

SOLVING PHYSICS PROBLEMS

A Step By Step Guide

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Welcome to *Solving Physics Problems: A Step By Step Guide*. This is the only guide you'll need to go from being a second-class physics citizen to a brilliant, world renown physicist in no time. Simply follow the steps listed below, and with hardly any effort at all, you'll immediately begin cranking out two-line proofs to those theorems your colleagues have been struggling to prove for years. Suddenly you won't be the one serving the coffee anymore.

STEP 1: RECOGNIZE THE PROBLEM

When you first read a problem, you must understand what it is that actually needs solving. Many times a problem will present a multitude of complicated symbols and meaningless jargon in an attempt to confuse you. Believe me, this is all for show. You rarely need to use even one tenth of the information presented to you. The real problem is typically hidden between the lines. The first key to solving physics problems, then, is to learn to decode the incoherent ramblings of the text and get right to the point. Take this example:

Problem A	
Given	It is obvious even to the casual reader that: $\left \langle A\Omega, e^{-tH}(I - E_2)A\Omega \rangle \right \leq B e^{-2Ct}$ Express this equation in its minimal form.
Actual	Write down whatever you want, because I have no idea what I'm talking about.

As you can see, a little bit of reading between the lines reveals that the author of this problem really knows nothing about physics whatsoever. Therefore, it is safe to assume that he simply

wants you to write whatever looks good, because he still gets paid either way. Don't be fooled by the fancy greek; this problem is a no-brainer.

STEP 2: WRITE DOWN THE ANSWER

As you learned in Step 1, often times physics problems are simpler than they appear. It is clear, then, that you really don't need to know very much in order to solve them. In fact, any problem can be solved by appealing to physical intuition. Hence, the answer should pop into your head immediately. When it does, simply write it down. Here is an illustration of this technique:

Problem B	
Given	Simplify this expression: $ \langle \Omega, \mathcal{O}(x)\mathcal{O}(y)\Omega \rangle \leq \exp(-C x - y)$
Actual	Write down an equation that uses different Greek letters.
Solution	$\beta(w) = \frac{\sqrt{2\pi}}{4} \log \left \frac{P(w) - \lambda^2}{P(w) + \lambda^2} \right $

The solution is presented here as it would appear written on a blackboard with white chalk. This is, incidentally, how I recommend writing down all of your initial answers. It will impress your colleagues and amaze your students.

STEP 3: PUBLISH YOUR RESULTS

Everyone knows that solving a physics problem is not worthwhile unless glory and fame come as a result of the solution. The easiest way to achieve this is to publish your answers. Do so

in a manner that highlights your superiority over the subject matter and reduces the chances that someone will challenge your work. There are numerous ways to accomplish this, but my personal favorite is to take large chunks out of the solution and leave it to the reader to decipher the missing steps. This method is demonstrated below:

Problem C	
Proposition	<p>Let C be a smooth locally convex planar curve parameterized by a nondegenerate parameter t. Let $l(t)$ be the tangent line to C at $C(t)$. Let m be a line not intersecting C. Let $P(t)$ be the point of intersection of $l(t)$ and m. Then $dP/dt \neq 0$ for all values of t^*.</p>
Actual Solution	<p>By a translation and rotation we can take m to be the y-axis. If $(x(t), y(t))$ parameterize C, then the line $l(t)$ is given by $\{x(t), y(t)\} + \lambda(x'(t), y'(t)) : \lambda \in \mathbb{R}\}$. It follows that the point of intersection of $l(t)$ with m occurs at the point $P(t) = (0, p(t))$ where $p = -(x(t)y'(t) - y(t)x'(t)) / x(t)$. A routine differentiation combined with the definition of the curvature κ yields that $dp/dt = v^3x/x^2\kappa$. It follows that $dp/dt \neq 0$ everywhere except at the excluded instants. QED.</p>
Published Solution	<p>The proof follows clearly from the proposition. The details are left to the reader. QED.</p>

Note the use of "QED" in the proof. Strictly speaking this is not necessary, but it enhances the image of your solution and is therefore recommended.

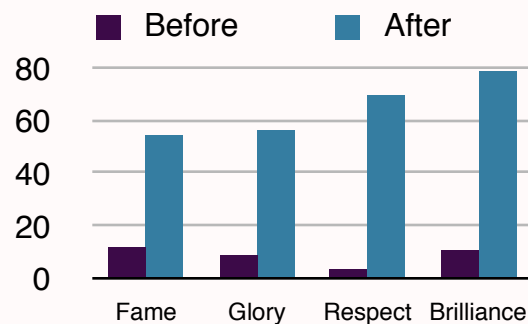
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We've covered a lot here, so let's quickly summarize the steps required to excel at solving physics problems quickly and efficiently.

Summary

- Recognize the Problem**
The problem is simpler than it appears. Don't be sidetracked by extraneous information.
- Write Down the Answer**
The answer should come to you quickly. Put it on the chalkboard when it does.
- Publish Your Results**
Get that answer out for the public to see. You deserve fame and glory for your work.

As you can see, solving physics problems is not nearly as difficult as it is made out to be. Follow the steps listed above, and you will become the envy of the physics world. Below is a simple chart showing the benefits* of using this plan:



Up until now you may have been skeptical; but from looking at the graph, it is clear that this plan has merit. Fame, glory, respect, and brilliance can all be yours in just three simple steps. So the next time you are required to prove a confusing theorem or solve a complex equation, remember that it is not as impossible as it seems. In fact, it is quite trivial.

*Results may vary