AP Physics 1 Summer Assignment

Hello, and welcome to AP Physics 1! This is your summer assignment, which **should be completed before the first day of school**. *Note: if you end up having this class in the spring, then it will should be completed before the first day of that class, and you should review it over the winter break. However, you should complete the assignment during the summer since you may not know which semester you have the class until shortly before school begins.* The purpose of this summer assignment is to give you a chance to review math skills that will be **necessary** for you to be successful in this course. If you have any questions, please note of them, as there will be some time in the first two days of school to ask questions about topics from the summer assignment.

Your to-do list *for the summer*:

- ☐ Review the prerequisite math skills (listed below) using the resources (also listed/linked below), as needed. Feel free to try the practice questions/puzzles mentioned below first and then use them to find out what you need to go back and review using the resources.
- ☐ Practice problem-solving skills to complete the enclosed practice questions/puzzles listed below. Feel free to collaborate with other AP Physics 1 students on these problems, but make sure you understand everything you are doing, or it's just a waste of your time. You will be expected to have these skills at the beginning of your AP Physics 1 course.
  - ☐ Scientific Notation, Metric Units, and Basic Trigonometry Tangram
  - ☐ Right Triangle Trigonometry Tangram
  - ☐ Algebra Practice
  - ☐ Geometry Practice
  - ☐ Graphing Practice TIPERs
- ☐ Conceptual Preview

Prerequisite math skills to review this summer

- ☐ Algebra manipulation of equations (e.g. isolating a particular variable in an equation)
- ☐ Trigonometry (SOH CAH TOA in particular)
- ☐ Graphing skills

Resources to use for reviewing: *(don't feel obligated to use all parts of all of them, but check them out and see what works well for you to review. As mentioned above, feel free to try the practice questions/puzzles first and then use them to find out what you need to go back and review using the resources.*

1. Khan Academy resources, select topics you need more review with (more info about Khan Academy on p. 2)
   a. Pre-algebra: The scientific notation sections of this topic
   b. Algebra I: Algebra foundations, Solving equations & inequalities, Working with units, Linear equations & graphs
   c. Geometry: Area, Right triangles & trigonometry
   d. Algebra: Vectors

AP Physics 1 Summer Assignment

How to use Khan Academy:

- Khan Academy has both information and practice questions for you to apply what you learn
- The tutorials on Khan Academy are a mixture of videos (with the triangle "Play Button" icon next to them) and written tutorials (with the piece-of-paper icon next to them).
- The tutorials are usually listed in order of increasing complexity. The skills from the later tutorials and videos build on the skills from the earlier ones. If you get lost in a tutorial, you may need to go back and review a previous concept first.
- After reviewing over everything in a section, complete the included practice to see if you can apply the skills. See if you can answer the questions without hints. If not, you may need to continue reviewing those concepts still. Remember, nothing says that Khan Academy should be the only resource you use to review those skills. Feel free to mix your resources!

Materials you need to have <u>every day</u> for AP Physics 1:

- Binder to organize notes + papers received in class (or you may choose instead to use a spiral/composition notebook plus a folder for storing papers you receive)
- Notebook paper
- Pencil
- Calculator
    - Check out this link for CollegeBoard's calculator policies, the calculators you are allowed to use on the AP exam: https://apstudents.collegeboard.org/exam-policies-guidelines/calculator-policies
    - CollegeBoard recommends a scientific or graphing calculator for AP Physics 1

AP Physics 1 Summer Assignment

Scientific Notation, Metric Units, and Basic Trigonometry Tangram

Instructions: Cut out the16 squares below. Then see the next page for further instructions.

$(8x10^3)/(2x10^5)$	9400 s	1	sin(90)
94.1 MHz	$(1.2x10^4)/(6x10^{-2})$	$\sqrt{2}/2$	$3.27x10^{-2}$
0.000000003 m	$(2x10^3)^3$	cos(90)	$9.41x10^7$ Hz
74 g	sin(30)	$(4x10^8)(5x10^{-3})$	640 nm
6.4x10^{-7} m	3.2 m^2	72 km/hr	$\sqrt{2}/2$
1 m/s	9.3x10^{-3} km/s	100 cm/s	0
$(7x10^3)^2$	$4x10^{-2}$	$7.64x10^6$ kg	$(3x10^6)(2x10^4)$
$6x10^{10}$	3.2x10^4 cm^2	3x10^{-9} m	20 m/s
cos(0)	8327.2 s	2.6 h	$2x10^5$
sin (45)	1/2	$8.3272x10^3$ s	cos (45)
7,640,000 kg	$8x10^9$	0.0093 km/s	0.074 kg

