

AP Physics 1 Summer Work 2019

The purpose of the AP Physics 1 summer work is to detail the specific math skills necessary for success in AP Physics 1 and give students an opportunity to practice those skills. The summer work will not be collected for a grade in class, but students are expected to come to class with these skills so that we can hit the ground running. Answers are included at the end of the packet. Please try the problems before using the solutions and if you are not sure how to get a particular answer feel free to reach out to us with questions (Kris Newton - knewton@cpsd.us or Tal SebellShavit - tsebellshavit@cpsd.us).

Look on your schedule to determine when your class meets and Join the appropriate Google classroom page for links to videos and/or websites that you might find helpful or interesting.

Fall Semester Class (Period 2) – Google Classroom Code: **gwdahs**

Fall Semester Class (Period 3) – Google Classroom Code: **obdar2f**

Spring Semester Class (Period 1) – Google Classroom Code: **7o1f4n**

Spring Semester Class (Period 4) – Google Classroom Code: **zjgzmk3**

Significant Figures and Scientific Notation Review

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

a) 6.001 Answer: _____ c) 206,000 Answer: _____

b) 0.0080 Answer: _____ d.) 27.00 Answer: _____

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

2) $(5.0 \times 10^{-8})(2.9 \times 10^2)$

3) $(3.25 \times 10^4 + 7.4 \times 10^3)$

4) $6.000 \times 10^{-11} \frac{1.00 \times 10^{26}}{2.00 \times 10^7}$

5) $\frac{8400}{1.2 \times 10^7}$

ADVANCED PLACEMENT PHYSICS 1 EQUATIONS, EFFECTIVE 2015

CONSTANTS AND CONVERSION FACTORS	
Proton mass, $m_p = 1.67 \times 10^{-27}$ kg Neutron mass, $m_n = 1.67 \times 10^{-27}$ kg Electron mass, $m_e = 9.11 \times 10^{-31}$ kg Speed of light, $c = 3.00 \times 10^8$ m/s	Electron charge magnitude, $e = 1.60 \times 10^{-19}$ C Coulomb's law constant, $k = 1/4\pi\epsilon_0 = 9.0 \times 10^9$ N·m ² /C ² Universal gravitational constant, $G = 6.67 \times 10^{-11}$ m ³ /kg·s ² Acceleration due to gravity at Earth's surface, $g = 9.8$ m/s ²

UNIT SYMBOLS	meter, m	kelvin, K	watt, W	degree Celsius, °C
	kilogram, kg	hertz, Hz	coulomb, C	
	second, s	newton, N	volt, V	
	ampere, A	joule, J	ohm, Ω	

PREFIXES		
Factor	Prefix	Symbol
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

VALUES OF TRIGONOMETRIC FUNCTIONS FOR COMMON ANGLES							
θ	0°	30°	37°	45°	53°	60°	90°
$\sin\theta$	0	1/2	3/5	$\sqrt{2}/2$	4/5	$\sqrt{3}/2$	1
$\cos\theta$	1	$\sqrt{3}/2$	4/5	$\sqrt{2}/2$	3/5	1/2	0
$\tan\theta$	0	$\sqrt{3}/3$	3/4	1	4/3	$\sqrt{3}$	∞

The following conventions are used in this exam.

- I. The frame of reference of any problem is assumed to be inertial unless otherwise stated.
- II. Assume air resistance is negligible unless otherwise stated.
- III. In all situations, positive work is defined as work done on a system.
- IV. The direction of current is conventional current: the direction in which positive charge would drift.
- V. Assume all batteries and meters are ideal unless otherwise stated.

Conversions Review

- 6) 16.7 kilograms is how many grams?
- 7) 560 nm is how many meters?
- 8) 15 years is how many seconds?
- 9) 8.99×10^9 seconds is how many years?
- 10) 2.998×10^8 m/s is how many kilometers per hour?

11) 360 degrees = _____ radians

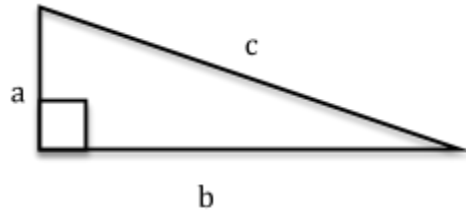
12) 4.5 revolutions = _____ radians

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

14) Find the length of an arc with a radius of 10.0 m swept across 100 degrees

Trigonometry Review

Use the figure below to answer problems 17-24.
Simplify as much as you can.



