



How to get A's in Engineering ... by *really* trying! Study tips for the hard working student

A photograph of a student with dark hair, wearing a purple shirt, sitting at a wooden desk and studying. The desk is cluttered with papers and books. The student is looking down at a book, and their hands are visible as they work. The background is dark, suggesting a dimly lit room.

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Greg Baker / AP

The secret to success is constancy to purpose.

-- Benjamin Disraeli

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- Why is engineering hard?
- Homework: Do it!
- Lectures: Come, listen and think!
- Studying for Tests: Don't!
- Growing your reputation



Why is Engineering Hard: Analysis

Three reasons why you may have trouble with a topic or a problem:

1. Math

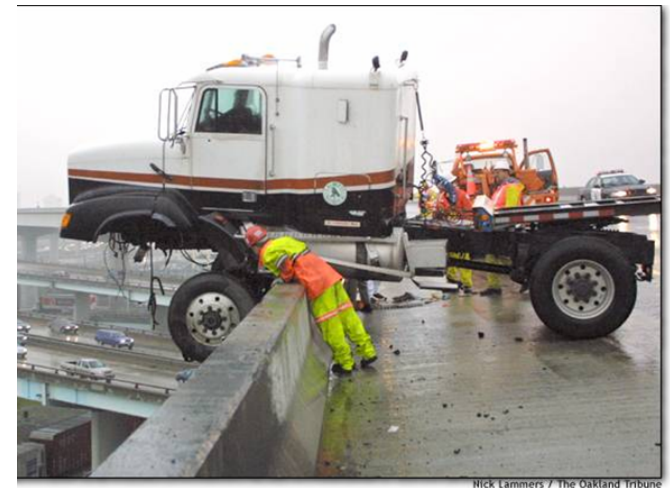
- You may have to learn, or re-learn, math techniques and tricks

2. Underlying principles ... physics of the topic

- Try to understand the qualitative picture
- Look at the final result of the derivation
 - This is usually a simple mathematical expression. Look at what terms are in the numerator, and what terms are in the denominator. What are the exponents? Plot these equations in different ways.

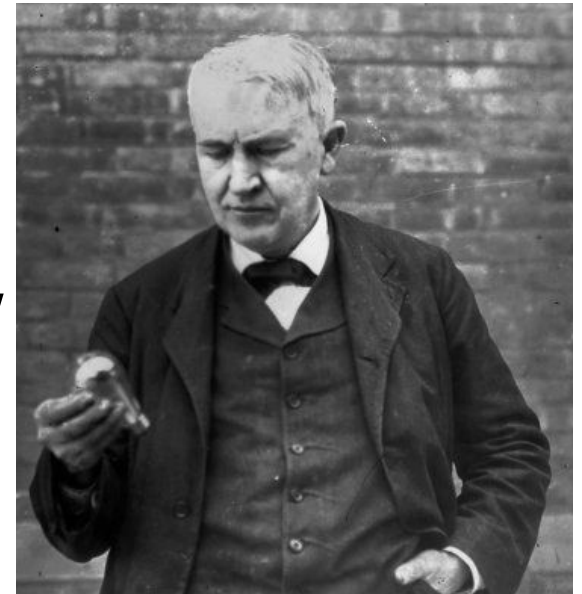
3. Complicated Application

- Try to understand the relevance, or the context of the example



Try to diagnose why you are having trouble

- The practice of engineering is about design.
 - Solving problems that have not been solved before!
 - Solving problems in new ways, with new technologies
- Creativity is hard to manage
 - But it is not impossible. Learn to brainstorm
- Ambiguity
 - In many cases, there is no clear optimal solution (or even what is desired)
 - Develop a “tolerance for ambiguity”



Thomas Edison

- Read the material three times:
 1. Read the whole chapter as you would a novel. Don't worry about details, try to get the big picture. Try to do this before the relevant class lecture.
 2. Study each section of the chapter. Use a highlighter sparingly. Copy over the examples.
 3. Take reading notes of the chapter.
- If you don't like the text's treatment of the material, look for another textbook (from the library) that does a better job.

- Keep up with the weekly homework assignment
- Be neat and professional
- Use a special pad of paper, and a scratch pad for rough drafts, and side calculations
- Work as much of the problem by yourself as you can ...
- ... but learn from others

- Start by summarizing the problem.
 - Classify the problem:
 - Is the problem a general derivation, a straight calculation or a design problem?
 - What are the givens?
 - What needs to be calculated?
- What must you bring to the problem?
 - What are the assumptions?
 - What are the relevant formulas?

- Do a rough draft
 - Ignore details, get a feel for where the problem is taking you
- Go back and be very attentive to details
 - Can you make fewer assumptions?
 - Is your mathematics perfect?
- Check your answer:
 - Units!
 - Does the answer make practical sense?
 - Check limiting cases
 - Check symmetry of answer

- Don't use the answer sheets. (They're often wrong anyway!)
- Discuss and debate the problem with a conscientious classmate.
 - Be open to different techniques.
 - Challenge the logic
 - Note pitfalls
- You are done when you are sure of your answer ... and can defend it to a skeptical colleague

- Come to every class
- Sit where you can hear the discussion and read the board
 - Speak up if you can't!
- Take notes
 - Not just the math, but the logic
 - Copy over your notes every 2-3 weeks into a separate notebook
- If you have to miss a lecture:
 - borrow the notes from 2-3 other students
 - compile these into your notebook
 - Then ask questions about what you don't understand.

- Don't cram right before a test
- Do get a good night's sleep
- Copy over your reading notes and lecture notes (again)
 - Your notes should get shorter, as you remember more, and find more things obvious
- Make a 1-2 page summary of the highlights

Studying Hint: This is best done *after* the test



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- Read through the whole test
 - Work on the easy questions first
- Be neat, and detailed in your answer
 - Teach your professor what you did
 - you'll get more partial credit, and feedback on how to improve
- Check your answers
 - Using a different method

- Projects are a chance to impress your instructor
 - Intelligent overkill!
 - Neat, complete, thoughtful professional job
- Don't do it all at once
 - Start by identifying what you need to learn, and what you want to deliver
 - Continually improve it until the deadline



Growing and Protecting Your Reputation

- Engineering is a tough career. You will get and keep the best jobs based on what your colleagues think of you
 - Performance and reputation ... for integrity.
- Engineering is about invention and innovation. The *first* one with the idea or the answer is the one who adds most of the value.

Put both of these thoughts together and decide if academic dishonesty has a place in a successful engineering career.