

AP Physics 1 & C

Name: \_\_\_\_\_

Summer assignment for 2020-2021 School Year

**DUE ON DAY 1 OF CLASS**

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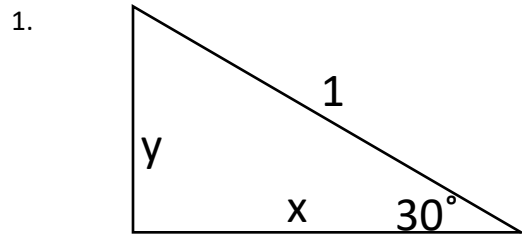
Part 1: Trigonometry

Remember: SOHCAHTOA

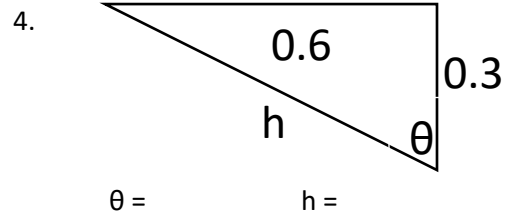
First write the equations for sine, cosine, and tangent, then complete the following questions.

$\sin(\theta) = \underline{\hspace{2cm}}$        $\cos(\theta) = \underline{\hspace{2cm}}$        $\tan(\theta) = \underline{\hspace{2cm}}$

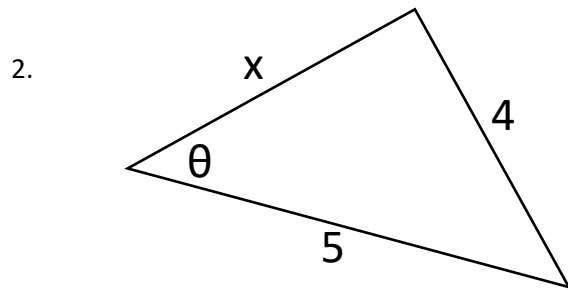
Find the numerical value(s) for the labeled side lengths and angles. Assume all triangles are right triangles and round to the nearest tenths place.



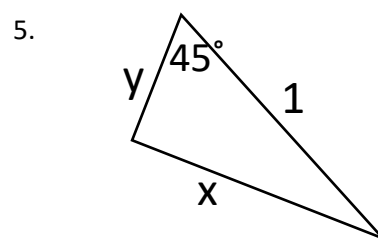
$y =$        $x =$



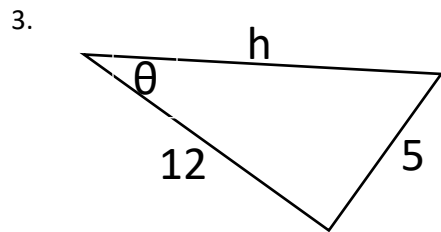
$\theta =$        $h =$



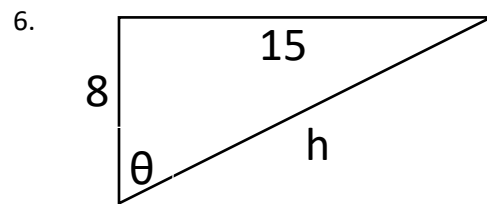
$\theta =$        $x =$



$y =$        $x =$

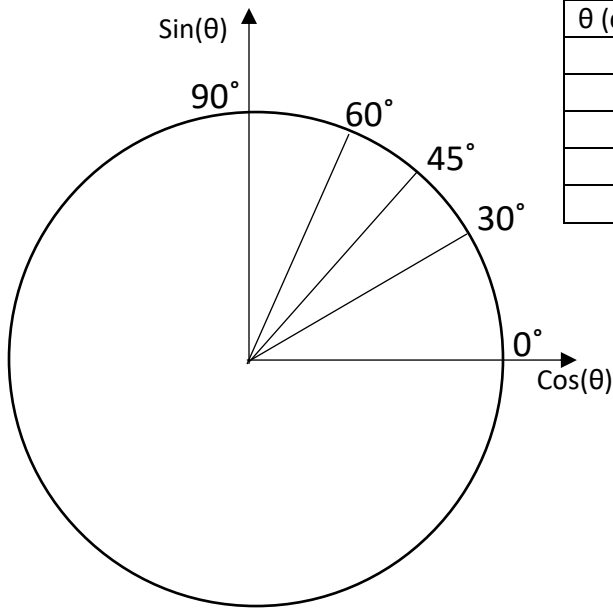


$\theta =$        $h =$



$\theta =$        $h =$

7. First complete the table of the first quadrant of the unit circle. Then answer the following questions **about the entire unit circle** [ $0^\circ \leq \theta \leq 360^\circ$ ].



$\theta$ (degrees)	$\theta$ (radians)	$\text{Sin}(\theta)$	$\text{Cos}(\theta)$
$0^\circ$			
$30^\circ$			
$45^\circ$			
$60^\circ$			
$90^\circ$			

8. What angle(s) cause cosine to be at its maximum value?
  
9. What angle(s) cause sine to be at its maximum value?
  
10. What angle(s) cause cosine and sine to be equal values?
  
11. What angle(s) cause cosine to be at its minimum value?
  
12. What angle(s) cause sine to be at its minimum value?

For additional practice Khan Academy is a great resource. The trigonometry and precalculus units will greatly help in getting ready for the class.

Part 2: Unit conversion and Dimensional analysis

Familiarize yourself with the following tables, than complete the following questions.

1. The following table shows many of the base units used in physics. Familiarize yourself with these base units, their symbol, and what they measure.

