# Summer Assignment

AP Physics 1

Welcome to AP (Advanced Placement) Physics 1!

**This course is designed to prepare you for a superior performance on the AP (Advanced Placement) Physics 1 exam in May.** The summer homework will allow us to start at once on the Physics subject matter when school begins. This assignment includes a math review to brush up on valuable skills, and perhaps a means to assess whether you are correctly placed in Advanced Placement Physics.

There are 5 parts to this assignment. It is the quantity not the difficulty of the problems that has the potential to overwhelm, so do it over an extended period of time.

If you have any questions over the summer about this packet, or the course in general, please do not hesitate to contact me via email, supplied below.

It is VERY important that this assignment be completed individually. It is a total waste of your time to copy the assignment from a friend, not to mention you need to know this for class. We will discuss any questions that you have when we meet on the first day. You should expect a quiz on this material within the first few days of school.

Sincerely,

*Grace Nguyen*

Sr. Grace Nguyen, CMR

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## AP Physics 1

## Summer Work Record

| Date | Time start to end | Content Studied or Worked on |
|------|-------------------|------------------------------|
|      |                   |                              |
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# Part 1: Topics to Review

Use the websites listed below for refreshers if you need to do so.

I.  Trigonometry

https://www.mathsisfun.com/algebra/sohcahtoa.html
https://www.mathsisfun.com/sine-cosine-tangent.html

II. Systems of Linear Equations: http://www.mathsisfun.com/algebra/systems-linear-equations.html

III. Scientific Notation & Significant Figures

http://www.mathsisfun.com/numbers/scientific-notation.html
https://www.khanacademy.org/math/arithmetic-home/arith-review-decimals/arithmetic-significant-figures-tutorial/v/significant-figures
http://chemistry.bd.psu.edu/jircitano/sigfigs.html

IV. Exponents: http://www.mathsisfun.com/exponent.html

V.  Graphing/Slope Calculations/Equations of Lines

http://www.coolmath.com/precalculus-review-calculus-intro/precalculus-algebra/01-graphing-slopes-of-lines-01
http://www.mathsisfun.com/equation_of_line.html

VI. Unit Conversions
http://www.mathsisfun.com/measure/unit-conversion-method.html

VII.    VECTORS

In addition, you will need to learn about vectors before coming to class.  Vectors are a foundational mathematical concept that physics uses all the time. If you have already taken Pre-Calculus, you have a head start. Either way, you need to learn about them and show you can work correctly with vectors when the school year begins. This is not something you should cram into the couple days before school starts but something you should work at over the course of the summer.

Here are some resources & requirements:

Videos to watch: Go to https://www.flippingphysics.com/algebra.html
Introductory Concepts – watch video 6 – "A Problem to Review SOH CAH TOA"
Go down to "Two Dimensional Motion" – find the "Vectors and Scalars" section
Watch all 7 videos

As you watch the videos, take notes, and work to understand how vectors work.  If you need to watch a video more than once, please do that.  You need to **UNDERSTAND** how vectors work and how to do math with vectors.  If you want more videos about vectors, a simple google search will give more – Khan Academy has several.

Next, go to: https://www.physicsclassroom.com/Physics-Interactives/Vectors-and-Projectiles.  Use the following interactives to help build your understanding of vectors. These games help you practice the concepts and gain understanding.  Practice enough so you are very comfortable with vectors.
- Vector Addition
- Name that Vector
- Vector Guessing Game
- Vector Addition: Does Order Matter?

Last, go to: https://www.physicsclassroom.com/Concept-Builders/Vectors-and-Projectiles.  You need to get ALL trophies for the following concept builders.  When you start the concept builder, put your name.  Once you have the trophies, take a screen shot and put it in a word (or google) document.  When you have all the trophies, you can email me the word document.
- Vector Direction
- Head-to-Tail Vector Addition
- Vector Addition
- Component Addition

*Note: the challenge with concept builders is that when you are wrong, it won't tell you why you are wrong.  You will have to show GRIT and determination to figure out the concept and how to get the right answer enough times to get the trophies.  We will do a lot of concept builders during AP Physics 1 so this is not only practice but showing you what we will be doing during the year.*

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## What's the point??

You need to email me your trophies by the first AP Physics class of the school year. They will count as your first homework assignment. Your first quiz will take place during the first week of school and it will be over vectors in addition to the other review topics within the summer assignment.

# Part 2: Quick Overview

1. Solve for the missing side $L$ in the right triangle below.

```
63°        15
```

$L$
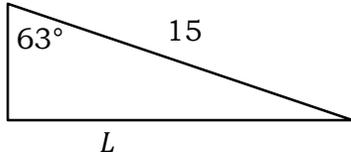
2. Solve for the missing angle $\theta$ in the right triangle below.

```
      51
    θ
            37
```
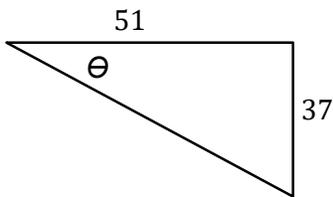
3. If $\cos\theta = 0.354$, what is the value of $\theta$?

