AP Physics 1 summer assignment

Advanced Placement (AP) is a program in the United States and Canada created by the College Board (the SAT people) which offers college-level curricula and examinations to high school students. American colleges and universities may grant placement and course credit to students who obtain high scores on the examinations if they choose to take them. If you do not chose to take the exam (many chose not to), this class will still be very beneficial to you for your preparation of college level courses and/or problem solving skills in the workforce..

Advanced Placement (AP) Physics 1, along with AP Physics 2, is a year-long AP course whose first exam was given in 2015. The course is intended to be similar to a one-semester algebra-based university physics course. Topics covered include forces and motion, conservation laws, waves, and electricity.

What this means is that the physics class you will take next year will be the equivalent of a college physics class. Physics is the most fundamental science class; it's the basis of all other science courses. As a result, we often encounter ideas and concepts that are best expressed mathematically. We also rely on empirical evidence (aka "data"), which is best expressed mathematically. For these reasons and others, you will need some math skills. These are all math skills that you have already been taught in Algebra I, Geometry, and in Algebra II. The thing is that you may not be proficient at them and you may not have used them in the context that we use them in physics. That's why you have a short review assignment to complete before your first day of AP Physics next year. Doing this over the summer will allow us to spend more time on learning physics topics in class, which will increase your level of success.

These skills are needed to be successful in AP Physics:

- Graphing data and extracting meaning from it
- Solving an equation for a needed variable
- Substituting numbers and expressions
- Basic right triangle trigonometry

If any of these seem completely foreign to you, don't despair. A video lesson on each of these skills can be found on a youtube playlist, so they should work on any device. I would recommend you watch them all; don't assume you know everything you need to know. Link here: https://goo.gl/zvRol6

Then complete each of the four assignments. I recommend you complete them in the order that they appear. All four assignments will probably take you several hours of time. Don't wait until the first day of school!

I will collect these assignments on the day of the first test (about 2 weeks into school). Answers to the summer assignment will be posted online so you can check yourself as you're working. Of course, if all you do is copy the answers you will receive no "credit" for doing it and you'll probably be frustrated when you "bomb" that first quiz.

Required Materials for AP Physics: graphing or scientific calculator, pencils, pens, eraser, ruler, graph paper, place to organize notes, place to organize handouts and work

Good luck and welcome to AP Physics!!!

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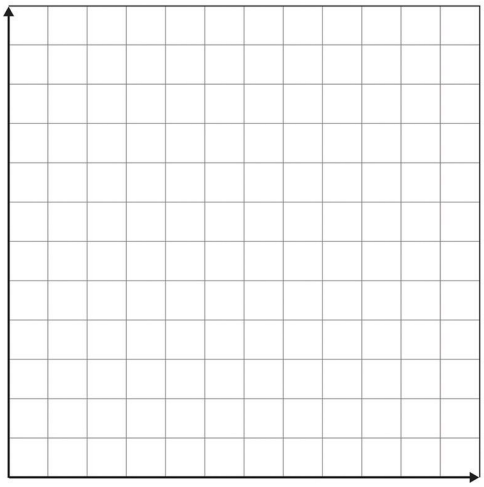
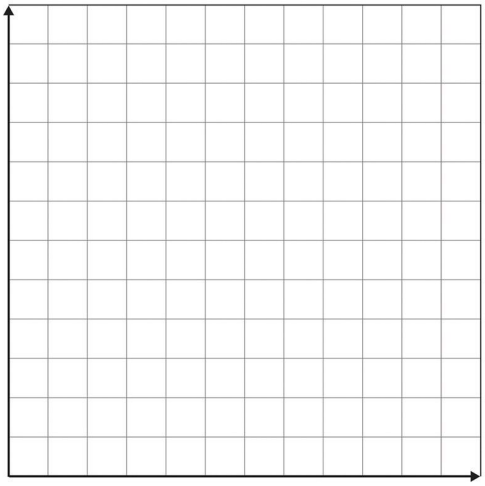
Graphing data and extracting meaning from it

Graph each of the following sets of data (on separate graph paper if you choose), choosing a reasonable scale and correctly labeling each axis. Draw a best fit line and then find the slope. Write an equation to describe the line, including units.

