Austin High School
Incoming 11th Grade AP Physics 1 Students
Summer Assignment 2020

Welcome to AP Physics 1 This is a math-based science course that will often require you to draw from your knowledge of Algebra and Geometry. I want you to be successful in this course, and make certain that you have the background skills necessary to do so. We will be hitting the ground running when we meet in the fall ☺.

Your Summer Assignment: Please complete the attached assignment over the summer; I strongly encourage you to work individually, so that the work reflected is your own, and is representative of your skills. The assignment is intended to show you the types of math skills we will use in class, as well as to provide you an opportunity to practice these skills. *It will be collected your first week of class following Summer Break*, so be prepared.

What If You Can't Remember How to Solve Problems? I tried to identify the different sorts of math skills by name (e.g., literal equations, dimensional analysis) so that you can easily find online resources to assist you. I strongly believe that finding useful resources is a necessary step toward your becoming the independent learner that you'll need to be once you leave Austin High. However, if you hit a wall, and find yourself needing direction, I have provided links to tutorials on my website (http://msquacksphysics.weebly.com/summer-assignments.html). Also, please feel free to contact me (pam.quackenbush@austinisd.org) over the summer with questions. I will try to check my e-mail frequently, unless I'm traveling, though my travel plans have been cut short this summer.

If there are just one or two skills that you recognize need a little work, don't sweat it. Do your best on the summer assignment; Ms. Quackenbush will be providing Zoom review sessions near the end of summer and video assistance for the following topics:

- Trigonometry (from Geometry)
- Significant Figures (from Chemistry)
- Unit Conversions (from Chemistry)

What If You Find the Material *Especially* Difficult? Our Chemistry teachers tried to steer you towards the right level of Physics for you. If you feel that the material in this review is *especially* difficult for you, you may wish to consider switching to grade level physics. We want you to be comfortable and happy in class, and not feel like you are trying to relearn the math skills we use regularly on top of learning the physics content. The class moves fast, and can be challenging on its own. If you have weak math skills, it may feel like trying to drink water from a fire hose, and I want your first experience with Physics to be a pleasant one, because Physics is wonderful! If you have questions or concerns, please contact your counselor over the summer regarding your placement.

Don't Procrastinate! Please don't wait until the last minute to start your summer assignment. Got a little spare time on a weekend? Knock out a couple problems. It will be less stressful if you space the assignment out over the course of the summer.

Complete Your Assignment on a Separate Sheet of Paper and SHOW YOUR WORK! Sorry, I don't want that to come across as yelling, but showing your work is kind of a big deal in this class. I will reinforce this throughout the year, but the sooner you get used to showing your work, the happier we'll all be. For the record, I care less about your getting the right answer than your ability to communicate what you did, and why you did it. You work should be neat and organized, so that others can easily follow your thought process.

We look forward to meeting you in August (fingers crossed)! Have a great summer!!

Sincerely,

Ms. Quackenbush

AP Physics 1 Summer Assignment

Work the Following on Clean Paper, Numbered, and Neat. SHOW ALL YOUR WORK.

ALGEBRA PRACTICE

1. **Literal Equations:** For each of the following formulae, rearrange the equation to isolate the variable given:

(a) Isolate **a**: $\mathbf{v_f = v_i + a\,t}$

(b) Isolate **A**: $\mathbf{R = \frac{\rho L}{A}}$

(c) Isolate **Δx**: $\mathbf{v_f^2 = v_i^2 + 2\,a\,(\Delta x)}$

(d) Isolate R_{eq}: $\mathbf{\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}}$

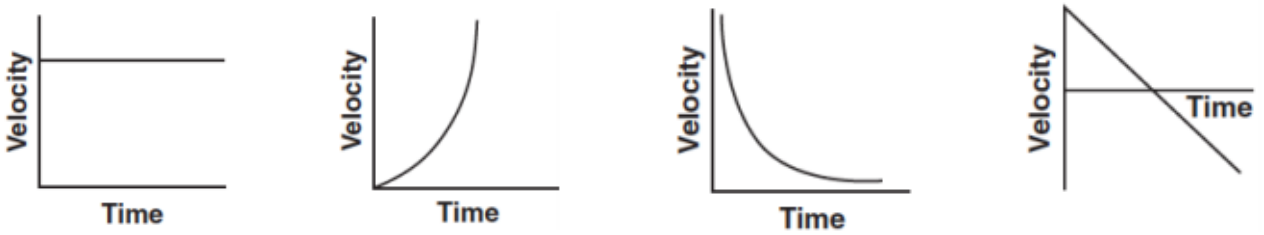
(f) Isolate **v**: $\mathbf{F_c = \frac{mv^2}{r}}$

