Introduction As explained in the syllabus, each homework contains both short and long questions. Each short question is graded on a scale of 0 to 2, while each long question is graded on a scale of 0 to 5, with 3 points for *soundness* and 2 points for *presentation*.

In general, you should make sure that your writings are legible to potential readers. It is also a good idea to clearly distinguish your final answers from the rest of your writings. In addition, please note that an appropriate unit is an integral part of any dimensionful numerical answers.

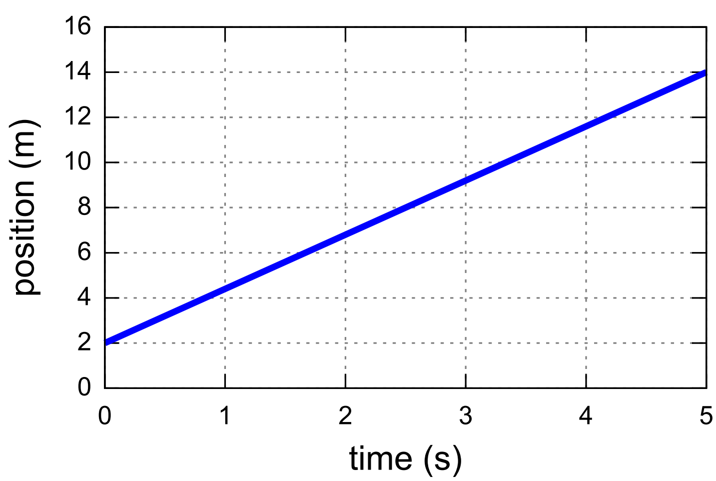
As a general rule, it is to your benefit to write down your work even if you know that it is incomplete or incorrect. In such case, you should describe why you think your solution is flawed, as well as what a complete solution might look like.

Short Questions To score 2 points on a short question, your answer must be correct and you should provide a short explanation and/or outline of your calculations. In particular, a final answer with neither explanations nor outline may receive at most 1 point.

If your answer is incorrect, you will receive 1 point for partial credit *only if* you include enough information for us to judge that you are making meaningful progress. In particular, if your solution consists of the final answer alone, you may not receive any partial credit if your answer turns out to be incorrect.

As an illustration, below is a sample question together with a few sample solutions with varying quality and score.

Sample Short Question. Below is the position-versus-time graph that depict the motion of a cyclist. Based on the graph, find the velocity of the cyclist.



Sample solution # 1.

$$v = \frac{\Delta x}{\Delta t} = \frac{14-2}{5-0} = \underline{\underline{2.4 (m/s)}}$$

The cyclist's velocity is 2.4 m/s

This is an exemplary solution. The solution outline, while short, clearly indicates the key ideas involved, and illustrate how these ideas lead to the numerical answer. In addition, the final numerical answer carries the proper unit and is clearly distinguished from the rest of the writings. This solution earns a full score of 2 points.

Sample solution # 2.

$$\boxed{v = 2.4 \ m/s}$$

This solution contains only a (correct) final answer. Because the answer is correct, it earns a score of 1 point.

Sample solution # 3.

$$v = \frac{\Delta x}{\Delta t} = \frac{14}{5} = \underline{\underline{2.8 \ m/s}}$$

This solution is incorrect but the outline does indicate that the student has a partial understanding of what needs to be done. This solution earns a partial credit of 1 point.

Sample solution # 4.

$$\boxed{v = 2.8 \ m/s}$$

This solution is incorrect and provides no insight into what the student might understand. This solution earns 0 points.

Sample solution # 5.

I know $v = \frac{\Delta x}{\Delta t}$, but I have no idea how to find Δx or Δt from the graph....

This solution is incomplete but the student has made an effort to communicate what he/she understands. Since the student has illustrated a partial understanding of what needs to be done, this solution earns a partial credit of 1 point.

Long Questions

The long questions are meant to be opportunities for you to develop your communication and systematic problem solving skills. Consequently, an explicit emphasis is placed in the grading of long questions for properly applying these skills. In particular, your solution is graded partially on whether it flows logically and follows the general problem-solving strategy.

In general, the solution process should start with a visualization of the situation, which often literally means a sketch of the situation. Moreover, you should collect the physical quantities that are relevant to the situation, including both quantities that are given and those you are interested to find. Occasionally, you will need to make reasonable assumptions in order to model the situation.

