

AP Physics C Summer Assignment

Hello future AP Physics C student. My name is Mr. Hill and I will be your AP Physics C teacher. This document is a brief overview of what your summer assignment is as well as the expectations for class when the school year starts.

Summer Assignment: The summer assignment is split into three parts. The summer assignments are very calculus heavy. Unfortunately we can not do calculus based physics without knowing calculus first.

1. The first assignment is a review of previous math concepts everyone in the class should have seen prior to the start of summer. It covers algebra 2/trig and the beginning of pre-calc material.
2. The second assignment is a combination of the end of pre-calc and the beginning of calculus. This is the most important assignment of the three. The last few problems are the basics of calculus. For the students that have not taken calculus prior to their senior year, this will be difficult. I strongly suggest you attempt these problems. Spend some time trying to learn and understand the basics of calculus on your own. If you are able to do this you will be well prepared for the first day of class.
3. The third assignment is a challenge assignment. It is geared toward the students that have already taken calculus. I encourage students who have not taken calculus to also attempt these problems, but they will be very difficult.

The summer assignments are due the first day of class. The first assignment will be graded for accuracy, the second will be graded for completion, and the third will not be graded. You do not have to be an expert in calculus by the end of the summer. However the more calculus you have been exposed to and understand, the easier the first couple months of our class will be.

First Month of School

The first 3-4 weeks of school will be a crash course in calculus. We need to understand the basics of calculus before we can do the beginner physics questions. For students who have taken calculus, this will be a great review to fortify previous concepts. Students who are taking calculus for the first time, this will be a difficult three weeks. We will be setting the foundation for the rest of the year.

Enjoy your summer. Rest and relax when you have a chance. When the school year starts it will be full speed ahead all the way till the AP test. Good luck with the assignments. If you have questions, please email me. mhill@bishopoconnell.org

Thank you,
Mr. Hill

Assignment 1

Show all your work on separate paper.

Please do not try to fit your work into the margin of this page.

Find the slope of the graphs of the following equations:

1. $4y + 10 = 3x - 8$

2. $8x + 3y = 14$

Find the roots of the following:

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

4. Show that $\frac{\sin \theta \cot \theta}{\sqrt{1 - \sin^2 \theta}} = 1$ for $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$

5. Show that $\cos \theta \sin\left(\frac{\pi}{2} + \theta\right) - \sin \theta \cos\left(\frac{\pi}{2} + \theta\right) = 1$ (use the formulas for the sums of angles)

For numbers 6 and 7, do not use a calculator.

6. Find $[(0.001)^6]^{-1/3}$

7. Express $\log(x^{2x})^3$ in terms of $\log x$

x	$\log x$	x	$\log x$
1	0.00	5	0.70
2	0.30	7	0.85
3	0.48	10	1.00

For the following questions, make use of the log table above to evaluate the logs. Do not use the log function of your calculator. Show the steps to get your answer. For example, to calculate $\log \sqrt{10}$ (Review Problem 16 on page 246) you would write:

$$\log \sqrt{10} = \log((10)^{1/2}) = (1/2) \log 10 = 0.5$$

8. $\log 350$

9. $\log 15^{5/2}$

10. $\log 81$

Assignment 2

Show all your work on separate paper.

Please do not try to fit your work into the margin of this page.

Find the following limits, if they exist. If there is no limit or if the limit is $\pm\infty$ then say so.

1. $\lim_{x \rightarrow 3} \frac{x^2 + x - 12}{x - 3}$

2. $\lim_{x \rightarrow \infty} \frac{1}{x - 1}$

3. $\lim_{x \rightarrow \infty} \frac{4x^3 + x}{5x^2 - x^3}$

Questions 4 & 5: An object moves so that its position is given by $S = at^4 + bt^2 + ct + d$ from time 0 to time T where a , b , c , and d are constants.

4. Write an expression for the *average* velocity of the particle from $0 < t < T$ in terms of T and the given constants.

5. Write an expression for the *instantaneous* velocity of the particle at $t = T$ in terms of T and the given constants.

Find the derivative of each of the following functions with respect to its appropriate variable.

6. $y = (x + 8x^3)^{-2}$

7. $f = \frac{\cos \theta}{\theta^2}$

8. $y = \cos(e^{2x})$

9. $v = t^3 \ln 2t$

10. Find $\frac{d^2}{dx^2}(x^3 - e^{-2x})$

Question 11 - 15: For the function $y = 4x^2 - 3x + 7$

11. What is the first derivative of the function?

12. Determine where the local maximum or minimum occurs.

13. Determine the value of the local maximum or minimum.

14. What is the second derivative of the function?

15. Is the value found in 13. a maximum or minimum?

Assignment 3 (Challenge Assignment)

Show all your work on separate paper.

Please do not try to fit your work into the margin of this page.

Evaluate the following indefinite integrals. Do not forget to include the constants of integration. Most of these integrations require the change of variable method.

1. $\int \cos 3x \, dx$

2. $\int \frac{dx}{(x+2)^2}$

3. $\int \cos^2 \theta \sin \theta \, d\theta$

Evaluate the following definite integrals.

4. $\int_{-3}^{+3} (e^x + e^{-x}) \, dx$

5. $\int_{-0}^{+5} \frac{x \, dx}{\sqrt{4 + x^2}}$

6. $\int_0^{\pi/2} \sin \theta \cos \theta \, d\theta$

7. $\int_0^7 (3 + 2x^2 + x^3) \, dx$

Solve the following word problems. You may have to use intermediate equations for area or volume to make all terms agree before evaluating the definite integral.

8. Bob leaves for a trip at time $t = 0$ and drives with the speed described in the function below. Calculate the distance in miles Bob travels after 2 hours of this motion.

$$v(t) = (60 \text{ mph}) - \frac{1}{2}t$$

9. Shauna starts painting at noon. She can paint $(140 - kt)$ square feet per hour, where t is the number of hours since she started painting and k is a constant accounting for the fact that Shauna slows down as she gets tired. If Shauna paints 100 square feet between 2pm and 3pm, what is k ?

10. A water tank in the shape of a cone (point on top) is filled with water at a constant rate of 0.227 m^3 per minute. The tank's base has a radius of 2.0 m and a height of 5.0 m. How much time in minutes will it take to increase the water level from 1.0 m high to 4.0 m high?