(g) Isolate **v**: $\mathbf{KE = \tfrac{1}{2}\,mv^2}$

(h) Isolate **k**: $\mathbf{T_s = 2\pi\sqrt{\frac{m}{k}}}$

(i) Isolate **r**: $\mathbf{F = G\frac{m_1 m_2}{r^2}}$

2. **Recognizing Functions:** Match the Velocity (v) vs. Time (t) graphs shown below to the equations (1 – 4) that best describe the relationship between these variables:



(a) **(b)** **(c)** **(d)**

Equations: (1) $\mathbf{v = 5 - 4\,t}$ (2) $\mathbf{v = 6}$ (3) $\mathbf{v\,t = 8}$ (4) $\mathbf{v = 2\,t^2}$

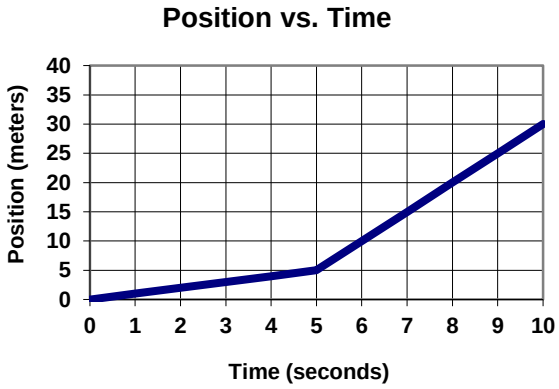
3. **Graphing and Slope :** Use the graph to the right to answer the following questions:

(a) What is the distance traveled in the first 5 seconds?

(b) What is the slope of the graph from t = 0 to 5 seconds (don't forget your units)?

(c) What is the slope of the graph from t = 5 to 10 seconds?

(d) Write the equation for the position (x) in terms of time (t) for the time interval t = 5 to 10 seconds?



4. **Quadratic Equations:** In the following equations, solve for x:

(a) $\mathbf{2x^2 + 4x + 5 = 3x + 8}$ (b) $\mathbf{5x^2 - 14\,x + 18 = 0}$

5. **Systems of Equations:** Given the systems of equations below, solve for x and y:

(a) $\mathbf{2x + 3y = 10}$ $\mathbf{2x - y = 0}$

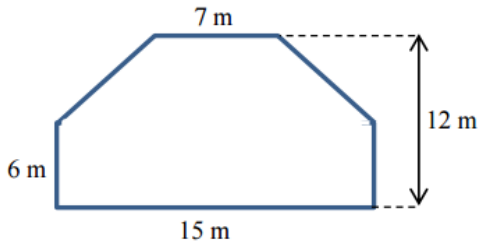
(b) $\mathbf{x + y = 15}$ $\mathbf{3x - 10\,y = 4}$

(c) $\mathbf{y = 2x^2}$ $\mathbf{x - y = -10}$

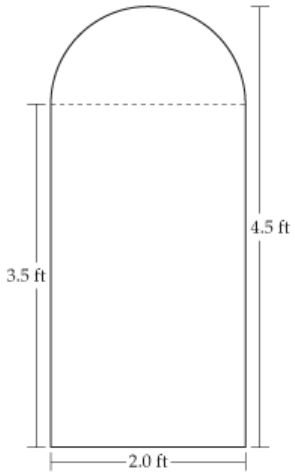
GEOMETRY PRACTICE

6. Solve for the unknowns in each of the following:

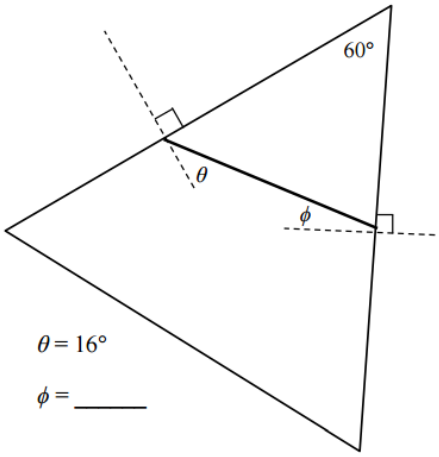
(a) Find the area of this shape:



