Solving Engineering Problems

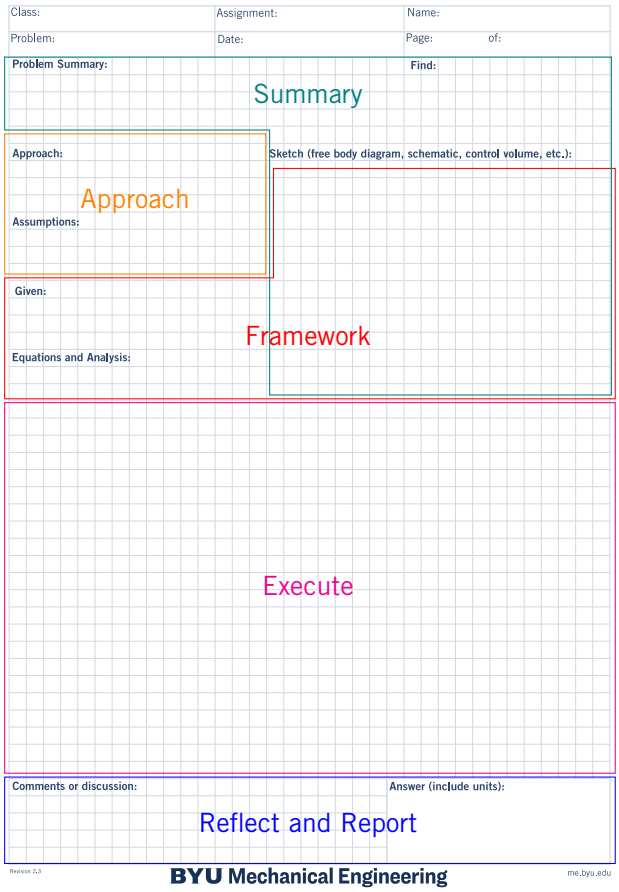
Obtain models with adjustable parameters that can be used to predict what might happen in the real world

The SAFER method for solving engineering problems

The SAFER method is a structured method for solving engineering problems. Following this method helps ensure that the solution is accurate, thorough and complete. The Mechanical Engineering Department at BYU has developed a problem-solving template to help you apply the SAFER method when solving problems. Although you may use scratch paper as you try to find an appropriate solution method for a particular problem, you should always use the SAFER template when reporting your work.

Summary

Begin with a summary of the problem, which should include a brief written statement that clearly identifies the desired answer. You should also include relevant sketches, such as pictorial sketches or schematic sketches that represent the problem.



Approach and assumptions

In some cases, the approach used to solve the problem will be obvious (this is often the case in textbook problems associated with a particular section). If the approach is not obvious, try finding multiple solution approaches, along with the assumptions necessary for each approach. Consider the strengths and weaknesses of each approach, and select the one that best matches the problem.

Framework

State the framework for your solution approach. The framework includes givens (those parameters of the problem that are given in the problem statement), solution diagrams such as free-body diagrams or control volumes, and relevant equations. It is generally wise to use variable names when defining the givens.

Execute

Execute your selected solution approach within the framework. Work methodically, one step at a time. Write down the results of each step, so you can check for errors later. Don't crowd your work — leave plenty of white space. Generally put one equation per line. Where possible, it is best to leave variables in the equations throughout the solution process. When you have solved for the desired variable, you have an engineering model that can be used to explore the effects of various parameters.

To obtain a numerical solution, substitute given values in the equations. When substitutions are made, include the units on all numbers and follow the units through the calculation. Sometimes you will need to use numerical methods to obtain a numerical solution. Be sure to use the variables when you implement the numerical method.

Reflect and Report

Review your work. Does the solution make physical sense? Are the units consistent? Is the order of magnitude correct? How does the solution change if you change given or assumed parameters? If you made assumptions (e.g. laminar flow), does the solution support these assumptions? What limitations, if any, have you identified for the solution? Clearly communicate any concerns or limitations of the solution along with the solution itself.