Assignments for Math 244 for Fall 2016

(assignments are due on the date listed)

for Wednesday, August 31

You can find the syllabus for Math 244, an introductory assignment on integration, and the first set of assignments at `http://people.whitman.edu/~gordon/` via the obvious (hopefully) links. If you need to review integration techniques, you can refer to the calculus books online at

`http://www.whitman.edu/mathematics/calculus/` or `http://people.whitman.edu/~gordon/`

(via the link Calculus Concentrate in the Math 126 materials for the latter) or consult any standard calculus text. It is very important that you be able to integrate efficiently as the course begins. To avoid a lengthy assignment after the first class period, it would be wise to start doing some of the problems on the review page before (yes, before) the first class meeting. It would also be a good idea to get a copy of the textbook (9th edition of Boyce and DiPrima; avoid an international version) and look over the preface and table of contents before the class begins. Most of Chapter 1 will be assigned as reading during the first week of the class.

for Friday, September 2

1. Read the syllabus carefully; pay particular attention to the second page.
2. Look over the handout and do all of the problems. This may take a while if you are rusty at finding antiderivatives, but it is very important that you get up to speed on these techniques quickly.
3. Turn in solutions for problems 1f, 2e, and 3f; I will collect these (just these three) problems at the beginning of class. Write your solutions carefully and clearly (refer to the syllabus). This is your first opportunity to show me the quality of your written work so do your best to make a good impression.
4. Spend a sufficient amount of time thinking about problem 4 as it illustrates some important ideas we will be discussing soon.

for Monday, September 5

1. Continue reviewing integration formulas and techniques if you had trouble with the handout.
2. Read Chapter 1 of the text. Pay particular attention to the examples arising from applications and to the comments about modeling that appear in Sections 1.1 and 1.2. Section 1.3 contains terms that we will use frequently and presents some ideas that are common to all differential equations; it is thus an important section but it makes for much better reading than a lecture. For the record, partial differential equations are studied in depth in Engineering Mathematics (Math 367). Section 1.4 contains some historical information that may put the topic of differential equations into perspective for you.
3. Do problems 1, 2, 7, 10, 11, 12, 15–20, 23, 24, and 25ab in Section 1.1. For 25, use meters for distance and seconds for time and determine the units for the constant of proportionality. What value would you use for g? By the way, if you are familiar with Maple, the following commands will (hopefully) give you a plot of a direction field. (You can use the Help function to learn more about this command.)
   > with(DEtools):
   > dfieldplot(diff(y(x),x)=(2-y(x))*x,y(x),x=0..10,y=0..8);
4. Do problems 1, 7, 9, 12, and 16 in Section 1.2 and problems 2, 6, 9, 12, and 25 in Section 1.3.
5. I will not be collecting any of the above problems so you need to motivate yourself to do them.

for Wednesday, September 7

1. Read Section 2.1 of the text. It is a somewhat lengthy section but there is only one key idea. Make certain you understand (that is, could reproduce the main idea) the general argument we did in class to find an integrating factor (it is also on page 36 of the text).
2. Do problems 5c, 9c, 13, 15, 16, 20, 26b, 28, and 35 in Section 2.1. I will not be collecting any of these so you need to motivate yourself to do them. This is the last time I will make this reminder; I am repeating it because one of the primary reasons for poor performance on exams is failure to do all of the assigned problems. You may find the integration formula

$$\int te^{kt}\,dt = \frac{1}{k^2}\,(kt-1)e^{kt} + C$$

   (which you should be able to derive) helpful as you do these problems.
3. Turn in solutions for the following two problems related to the ideas in Section 2.1. Remember to copy the problem and to write solutions clearly.

   14.5: (This means that the problem is similar to problems 14 and 15 from the textbook. See the directions for these problems in the text.) Solve the initial value problem $ty' + 2y = \dfrac{1}{\sqrt{3+t^2}}, \quad y(1) = 8,$ then determine the value of t when $y = 1/2$. Give the exact value for t, not a decimal approximation.

