MEMORANDUM FOR STUDENTS ENROLLED IN CENG 5353

SUBJECT: CENG 5353 Administrative Instructions, AY102S

1. Welcome to CENG 5353, the math course you are required to take to get a graduate degree in civil engineering. During the upcoming semester, I believe you will find our study of operations research and advanced math to be interesting, challenging, and rewarding. We will meet IAW the course schedule (see Encl 1). My bio and contact information are attached (Encl 2).

2. In this course you will learn the state-of-art operations research techniques and advanced mathematics for the analysis of engineering systems. You will be studying on the principles of problem identification and model formulation, linear and nonlinear programming, integer programming, multi-objective programming, dynamic programming and network programming, as well as foundations of the risk analysis, statistical modeling, and computer simulation. In addition, you will be given the opportunity to applying the principles learned throughout this course and we will work to maximize the use of your computer in support of our work. This course has 6 specific objectives (see Encl 3).

3. I teach Transportation Engineering junior course 11:00AM-12:15PM TTR in RBS 2019, CENG2353 Civil Engineering Measurements sophomore course 11:00AM-11:50AM WF (Lectures) and 2:00PM-4:40PM TF (Labs), and this Operations Research graduate math course 5:00-7:40PM Thursday in RBS 2019. If you will miss a scheduled class, you are still responsible for the material.

4. You are encouraged to seek additional instruction (AI, office hours? Basically, open policy… If I am in my office any time, please knock the door and get in. Or simply arrange a mutually agreeable time to meet with me). Take advantage of AI, it’s FREE and really will help!

5. Class Room Procedures:
   a. I will take daily time survey data – please ensure the Time Survey Sheets are circulated.
   b. Bring study notes, textbook, note-taking material, and calculator to every class. You may not borrow or exchange calculators during graded events. If your calculator fails during a graded exercise, I am not responsible to furnish a substitute. Class preparation is your individual responsibility.
   d. You are not required to use colored pencils or a straight edge, but colors and straight lines can help with emphasis and clarity in your notes.
   e. I may have announced/unannounced quizzes. 😊
   f. **ACADEMIC DISHONESTY:** Representation of other’s work as your own will not be tolerated. Cheating on examinations, quizzes, and homework and the false representation of work will be interpreted as academic dishonesty. Academic dishonesty will be subject to disciplinary action as outlined by the UT Tyler Student Guide on Conduct and Discipline.
6. Exams and Grading:

a. Grade Breakout and Cutoffs:

<table>
<thead>
<tr>
<th>Course Points</th>
<th>Grade Scale</th>
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<tbody>
<tr>
<td>Problem Sets (9 at 50-120 each)</td>
<td>800 (40%)</td>
</tr>
<tr>
<td>Mid-term Exams (1 at 300 each)</td>
<td>300 (15%)</td>
</tr>
<tr>
<td>Instructor Grade</td>
<td>200 (10%)</td>
</tr>
<tr>
<td>Projects (1 at 200 each)</td>
<td>200 (10%)</td>
</tr>
<tr>
<td>Final Examination</td>
<td>500 (25%)</td>
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<tr>
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<td>2000 (100%)</td>
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If you earn less than 65% on all Exams or if you fail to earn at least 50% on the Final, you may fail the course, **regardless of your course grade**. Of course, final grades are only A, B, C, D, F. Therefore, a C- is a C for a final grade. This distribution is to graphically remind you of how well you are doing. **University grade breaks will be used in final grade posting.**

b. Mid-Term Exams and Final Exam:

1) The dates for Mid-Term Exam(s) are included in the course schedule. Official reasons for missing an exam are outlined in “Student handbook”. You are required to take a make-up Exam, regardless of your reason for missing the scheduled Exam. Report any conflict to me as soon as possible prior to the Exam.

2) Exams and the Final are closed book and notes. You can use a **TI-30 calculator** (or FE equivalent) and the CENG 5353 reference data cards that I provide to you.

