Solution Tips

Your assignments will be graded by CAPA. However, each week, you will also have to copy one CAPA solution on a quiz. You will only have five minutes to do this, so you'll need to make sure that everything is in a readable format before you come to class each Thursday. Here are some guidelines to writing good homework solutions. Partial credit on quizzes will be based on following these steps. An example is provided on the reverse side.

1) Draw a *large* **diagram** when necessary.
2) Indicate your **coordinate system** both in words and on your sketch.
3) **List** all relevant quantities with respect to your coordinate system.
4) Indicate which **equation(s)** you will use.
5) Work **symbolically**. Examples of symbols include: m, g, π, v_0, 0, 1, and ½. Note that every symbol stands for a *sign*, a *number*, and its *units*. For example, g = +9.8 m/s^2. So, if you discover that $a = 2g$, then writing $a = (2g \text{ m/s}^2)$ is not just bad, it is **wrong**, because it really says $a = 19.6 \text{ m}^2/\text{s}^4$. You can't include the units twice!

   Good symbolic answers: $a_1 = \dfrac{g(m_1 + m_2)}{m_1}$

   $\mu_{\max} = \dfrac{\pi}{4}$

6) It is smart to use subscripts when there is more than one similar item in a problem. For example, a_1 refers to the acceleration of mass 1, and x_2 refers to the position of mass 2, etc. Subscripts can also refer to different moments in time. You can also use letters as subscripts for different objects: x_A, x_B, and x_C.
7) You don't need to show all of your algebra… just the first step or two, and the last step or two.
8) Check that your answers have sensible **units**. For example, if m = 10kg, then it is logically impossible for your answer to algebraically include $(m + 1)$ anywhere, since "1" doesn't have units of mass, and therefore can't be added to a mass.
9) **Box** the final answer.

Example of a good problem solution

4. A bolt comes loose from the bottom of an elevator that is moving upward at a speed $v_0 = 5$ m/s. The bolt reaches the bottom of the elevator shaft in time $t = 3$s. How high up H was the elevator when the bolt came loose?

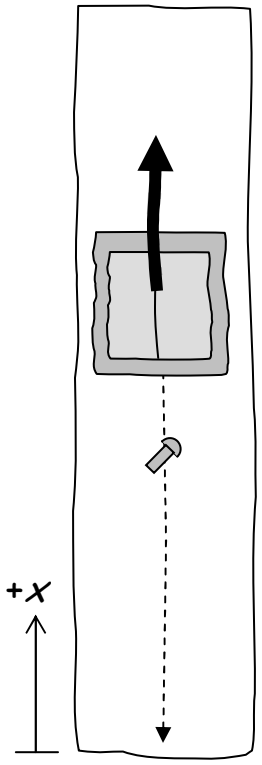
Solution:

Coordinate system: $+x$ is upwards from the bottom of the shaft (as shown in my sketch).

Variables Used: In this coordinate system, we have:

$x_0 = H =$?	(our eventual answer)
$x = 0$	(the bolt stops at the bottom of the shaft)
$v_0 = 5$ m/s	(starting velocity is known)
$v =$?	(the ending velocity is still unknown)
$a = -g = -9.8$ m/s^2	(acceleration for free fall)
$t = 3$ s	(ending time is given)

My Sketch



Fundamental Equation:

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2 \qquad [\textit{equation 2.8}]$$

Substitution from variable list:

$$0 = H + v_0 t + \tfrac{1}{2}(-g) t^2$$

After algebra:

$$\boxed{H = \tfrac{1}{2} g t^2 - v_0 t} \quad \leftarrow \textit{my final answer!}$$

Units Check:

$$H = (none)\left(\frac{m}{s^2}\right)(s^2) \; and \; \left(\frac{m}{s}\right)(s) = m \; and \; m = m \;\checkmark$$

Numeric Substitution:

$$H = (0.5)(9.8 \text{ m/s}^2)(3 \text{ s})^2 - (5 \text{ m/s})(3 \text{ s}) = 29.1 \text{ m}$$

$$\rightarrow \quad \boxed{H = 29.1 \text{ m}}$$