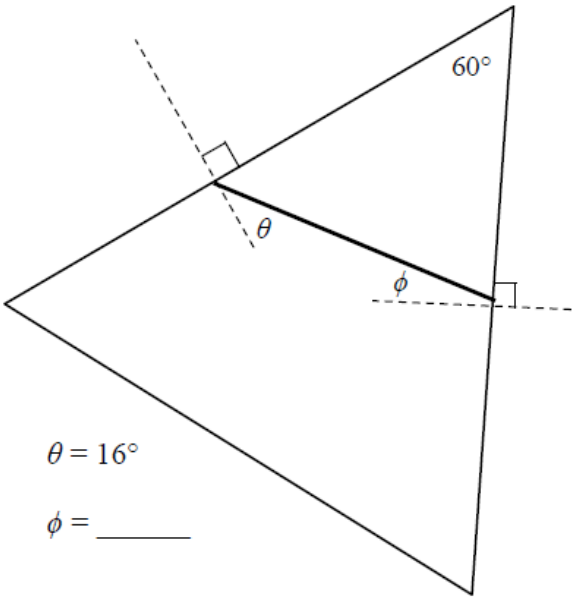
2.



Area = _____

Find the indicated angles for #3 – 6.

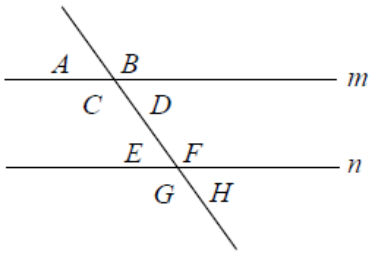
3.



$\theta = 16°$

$\phi =$ _____

4.

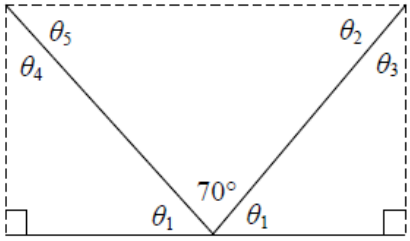


Lines m and n are parallel.

$A = 75°$ $B =$ _____ $C =$ _____ $D =$ _____

$E =$ _____ $F =$ _____ $G =$ _____ $H =$ _____

5.



$\theta_1 =$ _____

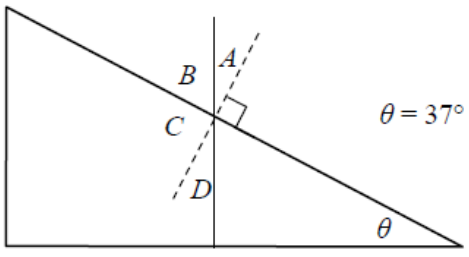
$\theta_2 =$ _____

$\theta_3 =$ _____

$\theta_4 =$ _____

$\theta_5 =$ _____

6.



$A =$ _____ $B =$ _____

$C =$ _____ $D =$ _____

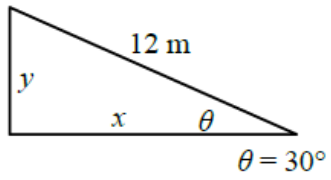
Part 3: Trigonometry

Write the formulas for each one of the following trigonometric functions. Remember SOHCAHTOA!

$\sin\theta =$ $\cos\theta =$ $\tan\theta =$

Calculate the following unknowns using trigonometry. Use a calculator, but show all of your work. Please include appropriate units with all answers. (Watch the unit prefixes!)

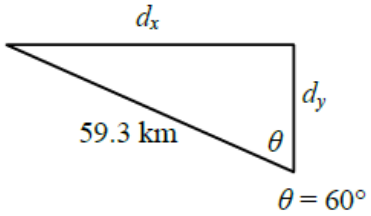
1.



$y =$ _____

$x =$ _____

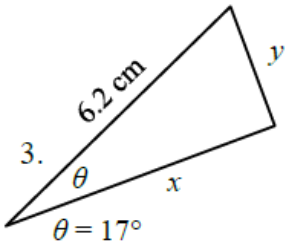
2.



$d_x =$ _____

$d_y =$ _____

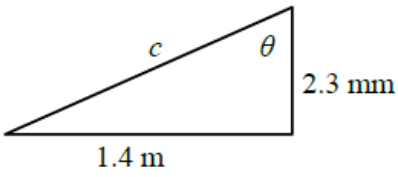
3.



$x =$ _____

$y =$ _____

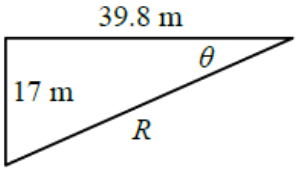
4.