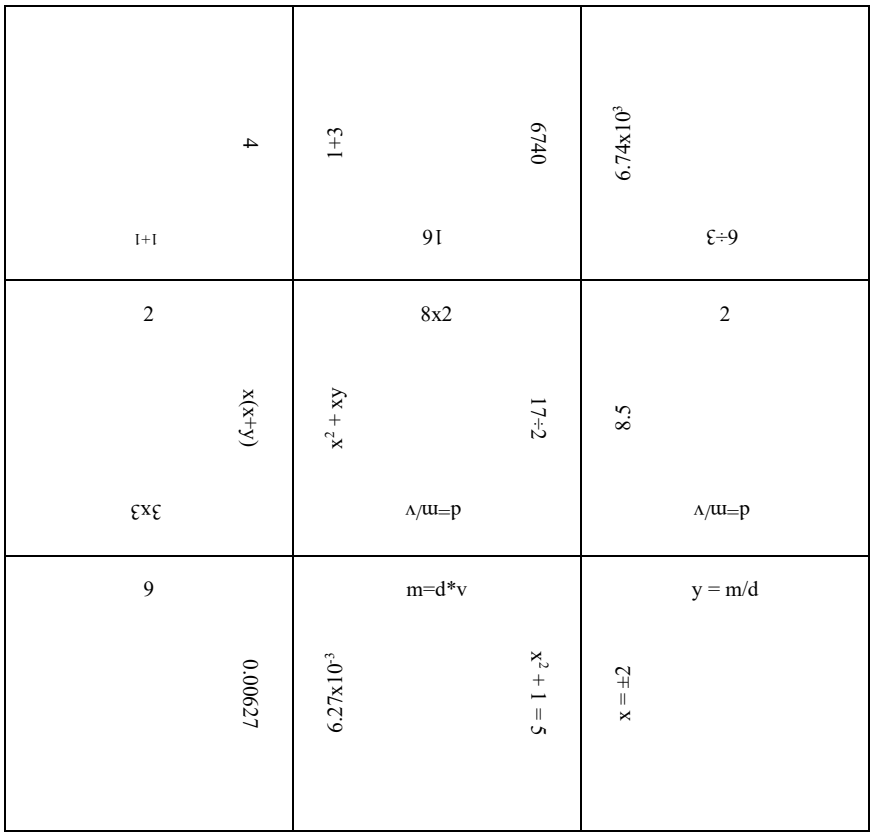
AP Physics 1 Summer Assignment

Scientific Notation, Metric Units, and Basic Trigonometry Tangram

Instruction: Your job is to create a 4x4 square with the 16 pieces, where all touching sides of the square "match" in some way. An example of a solved 3x3 square tangram is on the next page, along with some questions you will need to solve some of the pairs. Please note that for some clues, there are multiple possible matches, but you must get <u>all</u> sides of each square to match their surrounding squares. Fill in your answers on the sheet below, or tape/glue the squares in place.

AP Physics 1 Summary Assignment

An example of a solved tangram is below on the left. You should also use this to review some basic math skills and make sure you understand these pairs as well ☺



Questions:

1. What happens to the cosine of an angle as the angle increases from 0° to 90°?

2. What happens to the cosine of an angle as the angle increases from 0° to 90°?

3. Circle the appropriate option from each set in the statements below:
   a. When numbers are multiplied together, their exponents are (*added / subtracted*) and the bases are (*multiplied / divided*).
   b. When numbers are divided, their exponents are (*added / subtracted*) and the bases are (*multiplied / divided*)
   c. When an exponent is raised to another exponent, the exponents should be (*added / subtracted / multiplied / divided*).

4. Did you solve the puzzle without solving all the problems? Check out the pairs you didn't have to solve to see if you agree/understand. Use the table below to identify your favorite pairs (what made you think, was fun to solve, interesting, etc.) and list any questions you still have about pairs that you don't understand. Remember, the point of this is to learn, so if there are any pairs you don't understand, make sure you look them up or list them here.