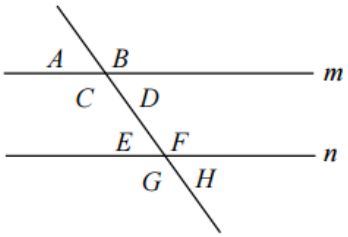
(b) Find the area of this shape:



(c) Solve for the unknown angle, ϕ:

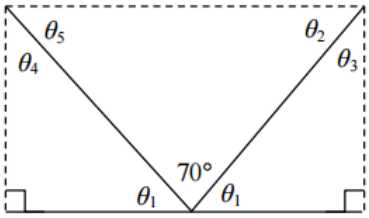


(d) Given A = 75°, Solve for the unknown angles:



Lines m and n are parallel.

(e) Solve for the unknown angles:



$\theta_1 =$ _____

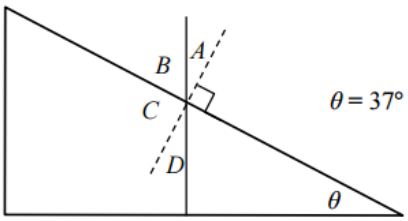
$\theta_2 =$ _____

$\theta_3 =$ _____

$\theta_4 =$ _____

$\theta_5 =$ _____

(f) Solve for the unknown angles:



$A =$ _____ $B =$ _____

$C =$ _____ $D =$ _____

TRIGONOMETRY PRACTICE: Recall SOH CAH TOA.

7. Complete the following:

   (a) $\sin\theta =$ (b) $\cos\theta =$ (c) $\tan\theta =$

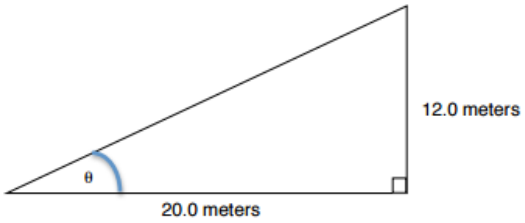
8. Using the triangle to the right, solve for the following:

   (a) What is the length of the hypotenuse?

   (b) What is the tangent of angle θ?

   (c) What is the sine of angle θ?

   (d) What is angle θ, in degrees?

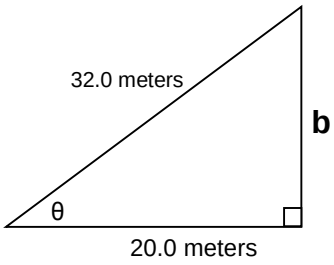


9. Using the following triangle, solve for the following:

   (a) Length of side **b**

   (b) $\sin\theta$

   (c) θ

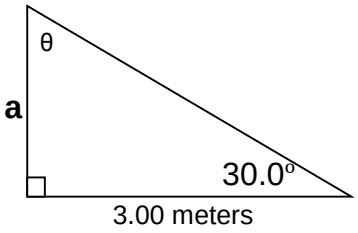


10. Using the triangle to the right, solve for the following:

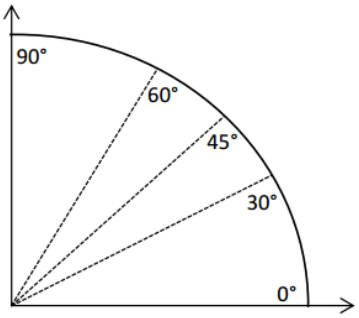
    (a) Length of side **a**

    (b) Length of hypotenuse

    (c) $\cos\theta$



11. Common Angles: The following angles are commonly used, and the more familiar you are with them, the better. Complete the table below, and then answer the questions regarding trends for sine and cosine.



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

   (a) As the angle increases in this first quadrant, what happens to the sine value?

   (b) As the angle increases in this quadrant, what happens to the cosine value?

   (c) For which angle are the sine and cosine values the same?

SIGNIFICANT FIGURES:

12. **What's Significant?** Don't Forget the Rules – look them up if you have to. Answer the following with "always", "sometimes", or "never":

- Non-zero digits are _____ significant.
- Zeros between two significant digits are _____ significant. (I like to call these "sandwich zeros")
- Leading zeros, (zeros to the left of the first non-zero digit) are _____ significant.
- Trailing zeros, (zeros to the right of the last non-zero digit) are _____ significant if they are in a number with a decimal point.