15) Solve for a if given b and c

16) Solve for a if given c and θ

17) Solve for θ if given b and c

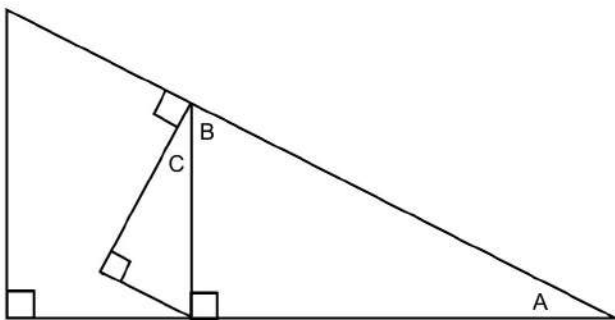
18) Solve for θ if given a and b

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

20) If $c = 10.0$ and $\theta = 60^\circ$, what is b ?

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

Answer:



Algebra Review

Solve the following equations for the given variable and conditions. Simplify if needed.

Example: $2x + xy = z$
 $x(2 + y) = z$

Solve for x.

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

22) $v^2 = v_0^2 + 2a(\Delta x)$

a) Solve for v_0

b) Solve for Δx

23) $x = x_0 + v_0t + \frac{1}{2}at^2$

a) Solve for t , if $v_0 = 0$

b) Solve for t , if $x = x_0$

24) $a_c = \frac{v^2}{r}$, Solve for v

25) $mg \sin \theta = \mu mg \cos \theta$, Solve for θ

26) $\frac{1}{2}mv_f^2 + mgh_f = \frac{1}{2}mv_i^2 + mgh_i$, Solve for h_f if $h_i = 0$ and $v_f = 0$

$$27) \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} \text{ Solve for } R_T$$

$$28) F_g = G \frac{m_1 m_2}{r^2} \text{ Solve for } r$$

$$29) \frac{mv^2}{R} = G \frac{Mm}{R^2} . \text{ Solve for } v.$$

$$30) T = 2\pi \sqrt{\frac{L}{g}} . \text{ Solve for } g.$$

Miscellaneous

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

$$31) \frac{1}{4} + \frac{1}{6}$$

$$32) \frac{1}{3} + \frac{1}{18}$$

$$33) \text{ Consider } z = \frac{x}{y}, c = ah, \text{ or } r = \frac{s^2}{t^2}.$$

- As x increases and y stays constant, z _____.
- As y increases and x stays constant, z _____.
- As x increases and z stays constant, y _____.
- As a increases and c stays constant, b _____.
- As c increases and b stays constant, a _____.
- As b increases and a stays constant, c _____.
- If s is tripled and t stays constant, r is multiplied by _____.
- If t is doubled and s stays constant, r is multiplied by _____.

Systems of equations

Conceptual Question:

34) How many equations are needed to solve...

- a) for 1 unknown variable? _____
- b) for 2 unknown variables? _____
- c) for 3 unknown variables? _____

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

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

36) $ma = T$ and $mg - T = 2ma$. **Solve for a** in terms of m , and g .

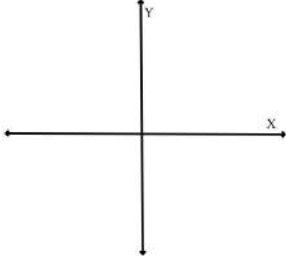
37) $T = 2\pi \sqrt{\frac{L}{g}}$ and $T = \frac{1}{f}$. **Solve for L** in terms of π , g , and f .

Graphing Equations

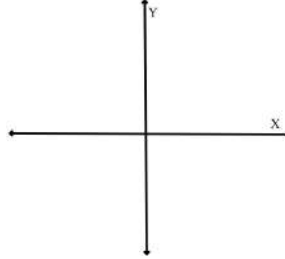
38) If $r = c - b*t$ was graphed on an r vs. t graph, what would the following be?
Slope: _____ y-intercept: _____

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

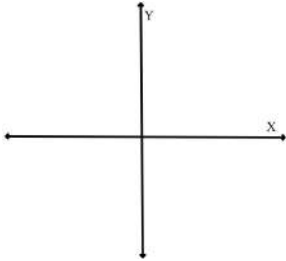
a) $y = mx + b$, if $m > 0$ and $b = 0$.



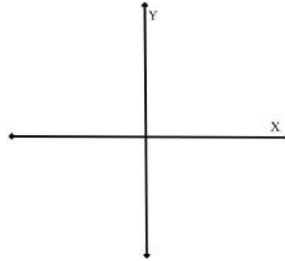
b) $y = mx + b$, if $m < 0$ and $b > 0$.