Favorite Pairs	Questions about any of the pairs

AP Physics 1 Summer Assignment

Right Triangle Trigonometry Tangram

Instructions: Cut out the 9 squares below. Please note that this goes with the questions on the page after the next page.

1.8 cm #2, d_x	#1, x 43.3 m	15.7 m #2, d_y
74.1° #4, θ 23.1° #4, c	#3, x #1, y	6m 31.3° #6, d
5.9 cm #3, y #6, θ	2.7 m 29.7 km #5, R	51.4 km #5, θ 10.4 m

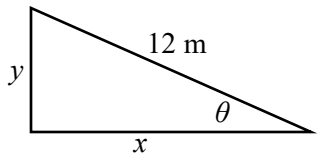
AP Physics 1 Summer Assignment

Right Triangle Trigonometry Tangram Answer

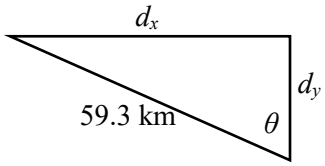
Instruction: Your job is to create a 3x3 square with the 9 pieces from the previous page, where all touching sides of the square match. An example of a solved 3x3 square tangram is given with the first tangram from your summer assignment. Please note that for some clues, there may be multiple possible matches, but you must get all sides of each square to match their surrounding squares. Fill in your answers on the sheet below, or tape/glue the squares in place.

AP Physics 1 Summer Assignment

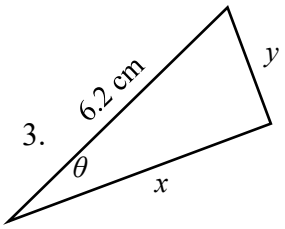
Calculate the following unknowns using trigonometry. Use a calculator, but show all of your work. Please include appropriate units with all answers. (Watch the unit prefixes!)

1. 

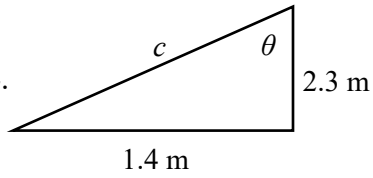
$\theta = 30°$

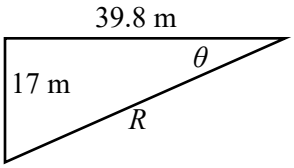
2. 

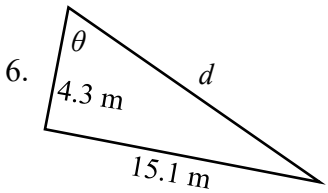
$\theta = 60°$

3. 

$\theta = 17°$

4. 

5. 

6. 

7. Did you solve the puzzle without solving all the problems? Check out the pairs you didn't have to solve to see if you agree/understand. Use the table below to identify your favorite pairs (what made you think, was fun to solve, interesting, etc.) and list any questions you still have about pairs that you don't understand. Remember, the point of this is to learn, so if there are any pairs you don't get, make sure you look them up or list them here.

Favorite Pairs	Questions

AP Physics 1 Summer Assignment

Algebra Practice

1. Use the equation $v_f = v_0 + at$ to answer the following questions
    a. Rearrange the equation to solve for t (don't plug in any numbers!)

    b. If $v_0 = 5$ m/s, $v_f = 25$ m/s, and $a = 10$ m/s^2, what is t (its unit is s)?

2. Use the equation $x_f = x_0 + v_0t + \frac{1}{2} at^2$ to answer the following questions
    a. If $v_0 = 0$, rearrange the equation to solve for a (don't plug in any other numbers besides $v_0 = 0$!!)

    b. If $v_0 = 0$ m/s, $a = 10$ m/s^2, $x_0 = 0$ m, $x_f = 120$ m, what is t (its unit is s)?

3. Use the equation $\Sigma F = ma$ to answer the following questions
    a. Rearrange the equation to solve for a (don't plug in any numbers!)

    b. If $\Sigma F = 10$ N and $m = 5$ kg, what is a (its unit is m/s^2)?

    c. If m is doubled, but ΣF is not changed, by what factor would the value of a change?

    d. If, instead, ΣF is doubled, but m is not changed, by what factor would the value of a change?