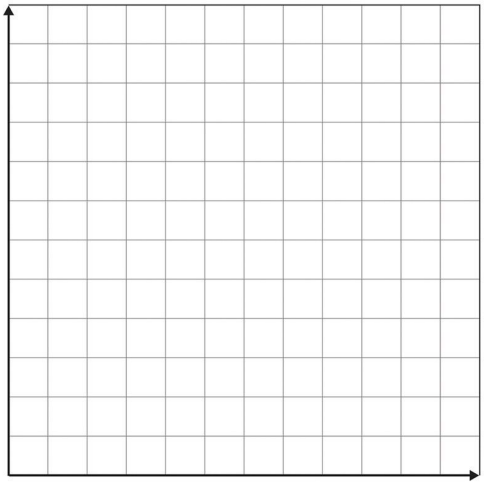
x-axis	*y-axis*
t (s)	***x (m)***
0	0.9
2	5.1
4	8.8
6	12.7
8	17.2
10	19.5





x-axis	*y-axis*
a (m/s^2)	***F (N)***
1.2	10.3
1.4	11.8
1.6	12.4
1.8	13.5
2.0	14.7
2.2	15.4

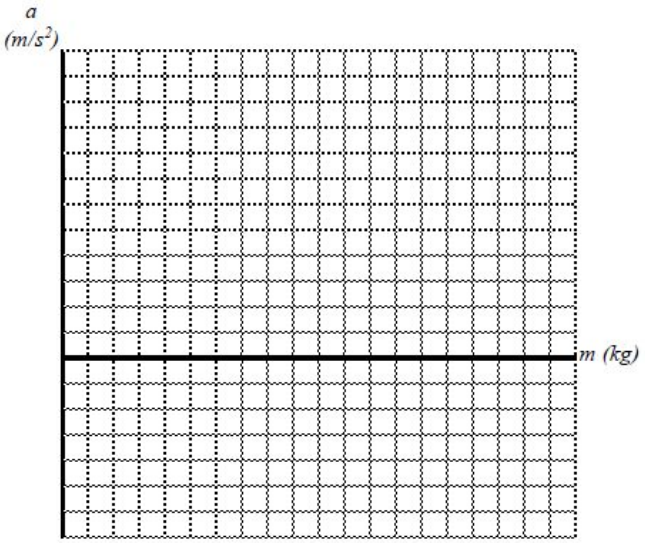
x-axis	*y-axis*
I (A)	***V (V)***
0.04	8
0.08	10
0.12	12
0.16	14
0.20	16
0.24	18

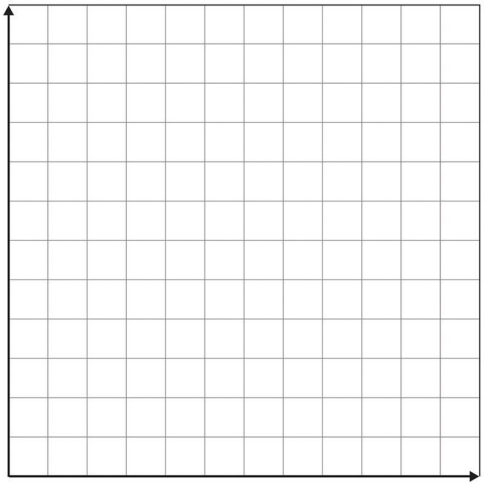


Linearizing data

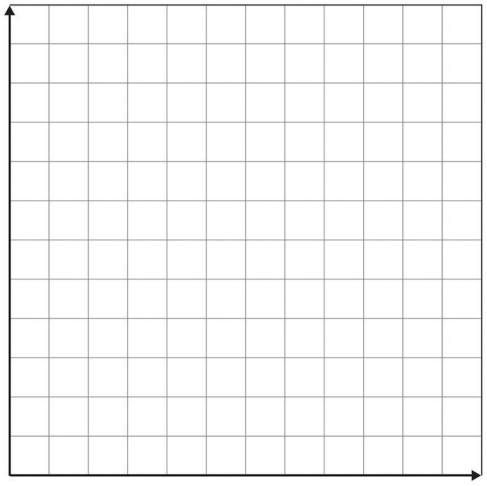
Plot each set of data and identify the relationship between the variables. Write a proportionality between the two variables. Then replot the data so that you get a straight line. Use the empty rows in the table to calculate new values. Draw a best fit line, find the slope, and then write an equation for the line.