$c =$ _____

$\theta =$ _____

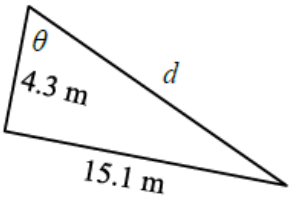
5.



$R =$ _____

$\theta =$ _____

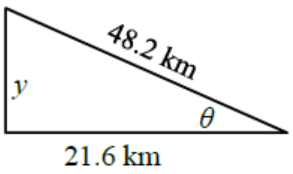
6.



$d =$ _____

$\theta =$ _____

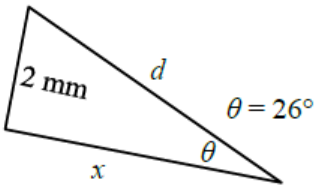
7.



$y =$ _____

$\theta =$ _____

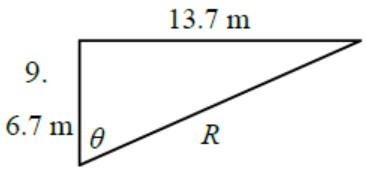
8.



$x =$ _____

$d =$ _____

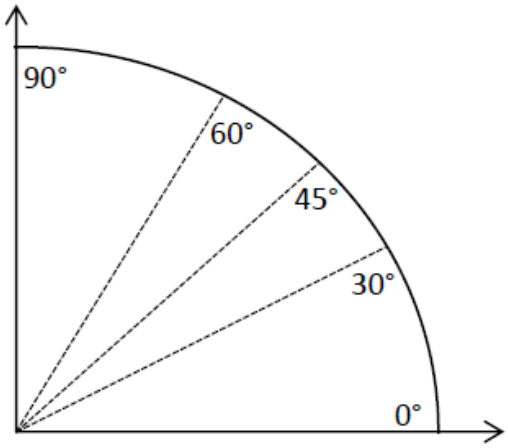
9.



$R =$ _____

$\theta =$ _____

You will need to be familiar with trigonometric values for a few common angles. Memorizing this unit circle diagram in degrees or the chart below will be very beneficial for next year in both physics and pre-calculus. How the diagram works is the cosine of the angle is the x-coordinate and the sine of the angle is the y-coordinate for the ordered pair. Write the ordered pair (in fraction form) for each of the angles shown in the table below



θ	$\cos\theta$	$\sin\theta$
0°		
30°		
45°		
60°		
90°		

Refer to your completed chart to answer the following questions.

10. At what angle is sine at a maximum?

11. At what angle is sine at a minimum?

12. At what angle is cosine at a minimum?

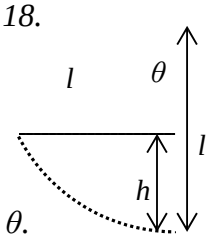
13. At what angle is cosine at a maximum?

14. At what angle are the sine and cosine equivalent?

15. As the angle increases in the first quadrant, what happens to the cosine of the angle?

16. As the angle increases in the first quadrant, what happens to the sine of the angle?

Use the figure below to answer problems 17 and 18.



17. Find an expression for h in terms of l and θ.

18. What is the value of h if l = 6 m and θ = 40°?

Part 4: Algebra

Solve the following. Units on thenumbers are included because they are essential to the concepts, however they do not have any *effect* on the actual numbers you are putting into the equations. In other words, the units do not change how you do the algebra. Show every step for every problem, including writing the original equation, all algebraic manipulations, and substitution! You shouldpractice doing all algebra *before* substituting numbers in for variables.

Section I: *For problems 1-4, use the three equations below:*

$$v_f = v_o + at$$

$$x_f = x_o + v_0 t + \frac{1}{2}at^2$$

$$v_f^2 = v_o^2 + 2a(x_f - x_o)$$

1. Using equation (1) solve for t given that v_0 = 5 m/s, v_f = 25 m/s, and a = 10 m/s^2.
2. a = 10 m/s^2, x_0 = 0 m, x_f = 120 m, and v_0 = 20 m/s. Use the second equation to find t.
3. v_f = - v_0 and a = 2 m/s^2. Using equation (3), what must be true of x_f and x_o?
4. How does each equation simplify when a = 0 m/s^2 and x_0 = 0 m?

Section II: *For problems 5– 10, use the four equations below.*

$$\Sigma F = ma \qquad\qquad f_s \leq \mu_s N$$

$$f_k = \mu_k N \qquad\qquad F_s = -kx$$

5. If ΣF = 10 N and a = 1 m/s^2, find m using the first equation.
6. Given $\Sigma F = f_k$, m = 250 kg, μ_k= 0.2, and N = 10m, find a.
7. $\Sigma F = T - 10m$, but a = 0 m/s^2. Use the first equation to find m in terms of T.