4. If $2x + 7y = 45$ and $5x - 4y = 17$, what are the values of $x$ and $y$?

5. If $4p - r = 10$ and $2p = 12 - 2r$, what are the values of $p$ and $r$?

6. Write the number 23,450,000,000 in proper scientific notation.

7. Write the number $5.03 \times 10^{-5}$ in decimal notation.

8. Simplify: $p^5 \times p^7$

9. Simplify: $\dfrac{6 \times 10^3}{2 \times 10^9}$

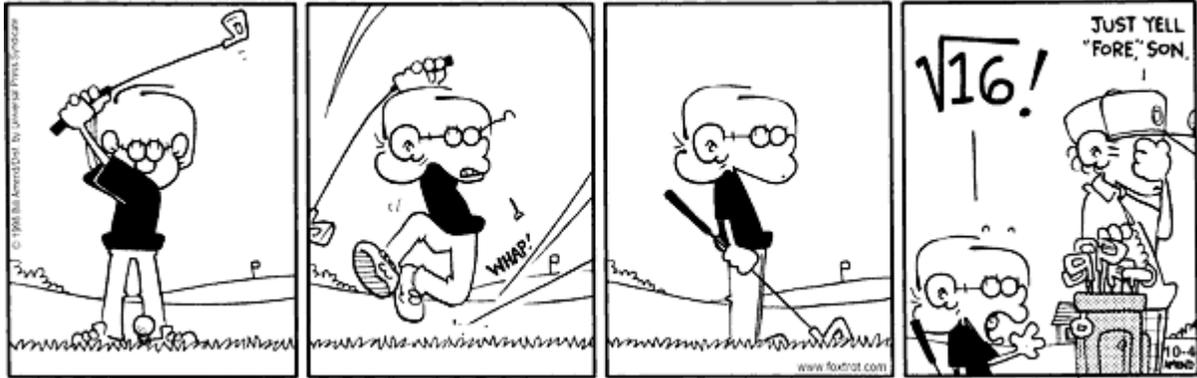10. Graph the following data on the grid provided. Draw the line of best-fit.

| Time | Position |
|------|----------|
| 0.5  | 2.3      |
| 2.7  | 13.7     |
| 4.8  | 25.0     |
| 7.2  | 34.8     |
| 10.1 | 49.6     |
| 11.5 | 58.1     |
| 13.6 | 69.5     |
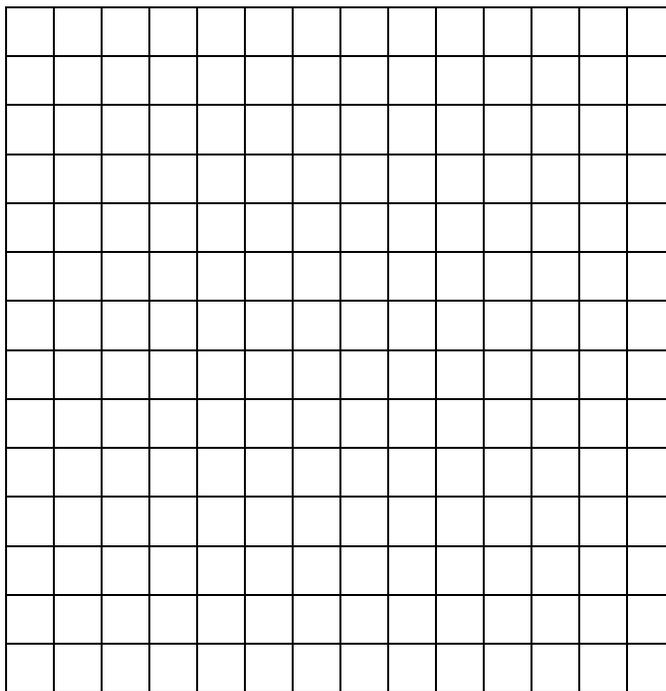
11. Calculate the slope of the line in question 10, include the units of measure.