Once you have a clear understanding of the situation you should make a plan to solve for what you want to find, and proceed to execute your plan in a logical order. Ideally, once you obtain your final answer you should go back and check if it make sense.

With this in mind, each long question is graded on both soundness and presentation, wherein the **presentation scale** is concerned with whether your solution flows logically and demonstrates a systematic solution process, and whether you communicate the physics clearly. It works as follows:

- **2 points.** The situation is visualized before any quantities are being solved (in the rare case where there is no natural picture to draw, collect all the relevant physical quantities). The ensuing solution demonstrates a sense of planning and/or proceeds logically. All physical quantities are unambiguous, and all equations are preceded by proper context.
- **1 points.** The situation is visualized and the solution demonstrates a general sense of logical progression, but contains occasional gaps, ambiguity, and/or misplacement of information.

- **0 points.** No visualization, no discernible plans towards solutions, and/or almost no elaboration on the symbols and equations used.

In comparison, the **soundness scale** is concerned with the logical and mathematical accuracy of the solution, and it works as follows:

- **3 points.** Correct reasoning and approach, as well as accurate answer(s) that include the proper unit(s).
- **2 points.** Minor flaw(s) in otherwise substantively correct reasoning and approach, and/or inaccurate answer(s).
- **1 point.** Progress towards a proper approach, possibly including insights on the shortcomings of the current solution and/or what the proper approach might look like.
- **0 point.** No substantive progress towards solutions.

A sample question together with a few sample solutions with varying quality and score can be found below to illustrate the grading scheme.

Multi-part problems. The general rule for a multi-part problem is that you should still follow the same problem-solving framework, but you do *not* have to redo what you have done. For example, if part (a) and (b) of the problem refers to the same situation, you can simply draw one picture to visualize both parts at the beginning.

Sometimes the parts of a problem serve to break down the solution process into smaller steps for you. If that's the case the intent should be clear from the way the parts are structured, and you just need to do what you are asked for in each part.

Hints and guidelines to long questions. Since the style and format of the long questions may be unfamiliar to you, the first few homework will include a section of hints and guidelines to help you approach these problems and to clarify what a decent solution should look like. However, you are encouraged to first work on the questions without consulting this section, and use its information only when you are stuck and/or as a way to check your work.

Also, please be aware that the hints and guidelines is not meant to replace the help sessions and/or the office hours. You are still strongly encouraged to make use of these resources if you encounter any difficulties, and to collaborate with your fellow students when working on the homework.

Sample Question. As you head to college you cleaned your room. You later realized that you have left your precious toys in the dump. The garbage truck had left an hour ago. You want to see if you can catch the truck before it reaches the landfill. To be safe you don't want to drive above 60 mph. You estimate that the landfill is 150 miles away and you approximate the speed of the truck to be 40 mph. Can you make it?

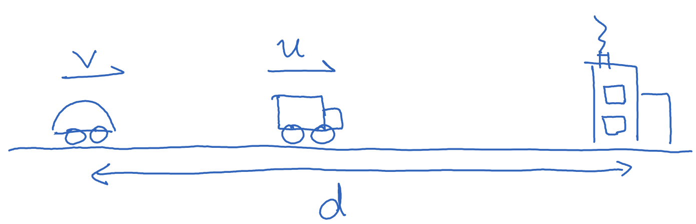
Sample solution # 1.

$$\frac{150}{60} + 1.0 - \frac{150}{40} = -0.25 < 0$$

So you will make it.

This solution correctly solves the problem posted but does not elaborate on how the criterion comes about. This solution earns 3 points for soundness and 0 point for presentation.

Sample solution # 2.



$$\Delta t_1 = \frac{d}{u} = \frac{150}{40} = 3.75 \text{ (hrs)}$$

$$\Delta t_2 = \frac{d}{v} + \Delta t_0 = \frac{150}{60} + 1.0 = 3.5 \text{ (hrs)}$$