3) Solutions to Exams will be posted on Blackboard.

c. Collection of Student Work: Throughout the semester I will collect student work (best, average, and worst) for the ABET course and outcomes notebooks. This will require me to make a copy of your work, keep your original and return a copy of the graded work to you. I will not draw attention as to what level of work you accomplished.

d. Embedded indicators of accomplishment of program outcomes: At times throughout the semester, portions of student work will be analyzed to determine if our program is accomplishing stated program outcomes based on established metrics. **If your work is below the minimum established metric, you will be required to repeat the assignment or that portion of the assignment until you achieve the minimum acceptable standard based on the metric.**

7. Homework: All homework is mandatory and becomes part of your grade, failure to submit any required homework will result in an incomplete. As an engineer your goal is to make a clear, logical, and professional presentation of your work, which is both accurate and correct. As such both your
presentation and the accuracy of your work are important, and both will be graded. In order to insure correctness and model professional CE practice, this semester we will often encourage you to discuss with your classmates and submit all your work to your classmates for “Review”. It is critical that you show all of your work and leave “foot prints” so that it can be easily followed. No guess work should be required to see what you did. All submissions must be turned in directly to me by 5:00PM (i.e., RIGHT BEFORE the class) on the due date and this rule will be strictly enforced throughout the semester. Late submissions should be placed in my folder or the CENG 3351 box in RBS 1003.

Additional guidance:

a. Problem Sets (PS)

1) Include a title sheet.

2) Use Engineer paper only or full-page printouts from Mathcad, Excel, SAS, GAMS, Lindo/Lingo, and/or CPLEX, etc. You may neatly tape or glue short computer printouts onto Engineer paper at the appropriate place in the logical flow of the problem. Only use one side of a page. Clearly present a brief problem statement and a sketch with your solution. Clearly and concisely explain each step. For narratives of more than a line or two, use your word processor or the text capability if you are using MathCAD or Excel. If you are writing out a paragraph or more, you must type it.

3) Late Submissions. It is a basic principle of professionalism that “Professionals are not Late.” A “COORDINATED LATE” submission occurs when you will miss the suspense for a graded homework assignment and you contact me in advance. Notification immediately before the submission will not suffice. Point cuts up to the amounts below may be assessed for a “COORDINATED LATE” submission:

1. 0-24 hours late a deduction of 25% of the earned grade
2. 24-48 hours late a deduction of 50% of the earned grade
3. More than 48 hours later No credit. Assignments must still be submitted.

Obviously there are circumstances that will occur and make a timely submission impossible and I will work with you when and if they occur.

4) All homework in this course must be properly documented. As you are discussing and/or having your work reviewed it is likely that you might receive help from your classmates, just simply document it. Information from the course textbooks (equations and outlines of procedures), class notes, or me is considered immediately available to all students and need not be acknowledged or documented. You are required to acknowledge and document all other assistance and references used. Documentation will be accomplished in accordance with any manual for writing, footnote or endnote, for papers, but for written homework, just place the documentation right at the point you received help using who and what assistance.

b. Assigned readings. Doing the assigned reading prior to class will help you to understand the material presented during the instruction and will fill in gaps for things we do not cover (I will not cover everything). It will also make you more familiar with terms and concepts to be covered. To help motivate you to do the reading there will be quizzes that you are required to complete prior to class on most readings. Be sure to check Blackboard, under assignments in a folder called Reading Quizzes. But I may or may not announce these quizzes in advance.
Projects. There will be one final project in this course which will be individual. For group projects, you are encouraged to discuss, wrap up the work together, and learn from each other. For the individual final project, you can discuss the given problem with your classmates, but your must work and get everything done on your own as each projects may be different. However, you are always encouraged to get any help from me.

8. There will be several opportunities to earn bonus points for outstanding work on problem sets and for completion of other optional assignments. Opportunities for bonus points will be clearly identified by me and announced in class. Make use of these opportunities to extend your learning!

9. Students Rights and Responsibilities. To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/StudentRightsandResponsibilities.html

10. Grade Replacement/Forgiveness. If you are repeating this course for a grade replacement, you must file an intent to receive grade forgiveness with the registrar by the 12th day of class. Failure to do so will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates will receive grade forgiveness (grade replacement) for only three course repeats; graduates, for two course repeats during his/her career at UT Tyler.

11. State-Mandated Course Drop Policy. Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the 12th day of class (See Schedule of Classes for the specific date). Exceptions to the 6-drop rule include, but are not limited to, the following: totally withdrawing from the university; being administratively dropped from a course; dropping a course for a personal emergency; dropping a course for documented change of work schedule; or dropping a course for active duty service with the U.S. armed forces or Texas National Guard.

Petitions for exemptions must be submitted to the Registrar's Office and must be accompanied by documentation of the extenuating circumstance. Please contact the Registrar's Office if you have any questions.

