AP Physics 1 Summer Work 2019

Welcome to AP Physics 1! I am very glad you are interested in Physics and I look forward to investigating energy, matter and well the universe with you next year. We will be spending most of next year investigating relationships between various properties of objects, what we call variables (because they can constantly change). We need to have a tool to describe these relationships and to apply them to other situations, that tool is mathematics. In fact, one of the most famous physicists, Sir Isaac Newton, developed Calculus along with his scientific work so he would have a way to describe his work and make predictions. Even though AP Physics 1 doesn't require that you know any Calculus, it does require that you have mastered the fundamentals of Algebra and Geometry.

The exercises below are a review of the prerequisite math skills that you need to succeed in AP Physics 1. Make sure to read all directions throughout the packet. All work must be completed on the pages below in the area provide. Calculators should not be used. Final answers can be in fractions and in terms of mathematical constants (π , *e*, *i*, etc.).

Your work must be legible and linear, and I must be able to follow it easily. Please no incoherent jumping around the page. Mark your final answers by either circling or boxing them.

Your completed summer work is due the first day of class. A 10% bonus on the assignment will be given to the students who turn in their assignment to the main office of the school by Thursday, July 25. Office hours are from 8 am – 2 pm. I highly suggest you make a copy for yourself, so you can review it during the summer. Remember you will have a quiz about this work during the first week of school!

Do not copy work from another student for your own integrity and for your own benefit because all AP Physics 1 students will take a quiz with problems similar to (if not exactly like) those found on this review the first week of school. No calculators will be allowed. You must score a 90% or better on the quiz. Use a math book or internet for reference. No physics is needed for this packet. If you have difficulty, please do not hesitate to email me at harris.susan@mail.fcboe.org.

I look forward to seeing you all in August!

Mrs. Harris

Significant Figures and Scientific Notation Review

1.) How many significant figures do the following numbers have?

a.) 6.001 Answer: _____

b.) 0.0080 Answer: _____

c.) 206,000 Answer: _____

d.) 27.00 Answer: _____

e.) π Answer: _____

Directions: Find the following. Final answers should be in scientific notation with the correct number of significant figures.

2.) $(5.0\times10^{-8})(2.9\times10^{2})$

3.) $\left(3.25\times10^{4}+7.4\times10^{3}\right)$

4.) $6.000\times10^{-11}\dfrac{1.00\times10^{26}}{2.00\times10^{7}}$

5.) $\dfrac{8400}{1.2\times10^{7}}$

Unit Conversions Review

6.) Finish the SI prefix table below. Follow the example of the centi- prefix. You will need to memorize these.

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

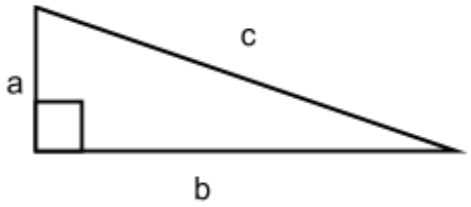
7.) 16.7 kilograms is how many grams?
8.) 560 nm is how many meters?

9.) 15 years is how many seconds?

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

11.) 2.998×10^{8} m/s is how many kilometers per hour?

Trigonometry Review
Directions: Use the figure below to answer problems 15-25. Simplify as much as you can.



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

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

14.) Find *a* if given *c* and θ.

15.) Find *b* if given *a* and θ.

16.) Find *c* if given *b* and θ.

17.) Find θ if given *b* and *c*.

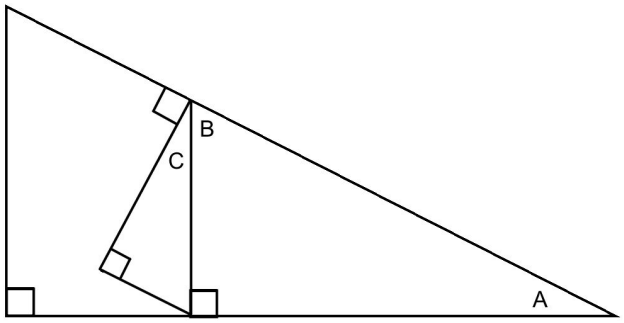
18.) Find θ if given *a* and *b*.

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

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

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

22.) Using the properties of triangles, prove that $\angle A \cong \angle C$ in the drawing below.



Answer:

23.) For what angles (in degrees) does sin $\theta \approx \theta$? Describe why mathematically.

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

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

25.) 360 degrees = _____ radians.

26.) 4.5 revolutions = _____ radians.

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

28.) 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*.

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

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

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

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

31.) $v_f^{\,2} = v_i^{\,2} + 2ad$

A.) Solve for v_i.

B.) Solve for *d*.

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

A.) Solve for v_o.

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

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

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

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

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

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

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

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

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

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

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

38.) $m_1v_{i,1} + m_2v_{i,2} = (m_1 + m_2)v_f$. Solve for $v_{i,2}$.

39.) $m_1v_{i,1} + m_2v_{i,2} = m_1v_{f,1} + m_2v_{f,2}$. Solve for $v_{f,2}$ if $v_{i,1} = 0$.