13. Give the correct number of significant figures in the following measurements, AND express each number using scientific notation:
    (a) 7.0890
    (b) 0.00520
    (c) 6200
    (d) 1.20000500
    (e) 100,001

Addition and Subtraction: When adding or subtracting significant figures, remember that your calculated value cannot be more precise than the least precise quantity used in the calculation – that least precise quantity has the fewest digits to the right of the decimal point.

Multiplication and Division: When multiplying or dividing significant figures, remember that the number of significant figures in your final calculated value will the same as the quantity with the fewest number of significant figures.

14. Use the rules above to complete the following operations; express your answer using the correct number of *significant figures* – it may be necessary to convert quantities so that they have the same units.

    (a) 0.0025 cm + 1.24 cm + 0.45 cm =
    (b) 2.367 mm × 1.52 mm =
    (c) 2.67×10^{-3} kg – 9.5×10^{-4} kg + 47.3 kg =
    (d) 7×10^{5} kg /2.4×10^{7} L =
    (e) 0.006 m + 0.03 cm =

International System of Units (SI Units): The international science community uses SI units, which is an extension of the metric system. We'll be using these units as well, and you should be familiar with the base units and the following prefixes.

15. What is the factor denoted by the following metric prefixes (note, you must REMEMBER the ones in bold)?

nano- (n)	10^{-9}	1 nanometer is 1×10^{-9} meters
micro- (μ)	_____	15 microcoulombs is _____ coulombs
milli- (m)	_____	2015 milliamperes is _____ amperes
centi- (c)	_____	5200 cm^3 is _____ m^3
kilo- (k)	_____	15 kilocalories is _____ calories
mega- (M)	_____	15 megawatts is _____ watts
giga- (G)	_____	22 gigabytes is _____ bytes

16. List an appropriate SI base unit (with a prefix as needed) for measuring the following:
    (a) The time it takes to play a CD on a stereo
    (b) The mass of a car
    (c) The length of a soccer field
    (d) The mass of a slice of pizza
    (e) Your mass
    (f) The distance you traveled from home to school
    (g) Your height

SCIENTIFIC NOTATION: When reporting numbers in proper scientific notation, the base number n must be ≥1 and <10, multiplied by a power of 10.

17. When numbers reported in scientific notation are multiplied together, you __add__ the exponents and __multiply__ the bases.
    When numbers are divided, you _____ the exponents, and _____ the bases.
    When an exponent is raised to another exponent, you _____ the exponents, and _____ the base.
    The base number reports only digits that are significant.

18. Use these rules to simplify the following numbers and report your answers in *proper* scientific notation:

    (a) $(3.2 \times 10^{7})(2.0 \times 10^{5}) =$

    (b) $(5.0 \times 10^{-5})(7.0 \times 10^{8}) =$

    (c) $\dfrac{4.0 \times 10^{8}}{2.0 \times 10^{-4}} =$

    (d) $\dfrac{5.0 \times 10^{-6}}{1.0 \times 10^{12}} =$

    (e) $(5.0 \times 10^{4})^{3} =$

    (f) $\dfrac{2.0 \times 10^{2}}{(1.0 \times 10^{3})^{2}} =$

19. Report the following numbers in scientific notation:
    (a) 1001
    (b) 53
    (c) 6,926,300,000
    (d) 0.00361
    (e) 0.1358
    (f) -20.

UNIT CONVERSIONS: (Sometimes called "dimensional analysis" or "DA" – but there's more to DA than just unit conversion)

20. Convert the following:
    (a) The density of lead is 11.34 g/cm^3. Convert this to kg/m^3.
    (b) How many seconds are in a year?
    (c) A light-year is the distance that light travels in a year. If the speed of light is 3.00×10^{8} m/s, how far is a light year in km?
    (d) An acre-foot is a measurement of volume. It is equal to an acre times one foot. What is this in ft^3? One acre = 4840 yards^2.
    (e) Every year, approximately 25,000,000 kg of hair is cut in the U.S. Each kg of hair contains about 0.0002 kg of zinc, and each kg of zinc is worth about 4 dollars. How many dollars worth of zinc is contained in the hair cut in the U.S. annually?