12. Compute the equation of the line from question 11.

# Part 3: Math Review



**SOLVING EQUATIONS**

**Solve the following equations for the quantity indicated.**

**1.** $y = \dfrac{1}{2}at^2$    Solve for $t$

**2.** $x = v_o t + \dfrac{1}{2}at^2$    Solve for $v_o$

**3.** $v = \sqrt{2ax}$    Solve for $x$

**4.** $a = \dfrac{v_f - v_o}{t}$    Solve for $t$

**5.** $a = \dfrac{v_f - v_o}{t}$    Solve for $v_f$

**6.** $F = k \dfrac{m_1 m_2}{r^2}$      Solve for $r$

**7.** $F = k \dfrac{m_1 m_2}{r^2}$      Solve for $m_2$

**8.** $T = 2\pi \sqrt{\dfrac{L}{g}}$      Solve for $L$

**9.** $T = 2\pi \sqrt{\dfrac{L}{g}}$      Solve for $g$

In each case make the specified variable the subject of the formula:

a)   $h = c + d + 2e,$      $e$      b)    $S = 2\pi r^2 + 2\pi r h,$      $h$

c)   $Q = \sqrt{\dfrac{c+d}{c-d}},$      $c$      d)   $\dfrac{x+y}{3} = \dfrac{x-y}{7} + 2,$      $x$

**FACTOR-LABEL METHOD FOR CONVERTING UNITS**

A very useful method of converting one unit to an equivalent unit is called the **factor-label method** of unit conversion. You may be given the speed of an object as 25 **km/h** and wish to express it in **m/s.** To make this conversion, you must change **km** to **m** and **h** to **s** by multiplying by a series of factors so that the units you do not want will cancel out and the units you want will remain. Conversion: 1000 **m** = 1 **km** and 3600 **s** = 1 **h**,

What is 1 km/h in m/s?

What is 1 m/s in km/h?

**Carry out the following conversions using the factor-label method. Show all your work!**

**1.** How many seconds are in a year?

**2.** Convert 28 km to cm.

**3.** Convert 45 kg to mg.

**4.** Convert 85 cm/min to m/s.

**5.** Convert the speed of light, $3 \times 10^8$ m/s, to km/day.

**6.** Convert 823 nm to m

**7.** $8.8 \times 10^{-8}$ m to mm

**8.** $1.5 \times 10^{11}$ m to μm

**9.** 7.6 $m^2$ to $cm^2$

**10.** 8.5 $cm^3$ to $m^3$

# Part 4: Graphing Techniques

Graph the following sets of data using proper graphing techniques.

**Note: The first column refers to the *y*-axis and the second column to the *x*-axis**

**1.** Plot a graph for the following data recorded for an object falling from rest:
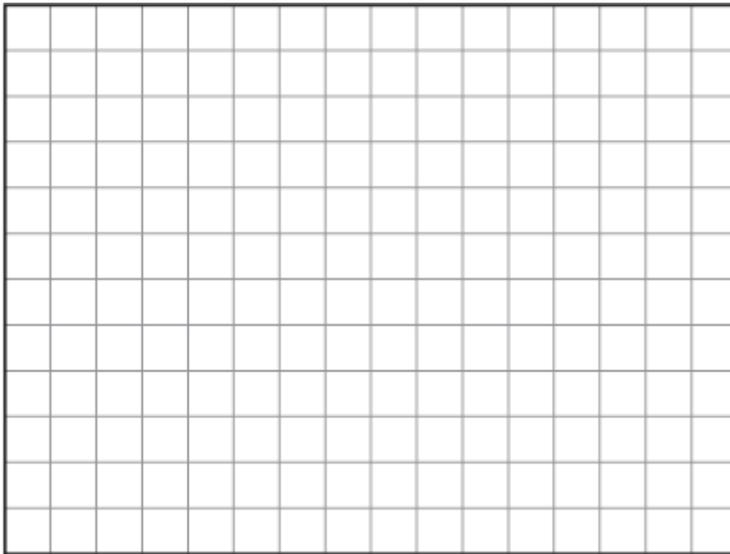
| Velocity (ft/s) | Time (s) |
|---|---|
| 32 | 1 |
| 63 | 2 |
| 97 | 3 |
| 129 | 4 |
| 159 | 5 |
| 192 | 6 |
| 225 | 7 |