12. Disability Services. In accordance with federal law, a student requesting accommodation must provide documentation of his/her disability to the Disability Support Services counselor. If you have a disability, including a learning disability, for which you request an accommodation, please contact Ida MacDonald in the Disability Support Services office in UC 282, or call (903) 566-7079.

13. Student Absence due to Religious Observance. Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

14. Student Absence for University-Sponsored Events and Activities. If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

15. Social Security and FERPA Statement. It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades
(e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

16. Emergency Exits and Evacuation. Everyone is required to exit the building when a fire alarm goes off. Follow your instructor’s directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do Not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Encls

Wei (David) Fan
Ph.D., P.E.
CENG 5353
## Topics Covered and Schedule

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>LESSONS</th>
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<td>Linear Programming</td>
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<tr>
<td>Examples, Model Formulations, Computer Implementation</td>
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<td>Simplex Method, Duality Theory, and Sensitivity Analysis</td>
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<td>Transportation and Assignment Problems</td>
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<td>Network Optimization Models</td>
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<td>Shortest Path; Maximum Flow Problem, Minimum Cost Flow</td>
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<tr>
<td>Network Simplex Method</td>
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<td>Dynamic Programming: Deterministic &amp; Probabilistic</td>
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<td>Integer Programming</td>
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<td>Model Formulation and Branch-and-Bound</td>
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<td>Nonlinear Programming</td>
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<td>Unconstrained Opt. and KKT, Applications</td>
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<td>Metaheuristics</td>
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<tr>
<td>Genetic algorithm; Simulated annealing; and Tabu Search</td>
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<tr>
<td>Simulation, Risk Analysis, Partial differential equations and Fourier analysis</td>
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<tr>
<td>Course Summary</td>
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<td>Exams</td>
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**Total Lessons** 15
## CENG 5353 102S
(Using new textbook 9th ed. as reference)

<table>
<thead>
<tr>
<th>Lsn</th>
<th>Date (Thursday)</th>
<th>Material Covered</th>
<th>Required Reading Assign. Before Class</th>
<th>Problem Sets Distributed</th>
<th>Due Date</th>
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<tbody>
<tr>
<td>1</td>
<td>20-Jan</td>
<td>Course Syllabus, Introduction &amp; Overview</td>
<td>Ch. 1 &amp; 2</td>
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<td>2</td>
<td>27-Jan</td>
<td>Linear Programming; Linear Programming Examples; Solving LP Models on a Spreadsheet &amp; GAMS/CPLEX</td>
<td>Ch. 3.1 – 3.3; Ch. 3.4 – 3.5; Ch. 3.6</td>
<td>PS#1</td>
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<td></td>
<td>31-Jan</td>
<td><strong>Withdraw without Penalty</strong></td>
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<td><strong>Census Date</strong></td>
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<tr>
<td>3</td>
<td>3-Feb</td>
<td>Setting Up the Simplex Method; Simplex Method in Tabular Form; Postoptimality Analysis and Computer Implementation</td>
<td>Ch. 4.1 – 4.3; Ch. 4.4 – 4.6; Ch. 4.7 – 4.8</td>
<td>PS#2; PS#1</td>
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<td>4</td>
<td>10-Feb</td>
<td>Foundations of Simplex Method; Revised Simplex Method &amp; Fundamental Insights</td>
<td>Ch. 5.1 – 5.4</td>
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<td>5</td>
<td>17-Feb</td>
<td>Duality Theory; Primal-Dual Relationships; Adapting to Other Primal Forms; Sensitivity Analysis; Sensitivity Analysis on a Spreadsheet;</td>
<td>Ch. 6.1 – 6.4; Ch. 6.5 – 6.9</td>
<td>PS#4; PS#3</td>
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<tr>
<td>6</td>
<td>24-Feb</td>
<td>Other Algorithms for Linear Programming (dual simplex); Linear Programming Model Building and Formulation Techniques</td>
<td>Ch. 7</td>
<td>PS#4</td>
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<td>7</td>
<td>3-Mar</td>
<td><strong>In Class Mid-Term Exam</strong></td>
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<td>8</td>
<td>10-Mar</td>
<td><strong>Spring Break</strong></td>
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<td>9</td>
<td>17-Mar</td>
<td>Transportation and Assignment Problems Network Optimization Models; Shortest Path; Maximum Flow Problem</td>
<td>Ch. 8; Ch. 9.1 – 9.5</td>
<td><strong>Final Project</strong></td>
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<tr>
<td>10</td>
<td>24-Mar</td>
<td>Network Optimization Models; Minimum Cost Flow; Network Simplex Method</td>
<td>Ch. 9.6 – 9.9</td>
<td>PS#5; PS#6</td>
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<td>30-Mar</td>
<td><strong>Last date to Withdraw</strong></td>
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<td>11</td>
<td>31-Mar</td>
<td>Dynamic Programming: Deterministic &amp; Probabilistic DP</td>
<td>Ch. 10</td>
<td>PS#7; PS#6</td>
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<td>12</td>
<td>7-Apr</td>
<td>Integer Programming: Model Formulation and Branch-and-Bound</td>
<td>Ch. 11</td>
<td>PS#8; PS#7</td>
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<tr>
<td>13</td>
<td>14-Apr</td>
<td>Nonlinear Programming: Unconstrained Opt. and KKT, Applications</td>
<td>Ch. 12</td>
<td>PS#9; PS#8</td>
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<tr>
<td>14</td>
<td>21-Apr</td>
<td>Metaheuristics: Genetic algorithm; Simulated annealing; and Tabu Search</td>
<td>Ch. 13</td>
<td>PS#9</td>
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<tr>
<td>15</td>
<td>28-Apr</td>
<td>Simulation and Risk Analysis Partial Differential Equations; and Fourier Analysis</td>
<td>Ch. 20</td>
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<td>16</td>
<td>5-May</td>
<td>Final Project Presentations and Final Exam Review</td>
<td>Handouts</td>
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<td><strong>Exam Week</strong></td>
<td>12-May (Thursday)</td>
<td><strong>Comprehensive Final Exam</strong> 5:00 p.m. - 7:00 p.m.</td>
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<td>Final Project</td>
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</table>
Dr. Wei (David) Fan
Position: Assistant Professor
Office Building/Room: RBS 1005 (Ratliff Building South)
Phone: (903) 565-5711
Email: wfan@uttyler.edu
Office Hours: M-F 1-3 PM