Name	Symbol	Measures...
Meter	m	Length
Kilogram	kg	Mass
Second	t	Time
Coulomb	q	Electric charge

2. Complete the table below for the following scientific prefixes. Mega, kilo, and milli have been done for you.

Name	Abbreviation	Numerical value
Nano-		
Micro-		
Milli-	m-	$10^{-3}$
Centi-		
Kilo-	k-	$10^3$
Mega-	M-	$10^6$
Giga-		

Convert the following units into the specified unit. Do not worry if the unit is not in Table 1, look at the prefixes to know what to multiply it by.

3.  $21 \text{ kg} = \text{_____ mg}$

7.  $1 \text{ m}^2 = \text{_____ cm}^2$

4.  $0.015 \text{ rad} = \text{_____ mrad}$

8.  $10,000 \text{ mm}^3 = \text{_____ m}^3$

5.  $600 \text{ nm} = \text{_____ mm}$

9.  $100 \frac{\text{kg}}{\text{m}} = \text{_____} \frac{\text{g}}{\text{cm}}$

6.  $0.2 \text{ GHz} = \text{_____ Hz}$

10.  $15 \frac{\text{m}}{\text{s}} = \text{_____} \frac{\text{km}}{\text{hour}}$

Use the factor-label method to convert the following units to the nearest thousandth.

Example:  $1 \frac{m}{s} = \frac{\text{mile}}{hr}$

$$\left(\frac{1 \cancel{m}}{1 \cancel{s}}\right) \left(\frac{3600 \cancel{s}}{1 \cancel{hr}}\right) \left(\frac{3.281 \cancel{ft}}{1 \cancel{m}}\right) \left(\frac{1 \text{ mile}}{5280 \cancel{ft}}\right) = \frac{11811.6 \text{ miles}}{5280 \text{ hr}} = \frac{2.237 \text{ miles}}{\text{hr}}$$

11. 1 year = \_\_\_\_\_ seconds

12.  $3 * 10^8 \frac{m}{s} = \frac{\text{ft}}{\text{week}}$

13.  $30 \frac{lb}{ft} = \frac{kg}{m}$

14.  $88 \frac{cm}{min} = \frac{m}{s}$

### Part 3: Scientific Notation

Complete the following questions about Scientific Notation.

Recall that for a number to be in scientific notation it must be in the form  $A * 10^b$ , where  $1 < A < 10$  or  $-10 < A < -1$  and  $b$  is the number of times the decimal place was moved to the left.

Example 1:  $-572.5 = -5.725 * 10^2$

Example 2:  $0.0231 = 2.31 * 10^{-2}$

Convert the following numbers to scientific notation.

1. 19300

2. 0.00000045

Convert the following numbers to normal notation.

3.  $8.6400 * 10^4$

4.  $5.64 * 10^{-4}$

Multiply the following numbers and give the result in scientific notation

5.  $(2.7 * 10^4) * (6.3 * 10^{-2})$

6.  $(5 * 10^{-3}) * (6.6 * 10^{-2})$

Add the following numbers and give the result in scientific notation

7.  $(2.5 * 10^8) + (1.2 * 10^8)$

8.  $(1.8 * 10^3) + (7.3 * 10^2)$

#### Part 4: Equation manipulation

Complete the following questions involving manipulating equations

Example:  $V = I * R$

Solve for I

$$I = \frac{V}{R}$$

1.  $U_s = \frac{1}{2}kx^2$

Solve for x

2.  $T_p = 2\pi\sqrt{\frac{l}{g}}$

Solve for l

3.  $v_f = v_i + at$

Solve for t

4.  $T_s = 2\pi\sqrt{\frac{m}{k}}$

Solve for k

Part 5: AP PHYS C only: Differentiation and Integration – Power rule

**In AP Physics C the major calculus rule you must learn quickly is the power rule for differentiation and integration.**

$$\frac{d}{dx}(A * x^n) = A * n * x^{n-1}$$

Power rule for differentiation

$$\int A * x^n dx = A * \frac{1}{n+1} * x^{n+1} + C, \text{ where } C \text{ is a constant}$$

Power rule for integration

NOTE: A is a constant number (aka, a coefficient)

Complete the problems below. If you can do these problems confidently you should be fine when class starts. Remember to use khan academy or **reach out to me** if you have any problems.

1. Use the power rule to find the derivative of  $f(x) = x^3$
  
  
  
  
  
  
  
  
  
  
2. Using the power rule, what is the derivative of  $5x^5$ ?
  
  
  
  
  
  
  
  
  
  
3. Using the power rule, what is the derivative of  $\frac{2}{x^3}$ ? (HINT: treat it as  $X^{-3}$ )
  
  
  
  
  
  
  
  
  
  
4. What is the derivative of  $-1 * \sqrt{x}$  (HINT: treat it as  $X^{0.5}$ )



5. Using the power rule, what is the INTEGRAL of  $3x^2$ ?

6. What is the integral of  $X^{-2/3}$ ?

7. What is the integral of 7? (Hint, treat it as  $7 \cdot x^0$ )

8. What is the integral of  $-2x^{-2}$ ?

## Part 6: Checklist

Please use this checklist to keep track of which parts of the Summer Assignment you have completed. This will also serve as a guide for what to bring for the first day of class.

- Completed the Trigonometry Review
- Completed Unit Conversion and Dimensional Analysis
- Completed Scientific Notation
- Completed Equation Manipulation
- **AP PHYS C ONLY:** Completed Differentiation and the Derivative Practice

Be prepared for a quiz during the first week on any/all of these topics.