**a.** What kind of curve did you obtain?

**b.** What is the relationship between the variables?

**c.** What do you expect the velocity to be after 4.5 s?

**d.** How much time is required for the object to attain a speed of 100 ft/s?

**2.** Plot a graph showing the relationship between frequency and wavelength of electromagnetic waves:
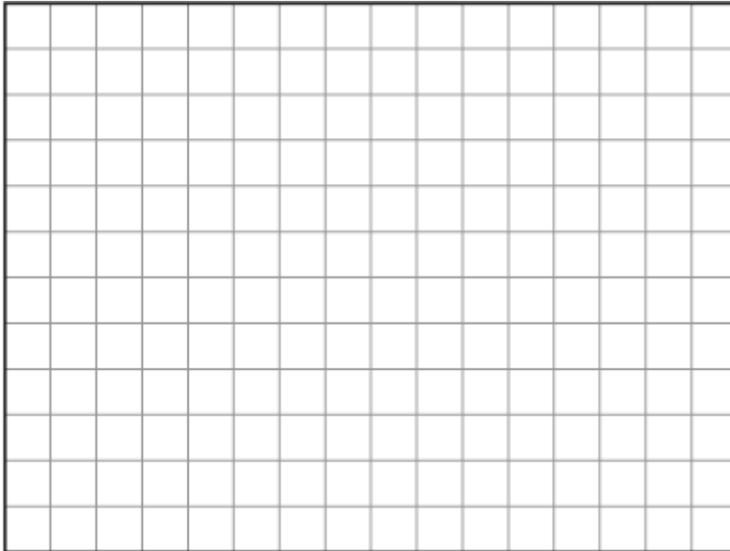
| Frequency (kHz) | Wavelength (m) |
|---|---|
| 150 | 2000 |
| 200 | 1500 |
| 300 | 1000 |
| 500 | 600 |
| 600 | 500 |
| 900 | 333 |

**a.** What kind of curve did you obtain?

**b.** What is the relationship between the variables?

**c.** What is the wavelength of an electromagnetic wave of frequency 350 Hz?

**d.** What is the frequency of an electromagnetic wave of wavelength 375 m?

**3.** In an experiment with electric circuits the following data was recorded. Plot a graph with the data:
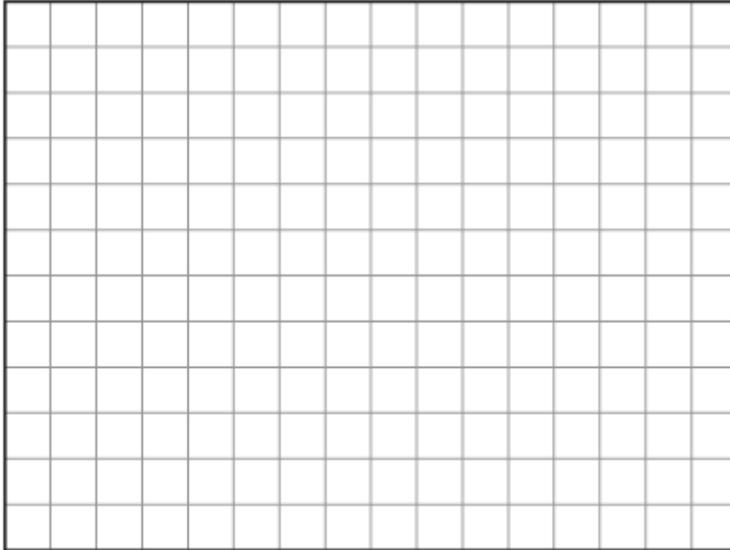
| Current (A) | Power (W) |
|---|---|
| 1.0 | 1.0 |
| 2.5 | 6.5 |
| 4.0 | 16.2 |
| 5.0 | 25.8 |
| 7.0 | 50.2 |
| 8.5 | 72.0 |

**a.** What kind of curve did you obtain?

**b.** What is the relationship between the variables?

**c.** What is the power when the current is 3.2 A?

**d.** What is the current when the power is 64.8 W?

# Part 5: Solving Quadratic Equations

Solve each of the following quadratic equations. Obtain your answers in surd, not decimal, form.

**Law of Surds**

1. $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

2. $\sqrt{a} \times \sqrt{a} = \sqrt{a^2} = a$

3. $a\sqrt{b} \times c\sqrt{d} = ac\sqrt{bd}$

4. $\dfrac{\sqrt{a}}{\sqrt{b}} = \sqrt{\dfrac{a}{b}}$

5. $\dfrac{\sqrt{a}}{\sqrt{b}} = \dfrac{\sqrt{a}}{\sqrt{b}} \cdot \dfrac{\sqrt{b}}{\sqrt{b}} = \dfrac{\sqrt{ab}}{b}$

6. $\dfrac{a}{\sqrt{b}} = \dfrac{a}{\sqrt{b}} \cdot \dfrac{\sqrt{b}}{\sqrt{b}} = \dfrac{a\sqrt{b}}{b}$

1. $x^2 + 8x + 1 = 0$

2. $x^2 + 7x - 2 = 0$

3. $x^2 + 6x - 2 = 0$

4. $4x^2 + 3x - 2 = 0$

5. $2x^2 + 3x - 1 = 0$

6. $x^2 + x - 1 = 0$

7. $-x^2 + 3x + 1 = 0$

8. $-2x^2 - 3x + 1 = 0$

9. $2x^2 + 5x - 3 = 0$

10. $-2s^2 - s + 3 = 0$

11. $9x^2 + 16x + 1 = 0$

12. $x^2 + 16x + 9 = 0$