$$\because \Delta t_2 < \Delta t_1 \Rightarrow \text{You can make it.}$$

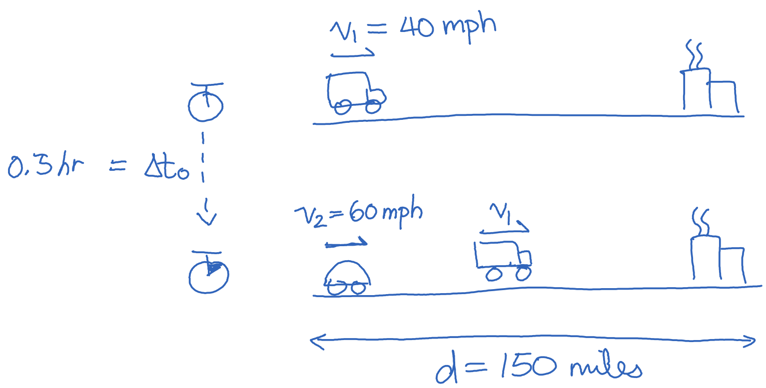
This solution correctly solves the problem. It also progresses logically and attempts to first visualize the situation. However, the presentation is flawed for two separate reasons:

- The meaning of the quantities Δt_1 and Δt_2 cannot be easily inferred from the presentation.
- The context that makes the equations for Δt_1 and Δt_2 applicable is not clearly stated.

As a result, this solution earns 3 points for soundness and 1 point for presentation.

Note: this solution would earn only 1 point for presentation as long as *any* of the two flaws above are present.

Sample solution # 3.



Both car and truck undergoes uniform motion.

Thus, time it takes for truck to reach landfill is:

$$\Delta t_1 = \frac{d}{v_1} = \frac{150}{40} = 3.75 \text{ (hrs)}$$

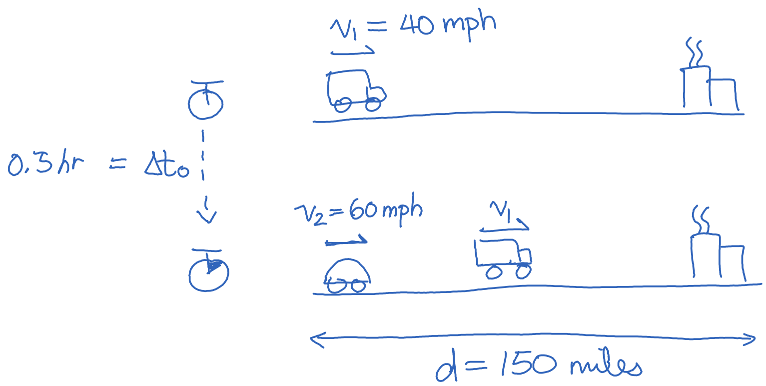
While the time it takes for car to reach landfill (measured from truck's departure) is:

$$\Delta t_2 = \Delta t_0 + \frac{d}{v_2} = 1.0 + \frac{150}{60} = 3.5 \text{ (hrs)}$$

Since $\Delta t_2 < \Delta t_1$, you will make it in time

This is an exemplary solution. It first visualizes the situation and labels all important quantities, then it proceeds to solve the problem in logical steps, with all important equations justified by the situation. Moreover the final answer is correct and clearly distinguished from the rest of the writing. This solution earns 3 points for soundness and 2 points for presentation.

Sample solution # 4.



Both car and truck undergoes uniform motion.

The time it takes for truck to reach landfill:

$$\Delta t_1 = \frac{d}{V_1} = \frac{150}{40} = 3.75 \text{ (hrs)}$$

The time it takes for car to reach landfill:

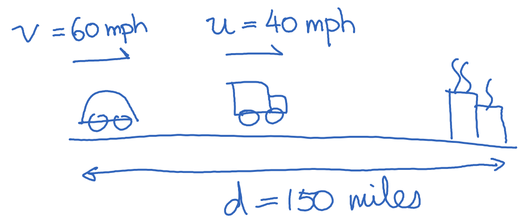
$$\Delta t_2 = \frac{d}{V_2} = \frac{150}{60} = 2.5 \text{ (hrs)}$$

Since $\Delta t_2 < \Delta t_1$, <u>you will make it</u> in time

This solution is similar to sample solution # 3 except that one equation somehow manages to miss the important Δt_0 term. This solution earns 2 points for soundness and 2 points for presentation.

Note: this solution would have earned the same 4 points even if the calculation produces a wrong conclusion.

Sample solution # 5.



Both car and truck are in uniform motion

$$\Longrightarrow \Delta x = v\,\Delta t$$

Not sure how to proceed from this...

I suppose you'll make/miss it by matters of hours?

This solution does not arrive at an conclusion, correct or not. It is however making progress, since it identifies the situation as being uniform motion for both the car and the truck. It also provides an estimate on the order of magnitude of the expected results. This solution earns 1 point for soundness and 1 point for presentation.