4. For each of the following equations, simplify them if $a = 0$ m/s^2 and $x_0 = 0$ m
    a. $v_f = v_0 + at$

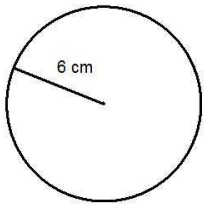
    b. $x_f = x_0 + v_0t + \frac{1}{2} at^2$

    c. $v_f^2 = v_0^2 + 2a(x_f - x_0)$

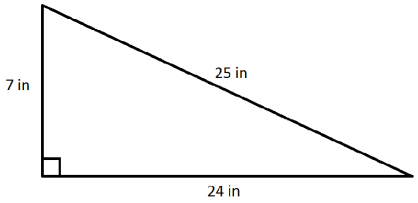
AP Physics 1 Summer Assignment

Geometry Practice

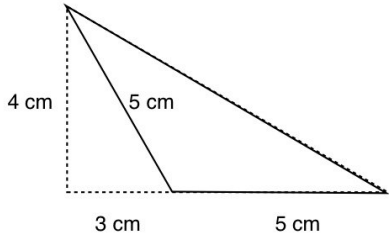
Match each shape to its area to find the hidden message. If the shape's labels don't have units, assume they are measured in meters. Round to the nearest whole number.



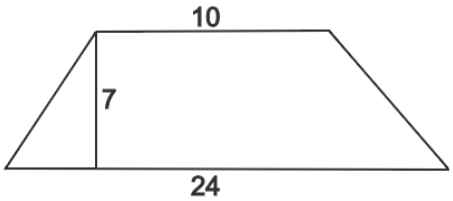
#1



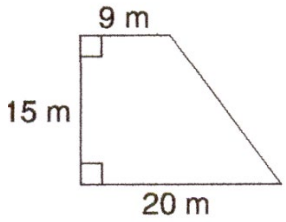
#2



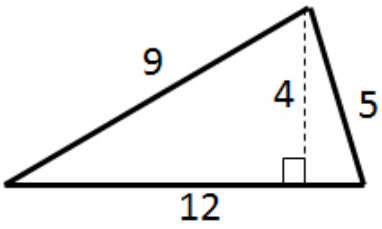
#3



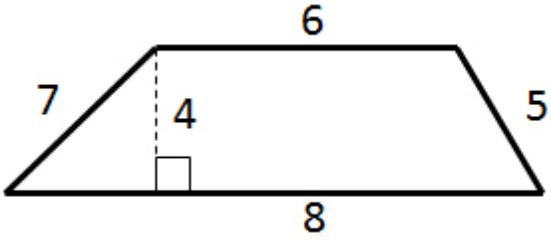
#4



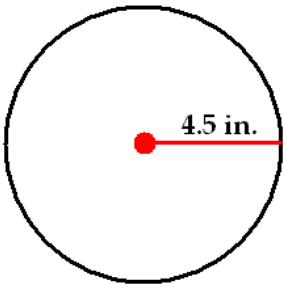
#5



#6



#7



#8

A	119 m^2	J	24 m^2
B	64 in^2	O	28 m^2
E	10 cm^2	R	84 in^2
G	113 cm^2	T	218 m^2

#1	**#2**	**#3**	**#4**	**#5**

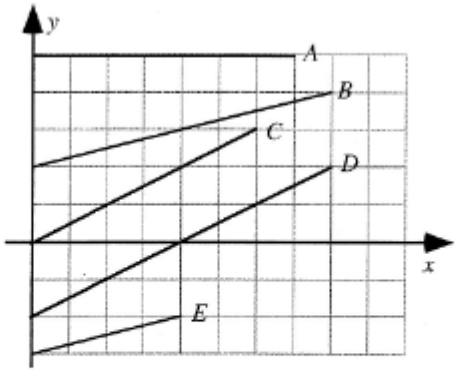
#6	**#7**	**#8**

AP Physics 1 Summer Assignment

Graphing Practice TIPERs

The following practice questions are what are known as TIPERs. You will see lots of these during class and for homework/review throughout this course. A common type of TIPER contains what are called ranking tasks, where you have to rank certain values. Some of them may be equal to each other, and that is fine. Just indicate clearly in your response which ones are equal to each other. For example, if A and C are equal, but larger than B, you can write: A = C > B.

Shown are several lines on a graph.