8. Given the following values, determine if the third equation is valid. $\Sigma F = f_s$, m = 90 kg, and a = 2 m/s^2. Also, μ_s= 0.1, and N = 5 N.

9. Use the first equation in Section I, the first equation in Section II and the givens below, find ΣF. m = 12 kg, v_0 = 15 m/s, v_f = 5 m/s, and t = 12 s.

10. Use the last equation to solve for F_s if k = 900 N/m and x = 0.15 m.

Section III: *For problems 11, 12, and 13 use the two equations below*

$$\tau = rF \sin\theta$$

$$a = \frac{v^2}{r}$$

11. Given that v is 5 m/s and r is 2 meters, find a.

12. Originally, a = 12 m/s^2, then r is doubled. Find the new value for a.

13. Use the second equation to find θ when τ = 4 Nm, r = 2 m, and F = 10 N.

Part 5: Graphing and Functions

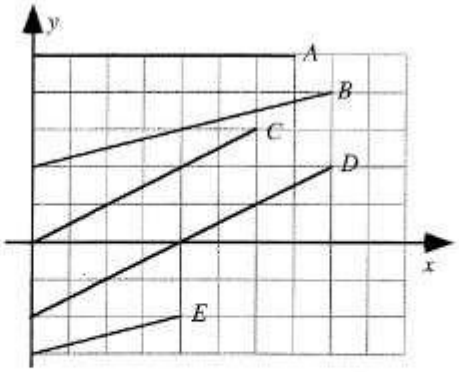
A greater emphasis has been placed on conceptual questions and graphing on the AP exam. Below you will find a few example concept questions that review foundational knowledge of graphs. Ideally you won't need to review, but you may need to review some math to complete these tasks. At the end of this part is a section covering graphical analysis that you probably have not seen before: *linear transformation*. This analysis involves converting any non-linear graph into a linear graph by adjusting the axes plotted. We want a linear graph because we can easily find the slope of the line of best fit of the graph to help justify a mathematical model or equation.

Key Graphing Skills to remember:

1. Always label your axes with appropriate units.
2. Sketching a graph calls for an estimated line or curve while plotting a graph requires individual data points AND a line or curve of best fit.
3. Provide a clear legend if multiple data sets are used to make your graph understandable.
4. Never include the origin as a data point unless it is provided as a data point.
5. Never connect the data points individually, but draw a single smooth line or curve of best fit
6. When calculating the slope of the best fit line you must use points from your line. You may only use given data points IF your line of best fit goes directly through them.

Conceptual Review of Graphs

Shown are several lines on a graph.

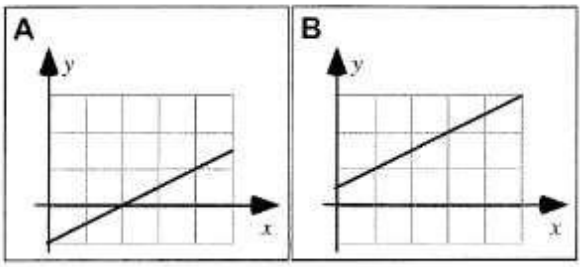


Rank the slopes of the lines in this graph.

					OR			
1 Greatest	2	3	4	5 Least		All the same	All zero	Cannot determine

Explain your reasoning.

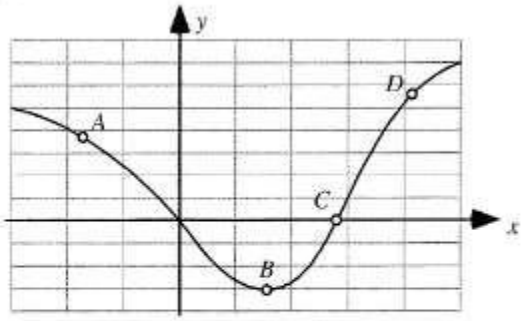
Shown are two graphs.



Is the slope of the graph (i) *greater in Case A*, (ii) *greater in Case B*, or (iii) *the same in both cases?* _____

Explain your reasoning.

Four points are labeled on a graph.



Rank the slopes of the graph at the labeled points.

				OR			
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

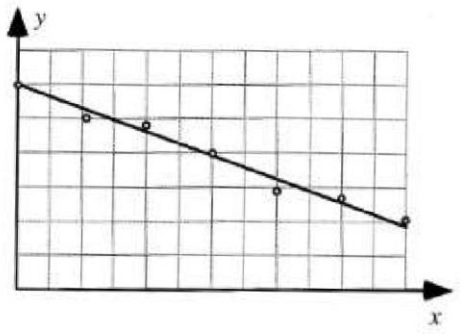
Explain your reasoning.

