PHYSICS 105a-2008  CLASS 2  FRIDAY 9-5-08 SUMMARY

Constant acceleration
\[
\begin{align*}
s &= x_f - x_0 \\
v &= \frac{dx}{dt} \\
a &= \frac{dv}{dt}
\end{align*}
\]
\[
\begin{align*}
v &= v_0 + at \\
s &= v_0 t + \frac{1}{2} at^2 \\
v^2 &= v_0^2 + 2as
\end{align*}
\]

Acceleration of gravity

* Most common example of constant acceleration
  (if air resistance is negligible)

* Acceleration \( g \) (= 9.8 m/s² on Earth)
  is independent of mass!

Video of hammer
& feather drop on the moon

A quantitive example

A pilot jumps out of a burning plane without a parachute. She reaches a speed of 120 km/h prior to impact. She falls onto a loose stack of hay. Assuming uniform deceleration to the bottom of the haystack, and that she can survive a 35g deceleration, how high must the haystack be for her to barely survive?

1. Draw a picture that complete captures the problem, inc. the desired unknown:
   \[ h = ? \]
   \[ v_0 = -120 \text{ km/h} \]
   \[ a = 35g \]

2. Re-read the problem to make sure your picture captures all the essential elements.

3. Identify the key concepts: constant acceleration

4. Write them in equation form:
   \[ v = v_0 + at \]
   \[ s = v_0 t + \frac{1}{2} at^2 \]
   \[ v^2 = v_0^2 + 2as \]

5. Do the math using symbols to get the final answer — no numbers yet!
   \[ v^2 = v_0^2 + 2as, \quad v = 0 \]
   \[ \rightarrow s = \frac{-v_0^2}{2a} \]