   31′: Follow the directions for problem 31 in the text but use the differential equation $y' + 15 = 3y + 4e^t$ rather than the one given in the text.

for Friday, September 9

1. Read Section 2.2 of the text.
2. Do problems 1, 2, 3, 8, 9ac, 10ac, 12ac, 23, 27, and 32 in Section 2.2. For problem 32, you will need to read problem 30 and the heading just above it. The purpose of this exercise is to give you practice reading new material on your own. As you will probably discover, this collection of problems is nontrivial; they begin to give you an idea of the level of computation and thinking that will be required in this class.
3. Turn in solutions for problems 23 and 32ab from Section 2.2. For problem 32, after doing parts (a) and (b), add the initial condition $y(1) = 2$, explicitly solve for the solution y, and determine the interval on which the solution is defined.

for Monday, September 12

1. Read Section 2.3 of the text. This is a longer section with several applied examples so the reading may take more time than other sections thus far. For this assignment, reading the comments about modeling and Examples 1 and 2 should be sufficient.
2. Do problems 1, 3, 4, 6, 10, 11, and 16 in Section 2.3. For problem 11, use 0.09/12 as the monthly interest rate. Be aware that each of these problems might take a while. It is very important that you learn how to set these problems up on your own so if you work with others make sure you step back and understand what is going on.
3. Turn in solutions for problems 4 and 16.

for Wednesday, September 14

1. Continue looking over the applications in Section 2.3 of the text, reading any portion of the section that you have not yet studied and working on any previously assigned problems that you have not finished. This is a very important section so give it the attention it needs.
2. Do problems 17, 23, 24, and 28 in Section 2.3. For problem 23, note that the acceleration due to gravity is 32 ft/sec^2 AND that pounds is a unit of force, not mass.
3. Turn in a solution for parts (a), (b), (c), and (d) of problem 23 from Section 2.3. Be very careful with units and make certain your explanations are clear.

for Friday, September 16

1. Read Section 2.4 of the text. This is a more theoretical section but give it your best shot and focus on the main ideas that are discussed.
2. Do problems 1, 2, 4, 5, 7, 8, 10, 13, 17, 22, 23, and 25 in Section 2.4. For problem 25, write a clear proof of this result. The proof is essentially algebraic steps but make sure that all of the steps are carefully included. The first step should look like

$$(y_1 + y_2)' + p(t)(y_1 + y_2) =$$

   then do a "distribute" step, a rearrange step, a substitute step, and then one more step should get you to $g(t)$. All of these steps should be written clearly and joined with $=$ signs in some sort of organized fashion. For the record, this is a good test question that involves the more "theoretical" material.
3. Turn in solutions for problem 25 as outlined above and for the following modification of problem 17. Solve the problem for the three particular cases $y_0 = 4$, $y_0 = 1$, and $y_0 = -2$ and explicitly find y. (For the record, there are various ways to represent y, some of which are easier than others.) Then examine the properties of the solution; for one of the solutions you should find that the solution has a vertical asymptote. Find the value of t where the asymptote occurs. For the other two solutions, determine what happens as $t \to \infty$.

By the way, we have a test next Friday. It covers Sections 1.1–1.3 and Sections 2.1–2.6. Any problem assigned thus far, any problem similar to a problem assigned thus far, and any problem that uses ideas considered thus far is fair game. Several exams on this material from previous semesters are posted on the website. I have not yet decided on the status of calculators for the exam but they will most likely not be allowed and this will have an effect on the types of questions that can be asked.

for Monday, September 19

1. Read Section 2.5 of the text. This is a long section but the discussion is more qualitative than quantitative so it reads a little more quickly than other sections. You can ignore the discussion of the phase plane and related material since a direction field is sufficient for our needs.
2. You will be responsible for problems 2, 3, 12, 15, 17, 19, 20, 22, and 24 in Section 2.5. Starting with problem 16, you will notice that the problems are rather wordy but there are some quite interesting applications here.
3. Turn in a solution for problem 22 in Section 2.5, including a part (c) for this problem. For this additional part, assume that $\alpha = 0.01$ and $y_0 = 0.25$, then find the time required for y to reach the value 0.75.

for Wednesday, September 21

1. Continue looking over the problems in Section 2.5 if you have been struggling with them.
2. Read Section 2.6 of the text; you can ignore the comments on integrating factors. Depending on the time, we may not have discussed this section in class. It considers one more type of first order equation that can be solved easily. If you happen to remember the fundamental theorem concerning line integrals from Calculus III, you might find some of the ideas here familiar.
3. Do problems 1, 2, 4, 13, and 15 in Section 2.6.
4. Turn in a solution for the following problem.

   Solve the initial value problem $\dfrac{dy}{dx} = \dfrac{4x - 2y + 1}{2x - 2y}, \quad y(1) = -1$. Then determine the interval on which the solution exists and find the minimum value (give the exact value) of the solution y.
5. We will review Chapters 1 and 2 during class.

for Friday, September 23

1. We have a test covering Sections 1.1–1.3 and 2.1–2.6.