

Everything I Needed to Know in Life I Learned from Jackson Electrodynamics

Davon Ferrara

<u>Realization</u>	<u>Lesson</u>
1. Amazingly, you really can use all that math from high school that you thought you never would! Even better (or worse), it's actually not as hard as you thought it would be.	You never know when some bit of knowledge will be useful. Keep Learning.
2. Graphing Calculators aren't as useful as you thought. As a matter of fact, the old fashioned calculators are just as useful, and may be used, at most, once a month for a Jackson problem.	Make sure you understand what you are doing and why – don't just run through the steps or rely on someone or something else to do it for you.
3. Mathematica isn't as smart as you thought – even it can't do some of Jackson's integrals.	Computers are useful tools, but they cannot replace human knowledge and intuition. Don't trust them blindly. They can spit out answers that are wrong, which can cause your professor to take 3 weeks trying to figure out why it was wrong.
4. Integration Tables and other Math Tables are more useful than any computer. Jackson must have made it his mission in life to revert arrogant graduate students back to the old ways. In the next edition, do not be surprised if slide rules are required.	Sometimes, the old ways really are better. Don't dismiss them as being out of date or stranding in the way of progress. They may prevent you from looking stupid (like writing an answer down that goes to infinity when it shouldn't)
5. Trying to do Jackson problems alone, without help from your fellow classmates, is like trying to push an 18 wheeler out of the mud by yourself wearing flip flops and with a broken leg.	Working together is important and a necessary part of life. Learn to collaborate.
6. Relying too heavily on your classmates and not pulling your weight while working on Jackson problems is a quick way to make enemies and fail tests.	Getting rewarded for something that you didn't earn is not only unfair to those who did earn the rewards, it will come back to bite you in the end.
7. If you think undergraduate physics classes were tough without a full night's sleep, try Jackson. If you saw the movie <i>Pi</i> , then the scene towards the end with the drill is the equivalent to trying working a Jackson problem without sleep.	Sleeping and personal time away from work is an important part of achieving success.

<p>8. One Jackson problem takes an average of 1.5 weeks to finish. Most of this time is often spent working on the first part of a multipart problem. An approximate breakdown of the timeline of solving a Jackson problem is:</p> <ol style="list-style-type: none"> a. Days 1-2: Arguing about what exactly the problem is asking, what assumptions to make, why the problem can't be done as stated, why Mathematica cannot handle the integral, why Jackson probably didn't do any of these problems, why the initial 10 pages of algebra failed to deliver the correct answer. b. Day 3: Rechecking the 10 pages of algebra for a missing minus signs and factors of 2. c. Day 4: Starting the problem over the exact same way as before since it is not clear where the algebra mistake came from. d. Day 5: Discussing with the professor and realizing the problem is not as easy/hard as previously thought and that 4 days were wasted doing the problem the wrong way. e. Day 6: Reworking the problem this new way: 13 pages of Algebra. f. Day 7: Realizing this new way didn't work either, and discussing with professor why it was wrong. After getting an extension and "knowing" the correct way to do the problem, swearing it will get done tomorrow. g. Day 8: After working 15 pages of Algebra, you realize that a minus sign was left out on page 2. Reworking all of it, you are off by a factor of 2 from the expected answer. Going back and reworking, you find the missing factor on page 3 of 16. The first part of a 3 part problem is now done. No other homework or research was done today (or the past 5 days). h. Day 9: Part b is not as hard, but still takes 6 pages of Algebra. i. Day 10: Part c takes 2 pages of algebra and a page of words trying to answer a conceptual question that no one cares about at this point. 	<p>Procrastinating solving problems is a BAD BAD BAD idea. They only become that much more insurmountable.</p> <p>Perseverance is an important virtue to have. No problem is insurmountable if you don't give up (unless you procrastinate).</p> <p>Be careful not to make careless mistakes – they can take a lot of time to fix.</p> <p>A lot can be learned from the difficulties that one encounters in life – you just have to take time to reflect on them.</p>

<p>j. Day 11: Turn in the homework assignment, and reflect on how much was learned and how horrible the problem was. It takes 24 pages total.</p>	
<p>9. Undergraduate E&M is about solving the simple problems exactly. Jackson E&M is about learning to approximate reliably. The entire book, with few exceptions, is a mathematical discussion on finding way to solve only 4 equations for different boundary conditions. Most of the time, this requires series expansions and other approximation techniques.</p>	<p>In an ideal world, the exact solution not only exists, but with a little work can be arrived at. Realistically, most problems cannot be solved exactly without relaxing the conditions and compromising. This doesn't mean that the exact/ideal solution doesn't exist; it just means no one has found it. Most of the time, this is ok because we can live with the compromise – sometimes we <i>have</i> to live with it. However, in many instances, finding a more perfect solution or the ideal solution is necessary and worth working for. If we settled for the approximation and didn't try to improve the solution, then physicists, doctors, politicians, religious, and many others would have been out of a job a long time ago.</p>
<p>10. Graduate student bonding takes place while doing Jackson problems. As a matter of fact, completing a course on Jackson Electrodynamics places you in a special club for students who survived Jackson. You are now connected, in a very special way, to everyone else who has ever taken a course with that infamous text book – professors and graduate students alike. It will be a subject of conversations with physicists you meet from far away places.</p>	<p>You are not alone in this world. The human condition is shared by everyone regardless of race, nationality, gender, religion, class, and personality. No matter how bad you have it, someone else can relate. It is important to realize that we are all connected in a special way, just by being human, and that we are called to break down barriers between us. We need each other, and your actions affect <i>everyone</i> else somehow. Also, overcoming challenges together can form very close bonds.</p>