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

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

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

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

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

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

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

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

Miscellaneous

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

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

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

50.) 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

Conceptual Question:

51.) How many equations are needed to solve…

a.) for 1 unknown variable? _____

b.) for 2 unknown variables? _____

c.) for 3 unknown variables? _____

More Literal Equations

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

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

53.) $F_1 + F_2 = F_T$ 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.

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

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

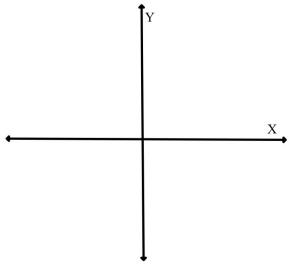
Graphing Equations

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

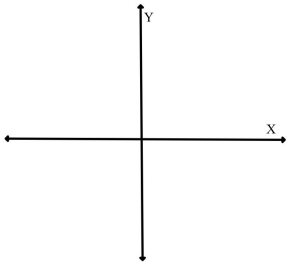
Slope: _____ y-intercept: _____

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

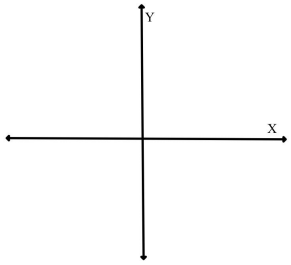
a.) y = $mx + b$, if $m > 0$ and $b = 0$.



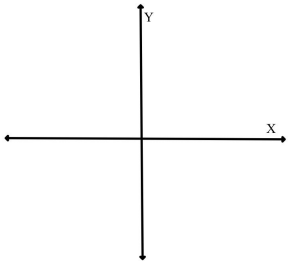
b.) y = $mx + b$, if $m < 0$ and $b > 0$.



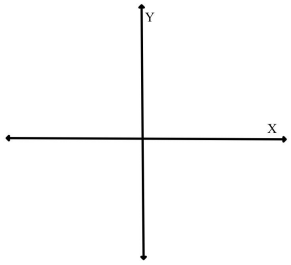
c.) $y = x^2$



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



e.) $y = 1/x$



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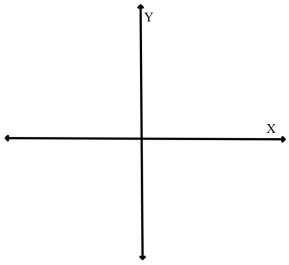
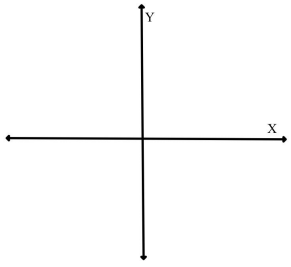
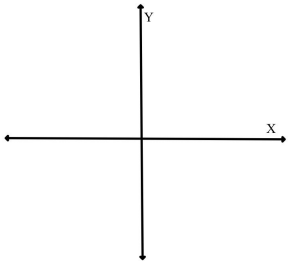


g.) $y = \sqrt{\frac{1}{x}}$



h.) y = sin(x)



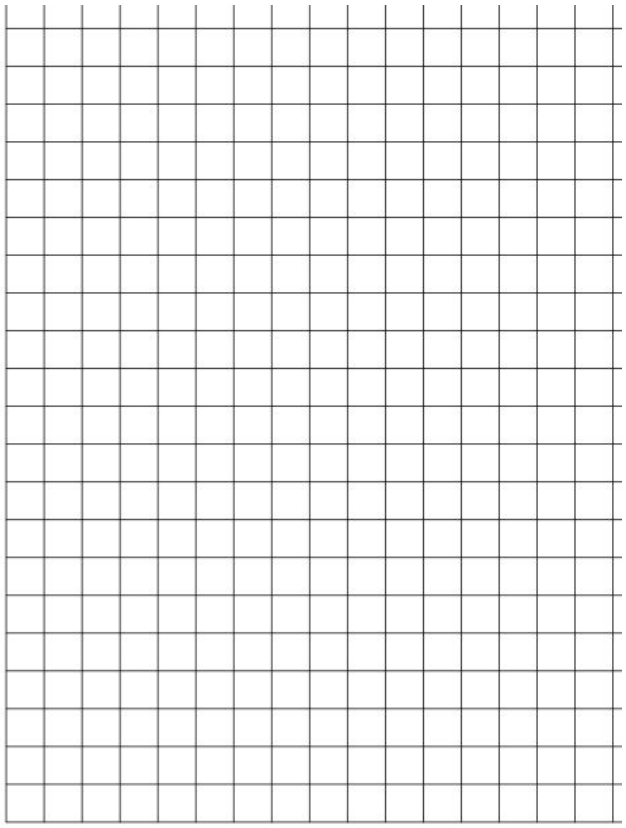
Marbles in Cylinder Lab

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. Lastly, give an explanation of your formula in words. Make sure to give an explanation of the slope and y-intercept of your formula.

58.) Graph below

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



59.) Formula: _____

60.) Explanation of the formula in words: (Include the meaning of the slope and y-intercept.)