Name: Bennett
Period: AP1
Due: The first day of class Summer Assignment v2.0

This assignment is a combination of math review (scientific notation, algebra, trigonometry, geometry, and basic graphs), a brief review of unit conversions, as well as a basic introduction to vectors and scalars. We will not explicitly be using any calculus this year, we will be using algebra, geometry, and trigonometry on a daily basis.

If you find that you are unable to complete a particular section, *don't worry!* It's okay, and that does not in any way mean that you're not cut out for AP Physics. Rather, take it to mean that you may need a bit more of a refresher for that particular topic. You may find that your math skills will improve throughout the year. Below are a few websites that you can use for your 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

This assignment is worth 3 homework grades for the first semester. It is due the first day of school. If you have any questions, please don't hesitate to ask. Feel free to email me at mbennett@bishopdiego.org.

- **It is my *strong* recommendation that you do as much of this packet as possible *without a calculator*!** Many of the questions you will encounter throughout the year can be done without one, whether they have numbers or not. However, for some questions you will need a calculator. When doing trig work, you'll want to be in degree mode.
- To copy a classmate's work would be a waste of everyone's time and is not a habit worth getting into. This class will test your understanding, not your ability to copy your classmate's work. Don't copy.
- Please show all your work on the pages below. If you need more space, please attach your work on a separate sheet of paper.

Part 1: Scientific Notation and Dimensional Analysis:

Throughout the year we will use the SI unit system, which I will sometimes refer to as "MKS units." MKS stands for meters, kilograms, seconds. Almost all of the units we work with can be broken down into some combination of these.

1. Express the following numbers in scientific notation. Keep the same unit as provided.
   a. 7,640,000 kg

   b. 0.000000003 m

   c. 8327.2 s

   d. 0.0093 km/s

2. Shown right is a table for scientific unit prefixes. Fill in the power and the symbol for the following unit prefixes. These should be memorized for the year. You may look them up as necessary.

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

3. Convert the following number into the specified unit, using scientific notation when appropriate.
   a. 24 g = _____ kg

   b. 94.1 MHz = _____ Hz

   c. 640 nm = _____ m

   d. 3.2 m^2 = _____ cm^2

   e. 40 mm^3 = _____ m^3

   f. 20 m/s = _____ km/hr

   g. 40 revolutions/minute (rpm) = _____ radians/second (rad/s)
   (Hint: 1 revolution = 2π radians)

4. You also need how to use your calculator for scientific notation. I use the "EE" button. I also hope that you begin to think of your calculator as a tool to help you find the answer, not the magic answer box. For the following questions, use your calculator to report your answer in scientific notation.
   a. $(8.98\text{x}10^{9})(3.5\text{x}10^{-6})(3.5\text{x}10^{-6})/(0.00004)^2$ =

   b. $(6.67\text{x}10^{-11})(5.98\text{x}10^{24})$ =

   c. $(4.11\text{x}10^{4})(3.11\text{x}10^{3})$ =

Part 2a: Solving Equations:
Most of the time, problems in AP Physics are done with variables only. For the following problems solve for the variable indicated. Don't let the different letters confuse you, you can manipulate them just like numbers. *Please show all work and box in or circle your final answer.* Then answer the equation interpretation question given after it.

5. Consider the following equation: $\frac{1}{2}mv^2 = \frac{1}{2}kx^2$

   a. Solve for *x*.

   b. How does *x* change as *v* changes?

   c. How does *x* change as *k* changes?

6. Consider the following equation: $T_P = 2\pi\sqrt{\frac{l}{g}}$

    a. How does T_P change as g changes?

    b. How does T_P change as l changes?

    c. Solve for g.

7. Consider the following equation: $F_g = G\frac{m_1 m_2}{r^2}$

    a. How does F_g change as r changes?

    b. How does F_g change as m_1 or m_2 change?