Education
The University of Texas at Austin Civil Engineering - Transportation PhD May 2004

Professional Society
Associate Editor, IEEE Transactions on Intelligent Transportation Systems, 2007 – Present
Member, Editorial Board, World Review of Intermodal Transportation Research, 2007 – Present
Member, Editorial Board, International Journal of Revenue Management, 2007 – Present
Member, Technical Committee on Emerging and Innovative Public Transport and Technologies (AP020), Committee on Transportation and Economic Development (ADD10), and Committee on Paratransit (AP060), Transportation Research Board, National Research Council, National Academy of Sciences and National Academy of Engineering, 2007 –
Member, Technical Advisory Panel (TAP) for the Research Management Committee 2 (RMC-2) and Committee 4 (RMC-4) of the Texas Department of Transportation, Austin, Texas

Reviewer:
_Prestigious Journals refereed: (Reviewed more than 40 journal papers in the past two years)_
Transportation Science
Transportation Research Record (TRR), National Research Council, National Academy of Sciences
Transportation Research Part C: Emerging Technologies
ASCE Journal of Transportation Engineering
ASCE Journal of Computing in Civil Engineering
ASCE Journal of Computer-Aided Civil and Infrastructure Engineering
Journal of Public Transportation
Journal of Transport Geography
Journal of the Eastern Asia Society for Transportation Studies
IEEE Transactions - Intelligent Transportation Systems
World Review of Intermodal Transportation Research International Journal of Revenue Management
European Journal of Operational Research

_Conferences refereed: (Reviewed more than 20 manuscripts in the past two years)_
Transportation Research Board (TRB), National Research Council, National Academy of Sciences

Journal Publications, Conference Proceedings, and Presentations (Over 30)

Course Taught Before at UT Tyler
ENGR 2301 Statics  CENG 2336 Geomatics
CENG 2353 Civil Engineering Measurements
ENGR 3301 Probability & Statistics for Engineers
CENG 3351 Transportation Engineering
CENG 4351 Traffic Engineering: Operations and Control (with Lab)
CENG 5353 Operations Research and Advanced Mathematics (Graduate Level)
CENG 5354 Urban Transportation Planning (Graduate Level)
CENG 5355 Transportation Systems Management and Operations (Graduate Level)
CENG 5357 Public Transportation Engineering (Graduate Level)