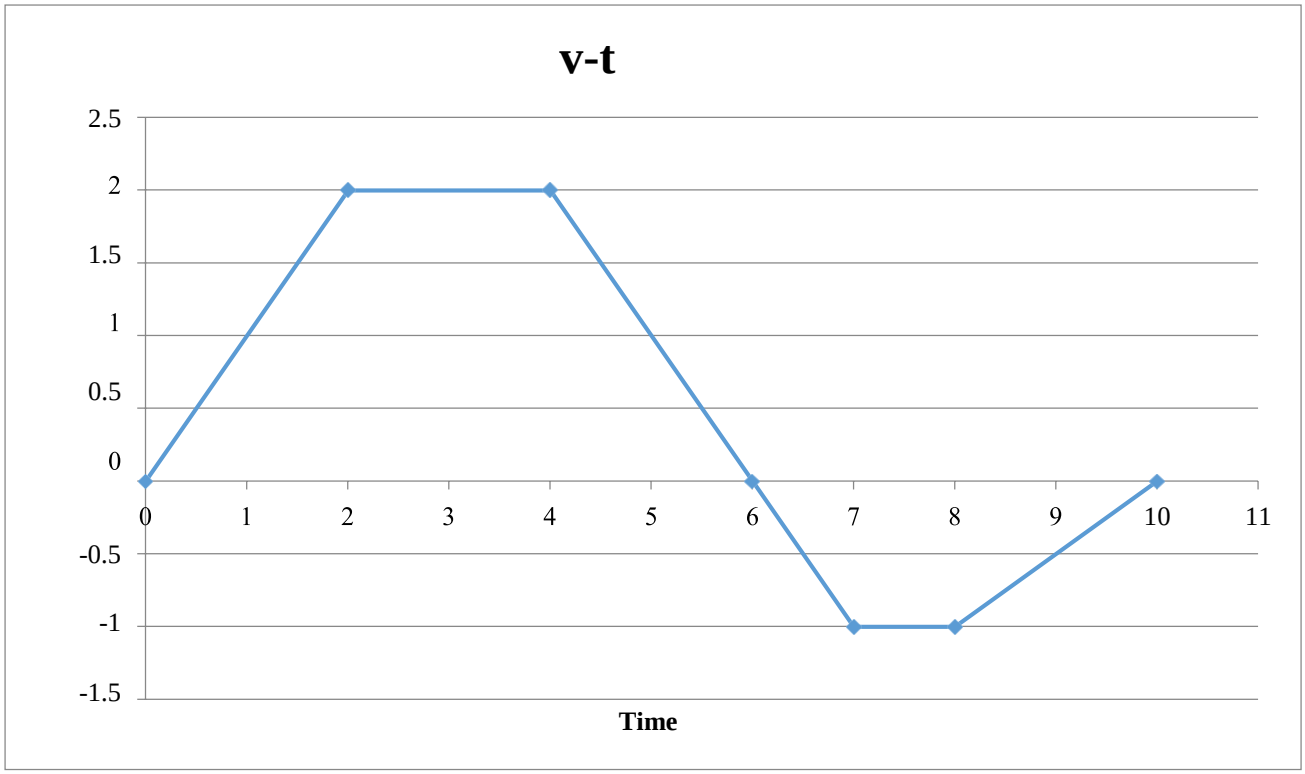
A1-WWT22: Line Data Graph—Interpretation

A student makes the following claim about some data that he and his lab partners have collected:

"Our data show that the value of y decreases as x increases. We found that y *is inversely proportional to* x*."*

What, if anything, is wrong with this statement? If something is wrong, identify and explain how to correct all errors. If this statement is correct, explain why.





This graph depicts a car starting from rest and moving to the right (positive direction). Interpret the graph and answerthe questions below and remember to show your work when calculating.

1. What is the slope of the line from 4 seconds to 7 seconds?

2. What is the area under the curve between 0 seconds and 2 seconds?

3. At what time(s) is the car not moving?

4. During which period of time is the car moving to the left?

Part 6: Scalars and Vectors Preview

Khan Academy is another great resource for AP Physics and for many other courses. Hooray for the Internet! Watch the following video. When you are done, summarize the content Mr. Khan is presenting in about three sentences. Then, write at least one question per video on something you didn't understand or on a possible extension of the elementary concepts he presents here.

http://www.khanacademy.org/science/physics/v/introduction-to-vectors-and-scalars

Summary:

Congratulations! You're done!