8. Consider the following equation: $mgh = \frac{1}{2}mv^2$

    a. Solve for v.

    b. How does v change as h changes?

    c. How does v change as m changes?

9. Consider the following equation: $x = x_0 + v_0 t + \frac{1}{2} a t^2$
   a. Solve for *t*.

Part 2b: Solving Equations (cont.):
Frequently in physics you will have multiple equations or equations that have particular initial conditions. For the follow problems, solve for the variable indicated. Again, *please show all work and circle or box in your final answer*. Simplify your answer.

10. Consider the following equation: $x = x_0 + v_0 t + \frac{1}{2} a t^2$
    a. If $v_0 = 0$, solve for *t*.

11. Consider the following equations: [1] $F_f = \mu n$
    [2] $n = mg \cos\theta$
    a. Solve for F_f in terms of *m*, *g*, θ, *and* μ.

    b. How does F_f change as θ changes? Consider limiting conditions of $0° < \theta < 90°$.

12. Consider the following equations: [1] $F = G\frac{Mm}{r^2}$
    [2] $F = \frac{mv^2}{r}$
    a. Solve for *v* in terms of *G*, *M*, *m*, and *r*.

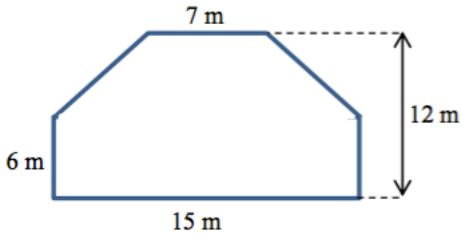
    b. How does *v* change as *r* changes?

    c. How does *v* change as *m* changes?

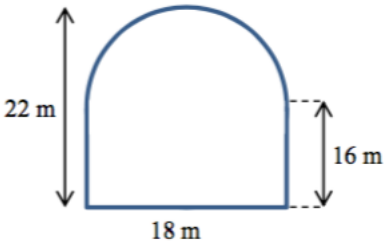
Part 3: Geometry:
When calculating the area of shapes, it may be necessary to break up the figure into common shapes.

For questions 13-16, calculate the area of the given shapes. Please give proper units in your answer.

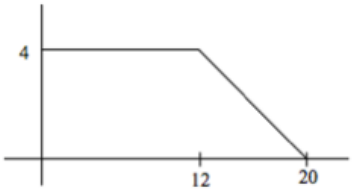
13. Area = _____



14. Area = _____

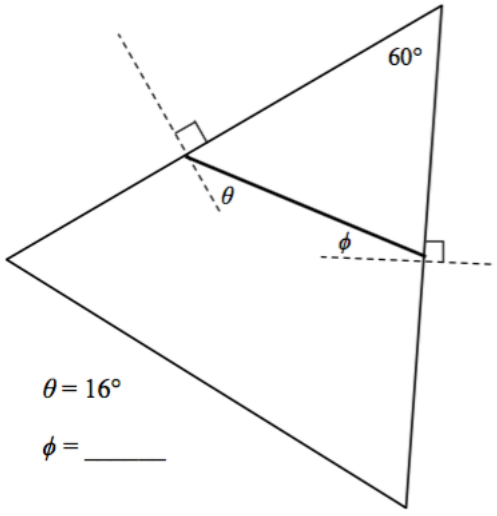


15. Area = _____ m^2



For questions 16-19, calculate the unknown angles.

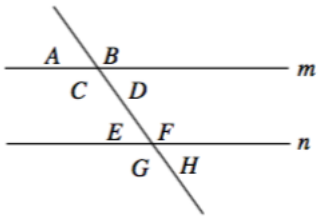
16.



$\theta = 16°$

$\phi =$ _____

17.

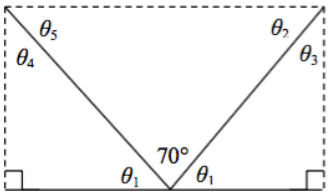


Lines *m* and *n* are parallel.