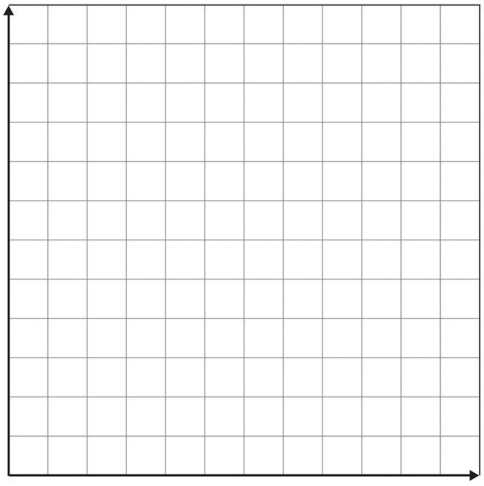
Acceleration (m/s^2)	4	2	1.4	1	0.8	0.67
Mass (kg)	5	10	15	20	25	30





Displacement (x)	0	1.0	4.0	9.0	16.0	25
Time (s)	0	2.0	4.0	6.0	8.0	10.0





Substituting numbers and expressions

For each of the following, substitute the indicated values and evaluate. Include the units in each step of your work and the answer.

1. $t = \sqrt{\frac{2y}{a}}$ (y = 800 m; a = 4 m/s^2)

2. $K = \frac{1}{2}mv^2$ (m = 4 x 10^3 kg; v = 2 x 10^5 m/s)

3. $T = 2\pi\sqrt{\frac{l}{g}}$ (l = 2.0 m; g = 10 m/s^2)

4. $F = m_1\left(a_1 - \left(\frac{m_2}{F_g} + a_2\right)4\right)$

(m_1 = 4 kg; m_2 = 5 kg; a_1 = 7 m/s^2; a_2 = 2.5 m/s^2; F_g = 5 kg·m/s^2)

5. $P = \frac{V^2}{R_1+R_2}$

(V = 200 V; R_1 = 80 Ω; R_2 = 20 Ω

6. $\mu = \frac{m_1g+m_2g}{(m_1+m_2)a}$

(m_1 = 2 kg; m_2 = 4 kg; g = 10 m/s^2; a = 5 m/s^2

7. $y = y_0 + v_0t + \frac{1}{2}at^2$

(y_0 = -4 m; v_o = -5 m/s; a = 6 m/s^2; t = 4 s)

8. $a = \frac{m_1g}{m_2} - \frac{m_2g}{m_1}$

(m_1 = 5 kg, m_2 = 4 kg, m_3 = 12 kg; g = 10 m/s^2)

9. $T = mg - ma - \mu mg$

(m = 5 kg, g = 10 m/s^2, a = -4 m/s^2, μ = 0.4)

10. $F_e = \frac{Kq_aq_b}{r^2}$

(K = 9 x 10^9 N·m^2/C^2; q_a = 3 x 10^{-6} C; q_b = 3 x 10^{-5} C; r = 3 m)

Solving an equation for a needed variable

Solve each equation symbolically for the indicated variable. Show all of your work.

1. $v = \frac{\Delta x}{\Delta t}$ (solve for **Δt**)

2. $y = y_0 + v_0 t + \frac{1}{2} a t^2$ (solve for **a**)

3. $F = ma$ (solve for **a**)

4. $F\Delta t = mv$ (solve for **v**)

5. $F_s = T - mg$ (solve for **m**)

6. $P = \frac{V^2}{R}$ (solve for **R**)

7. $K = \frac{1}{2} m v^2$ (solve for **v**)

8. $a_{cp} = \frac{v^2}{r}$ (solve for **v**)

9. $f = \frac{1}{T}$ (solve for **T**)

10. $T = 2\pi \sqrt{\frac{l}{g}}$ (solve for **l**)

11. $v^2 = v_0^2 + 2a(d - d_0)$ (solve for **v₀**)

12. $F_e = \frac{K q_a q_b}{r^2}$ (solve for **r**)

Basic right triangle trigonometry

For each of the given right triangles, solve for all of the indicated quantities. Make sure your calculator is in degree mode. Be sure to include the correct units.