Personal Information
Wife, Grace  Daughter, Jennifer, Age 6 years  Son, Peter, Age 4 years

Favorite Movie: Forrest Gump What’s Love Got to Do with It?
Favorite Sports & Team: NBA, San Antonio Spurs
Hero: Tim Duncan  Super Hero: Grace
CENG 5353 Operations Research and Advanced Mathematics Course Objectives:

1. Develop an organized quantitative analysis approach to solving problems in engineering systems.

2. Identify the problems, formulate mathematical models and use various existing optimization algorithms to solving the real-world decision making problems.

3. Apply mathematical modeling techniques to perform risk and statistical analysis.

4. Use advanced linear algebra, differential equations and fourier analysis numerical methods to solve engineering problems.

5. Perform computer simulations to compare and contrast different solution alternatives and facilitate the engineering decision making process.

6. Use several commercially available software packages as tools to design, analyze, evaluate, and develop engineering solutions.
Attachment 4

HOMEWORK FORMAT RULES
In doing your homework, you are required to follow the instructions listed below:

- Use a pencil - Do NOT use a pen.
- Completely erase any extraneous material - NO scratched out material should appear on the solutions
- Show all the pertinent details of how you obtained your solution
- Staple your assignment together - Do NOT use paper clips, dog-earing, or other means to assemble your hw.
- Write legibly, in print large enough to be easily read.
- Use 8 ½ by 11 inch engineering paper. Do NOT use paper torn from a spiral binder unless it is perforated and you can neatly remove the ragged edge.
- Use graph paper on problems requiring graphs
- Use straight edges to draw diagrams, schematics, etc.

Each homework problem must follow the structure given below:

- **Given:** Concisely state the problem, including relevant sketches, units, etc.
- **Determine:** State what is the goal of the problem (i.e. what is unknown)
- **Assumptions:** List all assumptions used in solving the problem
- **Solution:** Draw a Free-Body-Diagram and give a step-by-step solution of the problem, including explanatory sentences. Be careful to keep track of units, and Double underline or put a box around your final answer.

Additional features of a GOOD homework

- Each problem should have a neatly drawn figure. If you are not a true artist, you should use a straight edge. Also, the figure should be large enough to be easily read and important variables associated with the problem should be labeled on the figure. A well drawn figure will greatly help you solve the problem and help me understand your solution
- Each solution should be well organized. Labels for parts a), b), c) etc. should be easy to locate and the solution should be placed in the proper section.
- Don’t cram your solutions into a small space. There should be lots of “white space” in your solution. Leave blank lines between steps; this makes it much easier to grade and gives me room to make comments. Also, leave several blank lines between problems so that I can easily see where one problem ends and the next begins.

I would prefer that you start each problem on a new page.

- A homework solution should be capable of being “read” just like a textbook example problem. This means that you include all the pertinent details of the solution as well as text to help the reader follow you analysis. (Include sentences in your solutions not just equations.) Explain what you are doing, tell where you have taken an equation from, etc.
- Any variable used should be described in words or clearly shown on a figure.
- For nearly every problem your approach should be:
  1. While you are writing the given & find think about the problem. Think about what you know and don’t know; think about which fundamental law might relate the quantities; form a strategy!
  2. Start your solution with a very general equation (such as Newton’s law, conservation of energy, conservation of momentum, etc) The equation should be written with symbols only.
  3. Simplify the equation and state why you have made your simplifications. Show all of the details. There should be words in your solution,
  4. Once the equation is simplified, then plug in the numbers. EVERY NUMBER REPRESENTING A PHYSICAL QUANTITY MUST HAVE UNITS WITH IT!!!
  5. Calculate the final answer and determine the final units. (Don’t just slap the final units on)
  6. Ask yourself if the answer makes sense (e.g. you calculated a negative velocity but the object is moving to the right - correct solution: go back and look for your error; wrong solution: slap in a negative sign somewhere and hope the teacher doesn’t notice.)
  7. Only at this point should you check you answer with the book’s answer. If you are off, go back and rethink you analysis. If you can’t find a good reason for you mistake, DO NOT JUST FORCE THINGS TO GET THE CORRECT ANSWER; COME AND SEE ME SO THAT I CAN HELP YOU FIND YOUR MISTAKE!!!! ☺