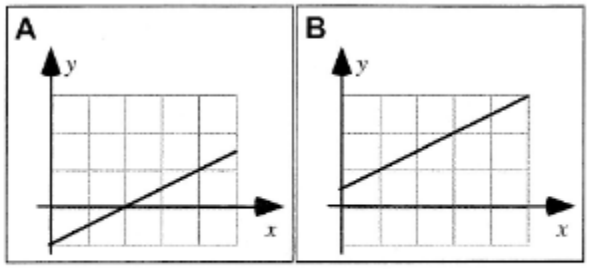
Rank the slopes of the lines in this graph.

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

Explain your reasoning.

Follow-up Question: Which of the above lines, A-E, represent(s) a directly proportional function? Explain your reasoning.

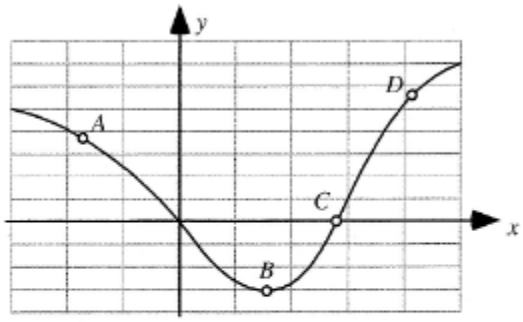
Shown are two graphs.



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

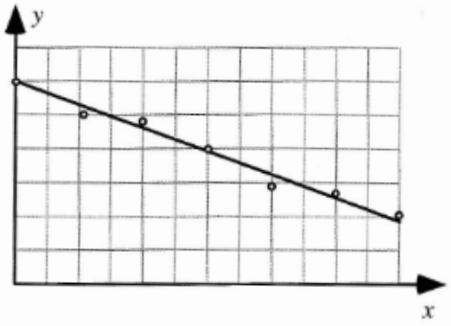
Explain your reasoning.

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.



AP Physics 1 Summer Assignment

Conceptual Preview

QUESTIONS FOR YOU TO THINK ABOUT and *then* RESEARCH…

Do your best to answer the following questions after examining the provided videos and links. These concepts are important ideas we will discuss throughout the year.

Kinematics

1. A gun is fired parallel to the ground. At the same instant, a bullet of equal size and mass next to the muzzle is released and drops to the ground. Which hits the ground first and why?
   http://www.youtube.com/watch?v=oBdalzRJR5g
   http://phet.colorado.edu/en/simulation/projectile-motion

Newton's Laws

2. Why can you exert a greater force on the pedals of a bicycle if you pull up on the handlebars?
   http://ed.ted.com/lessons/joshua-manley-newton-s-3-laws-with-a-bicycle
   http://phet.colorado.edu/en/simulation/ramp-forces-and-motion

Work and Energy

3. Consider a fly that is hovering on the inside of your car as you are traveling down the Interstate. Does it have more or less kinetic energy than the car?
   http://ed.ted.com/lessons/how-does-work-work-peter-bohacek
   http://phet.colorado.edu/en/simulation/energy-skate-park

AP Physics 1 Summer Assignment

Momentum and Impulse

4. Describe why a watermelon will be obliterated when you drop it in a parking lot but will remain intact when dropped from the same height into a pool.
   http://www.youtube.com/watch?v=Hx9TwM4Pmhc
   http://phet.colorado.edu/en/simulation/collision-lab

Circular Motion and Gravitation

5. Either for fun or for physics (sometimes you can't tell these apart…) you are swinging a rock attached to a string over your head. Suddenly the string breaks. Describe the new motion of the rock by drawing a picture.
   http://www.youtube.com/watch?v=zN6kCa6xi9k
   http://phet.colorado.edu/en/simulation/balancing-act

To make physics easier, familiarize yourself with some of the bizarre, counterintuitive concepts that we'll be studying this year! A little investment now will have huge payoffs later on!

Congratulations! You're finished!

*This course is a wonderful opportunity to grow as a critical thinker, problem solver and great communicator. Don't believe the rumors- it is not impossibly hard. It **does** require hard work, but so does anything that is worthwhile. You would never expect to win a race if you didn't train. Similarly, you can't expect to do well if you don't train academically. AP Physics is immensely rewarding and exciting, but you do have to take notes, study, and read the book (gasp!). I guarantee that if you do what is asked of you that you will look back to this class with huge sense of satisfaction! I know I can't wait to get started…*

*Let's learn some **SCIENCE**!!!*