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

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

18.



$\theta_1 =$ _____

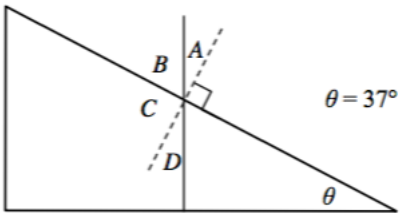
$\theta_2 =$ _____

$\theta_3 =$ _____

$\theta_4 =$ _____

$\theta_5 =$ _____

19.



$A =$ _____ $B =$ _____

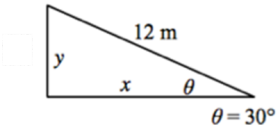
$C =$ _____ $D =$ _____

Part 4: Trigonometry:
For problems 1-6, fill in the blanks with the appropriate values.

20. Write formulas for the following trig functions. Recall: SOHCAHTOA.

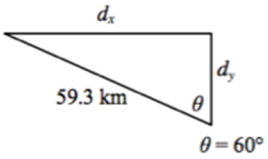
$\sin\theta =$ $\cos\theta =$ $tan\theta =$

21. For the shapes shown below, calculate all of the following unknowns.



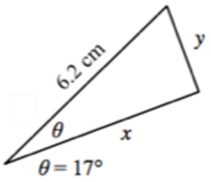
$y =$ _____

$x =$ _____



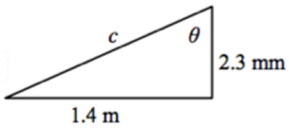
$d_x =$ _____

$d_y =$ _____



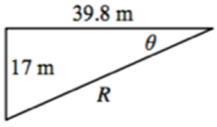
$x =$ _____

$y =$ _____



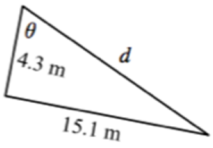
$c =$ _____

$\theta =$ _____



$R =$ _____

$\theta =$ _____



$d =$ _____

$\theta =$ _____

22. Consider the first triangle shown above. What happens to y as θ gets smaller and smaller (approaches zero)? What value does the hypotenuse approach as θ approaches zero?

Part 5: Graphing and Functions:

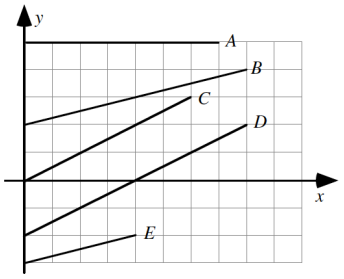
An important part of AP Physics is graphing and analyzing characteristics of graphs. You will find a few conceptual questions below that may or may not need review.

You're also probably very tired of this packet by now, but in the end the work you're doing now will be greatly beneficial to you throughout the year. This course is rewarding, but you have to put in the work. If you don't believe me, ask some of last year's students and see what they say.

Okay, enough pep talk for now. Time for some graphing questions.

23. **A1-RT02: Y-X Graph Lines—Slope**

Shown are several lines on a graph.



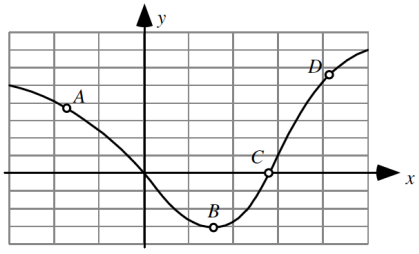
Rank the slopes of the lines in this graph.

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

Explain your reasoning.

24. **A1-RT08: Curved Line Graph—Slope**

Four points are labeled on a graph.



Rank the slopes of the graph at the labeled points.

