# AP Physics C Summer Assignment

You are required to learn the material in the book Quick Calculus, by Kleppner and Ramsey. The book is a self-teaching book. The reason for the assignment is that calculus including integration is needed for AP Physics C right from the start, and it is normally several months before integration is treated in a calculus course. The book is currently available new at Amazon.com for around $13.57 plus shipping, or for a few dollars more at local bookstores such as Barnes & Noble or Borders. You could also find a used copy somewhat cheaper from the internet (e.g. Ebay or Amazon used—Amazon used now has them as low as $3.00). It is recommended that you buy a book so that you can write in it; however, I have several copies that I can issue to students, provided they are used without writing in them (by using a notebook). If you check out one of the Westfield copies it must be returned in very good condition, without damage or writing—otherwise you will be charged for it.

As part of the assignment, you will also be required to print out the three quizzes on the sheets that follow and mail them to me, postmarked no later than the following deadlines:

Quiz 1 on Chapter 1: July 9
Quiz 2 on Chapter 2: July 30
Quiz 3 on Chapter 3: August 27

Please do not email me the quizzes unless they are worked out using an equation editor.

These may be sent earlier, even all at once before the first deadline if desired. The address is: Dr. Christopher Lyndon, 6868 Ridge Water Court, Centreville, VA 20121. You should also save another copy of each assignment (print it out and then recopy your answers INCLUDING YOUR WORK) because it is possible for the postal service to lose your assignment by delivering it to the wrong address, etc. You should email me at christopher.lyndon@fcps.edu to tell me that the assignment has been sent and leave a phone number where you can be reached (e.g. phone number of the Honolulu Marriott, etc.). Alternatively, you can call me at 703-815-1232 and leave a message that the assignment was sent and a phone number where you can be reached. In case I don't receive it I can phone you and have you read me your answers and work over the phone from the other copy you made For questions you may call 703-815-1232. (This

works better than email since I may not be checking my email frequently over the summer.) I will welcome questions and may even be able to meet for a session if a student is having particular difficulty (but don't give up and look for that option too quickly!) The first quiz is review and you may find you can do it without reading the book. Also, you may be able to do parts of the second quiz from what you learned in Pre-Calc. However, you should work through chapters 2 and 3 of the book up to page 199 unless you have already taken calculus, in which case you may be able to do all the quizzes without reading the book. Don't worry if you aren't a master of calculus by the end of the summer, since you will be taking calculus concurrently with AP Physics and you will learn it more thoroughly during the school year. However, you need to learn to do the derivatives and integrals in the assignments in the traditional way as taught by the book, and not rely on calculators which can do derivatives and integrals with symbolic manipulation (like the TI-89) or numerical evaluation of integrals and derivatives such as can be done by TI-83's etc. This also goes for finding maxima and minima of functions, that you should learn how to do by finding the derivative and setting it equal to zero. You will be tested on the derivative and integral material at the beginning of school next year, and you will only have the benefit of a non-graphing scientific calculator, which I will provide.

You should do the quizzes without working together or getting help. Show your work on another page if you have difficulty fitting it in the space provided. If you want to work together or get help, it is all right to do this with the Review Problems found on pages 245 to 253 (including answers). These problems are not part of an assignment but they are similar to the quizzes (and in a few cases the problems are the same). Or if you are stumped you can call me or email me. Besides the quizzes there is also a list of corrections on the book (Errata) on the last page of this document.

Enjoy your mathematical experience!

Name _____

# Quiz 1 on Chapter 1

Show any work you do.

Find the slope of the graphs of the following equations when *y* is expressed as a function of *x*:

1. $8y + 10 = 5x - 8$

2. $2x + 7y = 14$

Find the roots of the following either by factoring the expression or using the quadratic formula:

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

4. Show that $\dfrac{\sin\theta\cot\theta}{\sqrt{1-\sin^2\theta}} = 1$ for all θ (not just for a specific θ).

5. Show that $\cos\theta \sin(\pi/2 + \theta) - \sin\theta\cos(\pi/2 + \theta) = 1$ (Use the formulas for sin and cos of the sums of angles).

For number 6 you may use a calculator.

6. What is a) $\cos 65^\circ$ ?
   b) $\sin(-11\pi/2)$ ?
   c) $\tan(17\pi/4)$ ?

For numbers 7 and 8, do not use a calculator.

7. What is $(-1)^{12}$ ?

8. Find $[(0.001)^6]^{-2/3}$

9. Express $\log(x^{2x})^3$ in terms of $\log x$ (not just $x$).

| 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 5 questions make use of the log table above to evaluate the logs. Don't 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:

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

10. log 35

11. $\log\sqrt{21}$

12. log 140

13. $\log 15^{3/2}$

14. log 0.007

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# Quiz 2 on Chapter 2

Show any work you do. Find the following limits, if they exist. If there is no limit or if it is $\pm\infty$, say so.

1. $\lim_{x \to 3} \dfrac{x^2 - 2x + 35}{x - 7}$

2. $\lim_{\theta \to 0} \cot \theta$

3. $\lim_{x \to -1} \left[ 4 + \dfrac{x^2 - 1}{x + 1} \right]$

4. $\lim_{x \to -7} \left[ \dfrac{(x + 4)^2 (x - 3)}{x + 4} + 4 \right]$

5. $\lim_{x \to 0} \dfrac{1}{x}$

6. What is the *average* velocity in mph of a car that travels 15 miles west during 15 minutes, stops for 30 minutes, and then goes 25 miles east in 20 minutes? (Note: you don't use a derivative to find this.)