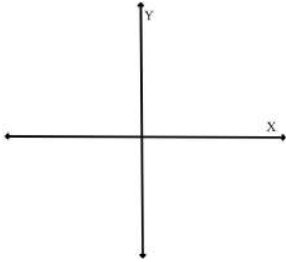
c) $y = x^2$



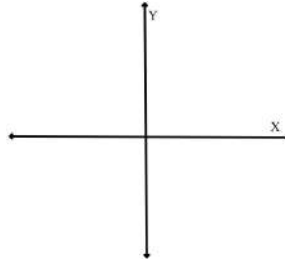
d) $y = \sqrt{x}$



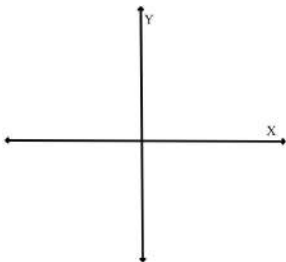
e) $y = 1/x$



f) $y = 1/x^2$



g) $y = \sin(x)$

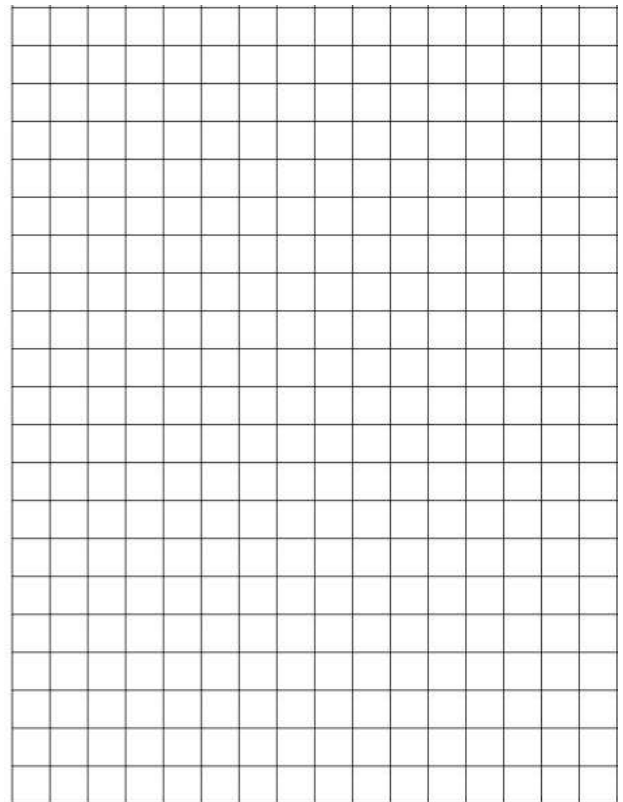


Marbles in Cylinder Lab

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. Find the slope of the line. Remember that you need to use the best fit line – not the data points – to find the slope. 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.

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



Formula: _____

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

AP Physics 1 Summer Work 2019 Answers

- 1a) 4 b) 2 c) 3 d) 4
2. 1.4×10^{-5}
3. 3.99×10^4
4. 3.00×10^8
5. 7.0×10^{-4}
6. 16700 g
7. 5.6×10^{-7} m
8. 4.7×10^8 s
9. 285 years
10. 1.079×10^9 km/hr
11. 2π
12. 4.5π
13. 15 m
14. 17.4 m
15. $a = \sqrt{c^2 - b^2}$
16. $a = c \sin \theta$
17. $\theta = \cos^{-1}(b/c)$
18. $\theta = \tan^{-1}(a/b)$
19. 6.7
20. 5
21. Proof
- 22a. $v_0 = \sqrt{v^2 - 2a(\Delta x)}$
- 22b. $\Delta x = (v^2 - v_0^2)/2a$
- 23a. $t = \sqrt{2(x - x_0)/a}$
- 23b. $t = 0$ OR $t = -2v_0/a$
24. $v = \sqrt{a_c r}$
25. $\theta = \tan^{-1}(\mu)$
26. $h_f = v_i^2/2g$
27. $R_T = R_1 R_2 / (R_1 + R_2)$
28. $r = \sqrt{Gm_1 m_2 / F_g}$
29. $v = \sqrt{GM/R}$
30. $g = 4\pi^2 L / T^2$
31. 5/12
32. 7/18
33. a) increases b) decreases c) increases d) decreases e) increases f) increases g) 9 h) $\frac{1}{4}$
34. a) 1 b) 2 c) 3
35. $\mu = F_f / mg \cos \theta$
36. $a = g/3$
37. $L = g/4\pi^2 f^2$
38. Slope = -b y-intercept = c
39. Use a graphing program such as Desmos to check