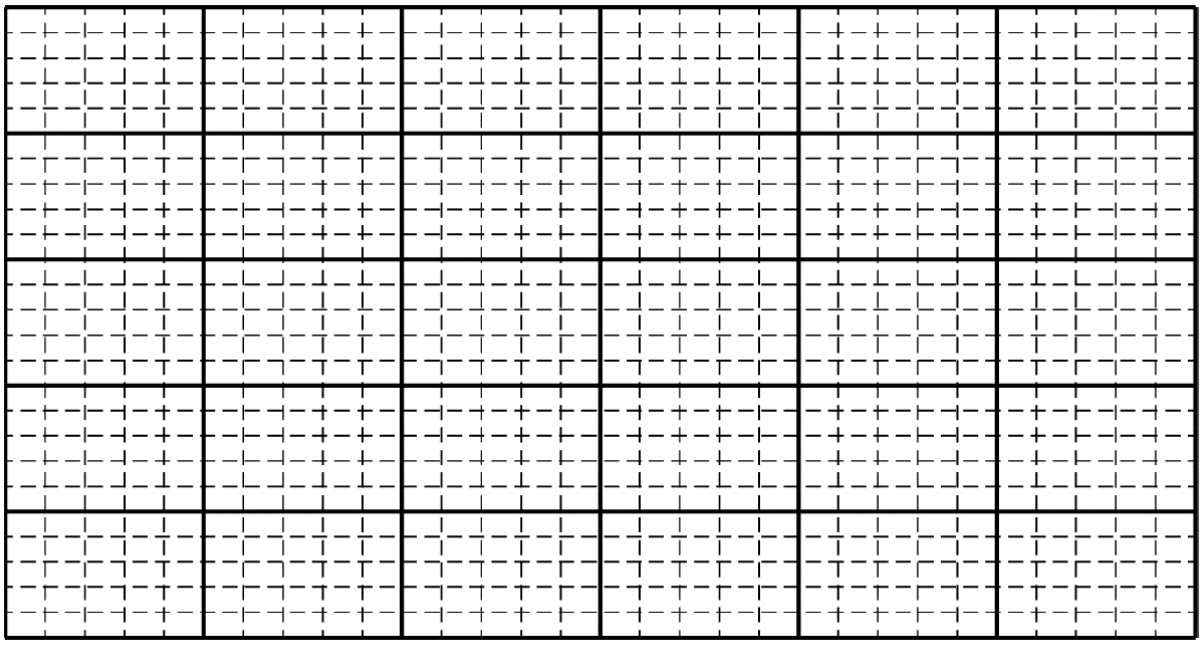
				OR			
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

25. A group of students conduct a lab experiment where they measure how long it takes a cart to move equal distances. They record their data in the chart below.

x (m)	0.5	1.0	1.5	2.0	2.5
t (s)	0.35	0.71	1.04	1.40	1.75

a. On the grid below, plot the position *x* on the y-axis and the time *t* on the x-axis. Do not connect the lines. Leave them as a scatter plot for now. Label both axes, including appropriate units.



b. What kind of curve did you obtain?

c. Describe the relationship between the variables?

d. How much time would it take for the object to travel 4.0 m?

Part 6: Vectors and Scalars Preview:
You're almost done. The internet is going to help you here. Watch the following two videos from Khan Academy on vectors and scalars. Vectors are a critical part of physics, so this part of your summer packet is intended as a preview. For each video, (1) summarize, in three sentences, the content that Mr. Khan is presenting in each video. Then, (2) write at least one question for each video on something that you didn't understand *or* on a possible extension of the elementary concepts her presents.

26. Video 1: http://www.khanacademy.org/science/physics/v/introduction-to-vectors-and-scalars

Summary and question(s):

27. Video 2: http://www.khanacademy.org/science/physics/v/visualizing-vectors-in-2-dimensions

Summary and question(s):

Finished! In all seriousness, I couldn't have said that this course is rewarding unless some of the students who have taken it have already said it was rewarding, and I asked them just now, while putting together this summer assignment. It's not an impossible course, but it is difficult, and it does require hard work. But that work is worth it.

Looking forward to working with you all this year.

Best,
MB