7. Give an expression for the *average* velocity of a particle which leaves the origin at time t = 0, whose position is given by $S = at^4 + bt^2 + ct + d$ . The average is from t = 0 to time t, and a, b, c, and d are constants. (Note: you don't use a derivative to find this.)

8. An object moves so that its position is given by $S = S_0 \sin(5\pi t)$, where S and $S_0$ are in meters, t is in seconds. $S_0$ is a constant. If $S_0 = 2.5$, what is its *instantaneous* velocity at t = 18 s?

9.Find the instantaneous velocity of a particle in terms of *a* and *b*( *a* and *b* are constants) whose position is given by $S = at^3 + bt^2$ when t = 8 .

Find the derivative of each of the following functions with respect to its appropriate variable. a and b are constants. Most of these involve the chain rule.

10. $y = 5 + 6x^3 + 3x^4$

11. $y = (x + 4x^5)^{-2}$

12. $p = \dfrac{1}{\sqrt{b^2 + q^3}}$ (note: b is a constant)

13. $y = x^{4e}$

14. $f = \dfrac{\sin \theta}{\theta^2}$

15. $f = \dfrac{1}{\sqrt{1 + \sin^3 \theta}}$

16. $y = \cos (\ln^2 x)$

17. $y = (\ln x)^{-3}$

18. $y = e^{x^2}$

19. $y = \pi^{\sqrt{x}}$ Hint: see box 234 on p. 122 of Quick Calculus.

20. $f = \cos (2\sin \theta)$

21. Find $\dfrac{d^3}{d\theta^3} \sin (7\theta)$

22. Find $\dfrac{d^2}{dx^2} (x^2 e^{2x})$

Find where the following functions have their maximum or minimum values. Do this by finding an expression for the derivative, then setting the derivative equal to zero and solving for x. Also find the second derivative to see if the original function has a maximum or a minimum. Show your work.

23. $y = e^{-(5x+3)^2}$

First derivative:

Value of maximum or minimum:

Second derivative:

Value of the second derivative at the Maximum or minimum:

Circle one: maximum minimum

24. $y = 2x^2 - 3x + 7$

First derivative:

Value of maximum or minimum:

Second derivative:

Value of the second derivative at the Maximum or minimum:

Circle one: maximum minimum

Find the differential for

25. $f = (\ln x)(\sin x)$

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# Quiz 3 on Chapter 3

Evaluate the following indefinite integrals Don't use the integral function of your calculator. Show all steps: (Omit the constants of integration.) Most of these integrations require the change of variable method.

1. $\int \cos 5x \ dx$

2. $\int \frac{7\ dx}{(x+2)^2}$

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

Evaluate the following definite integrals Don't use the integral function of your calculator. Show all steps:

4. $\int_{-3}^{+3} (e^{2x} + e^{-2x})dx$

5. $\int_0^5 \frac{3x^2 dx}{\sqrt{4+x^3}}$

6. $\int_0^{\pi/4} \sin \theta \cos \theta \ d\theta$

7. $\int_0^7 (8 + 4x^2 + x^3) \ dx$

# Errata

1. p.32, box 60, the answer to the tan $\phi$ question is wrong.
2. p. 107, box 206, the numerator in the derivative expression should read $vu' - uv'$, not $uv' - vu'$.
3. p. 111, box 211, should read Appendix A5, not A4.
4. p 119, box 226, should read Appendix A8, not A9.
5. p. 120, box 228, should read "If right, go to 231."
6. p. 147, box 285, should read "*t*he maximum gross.." (the t is missing)
7. pp. 148-149 The same constant is called $D_0$ in box 287 and D in box 288. The subscript serves no very useful purpose and should probably be dropped in box 287.
8. p 164, box 310, parentheses are needed for the $1/(2\sqrt{u})$ on the first line to show that the radical is in the denominator.
9. p.164, box 312, there should be a minus sign on the last line before the cos 3x.
10. This is not actually a mistake, but p. 166, box 315 could also read on the last line $= 1/(ab)\ \tan^{-1}(bx/a) + c$. However it is also correct as written. The c would just stand for a different arbitrary constant in either case.
11. p. 187, box 355, there should be two terms $y_2$ in the line that has the $2\ \Delta/6$ in it; i.e., $(2\ \Delta/6)\ (\ y_0 + 4\ y_1 + y_2 + y_2 + 4y_3 + y_4 + \ldots\ )$
12. p 188, box 357, the entire line starting $I = \int x^4 dx$ is wrong. The integrand (function being integrated) should be $x^3$ as in the line preceding it. When $x^3$ is integrated between the limits of 0 and 10 the result is 2500, not 20,000.
13. p 189, box 358, I get 2500 exactly, not 2501.33..
14. p. 231, Appendix A8: A reference to frame 109 on p.58 would be helpful for the last line of the proof. Also, no justification is given for the next to last line, where the limit of the natural log of an expression is said to be the same as the natural log of the limit.
15. p. 248, number 48's hint should read Appendix B1, not B3.