Free Fall

A great example of constant acceleration is GRAVITY! an object that is in free fall will accelerate at \(-9.8 \text{ m/s}^2\). notice that there is a negative sign this means that gravity's acceleration will act DOWN. Memorize this value.

Example:
a ball is dropped from a building. how far will it travel in 3 seconds?

Given
\[ V_t = 0 \]
\[ t = 3 \text{ s} \]
\[ a = -9.8 \text{ m/s}^2 \]

Looking For
\[ \Delta y \]

\[ \Delta y = v_t t + \frac{1}{2} a t^2 \]
\[ \Delta y = 0 \cdot t + \frac{1}{2} (-9.8) (3)^2 \]
\[ \Delta y = -44.1 \text{ m} \]

we receive a negative displacement because that is what happened. it went down!
Let's document a ball thrown up...

\[ t = 3 \text{ s} \]
\[ v = 0 \text{ m/s} \]
\[ \Delta x = 45 \text{ m} \]
\[ a = -10 \text{ m/s}^2 \]

\[ t = 2 \text{ s} \]
\[ v = 10 \text{ m/s} \]
\[ \Delta x = 40 \text{ m} \]
\[ a = -10 \text{ m/s}^2 \]

\[ t = 1 \text{ s} \]
\[ v = 20 \text{ m/s} \uparrow \]
\[ \Delta x = 25 \text{ m} \]
\[ a = -10 \text{ m/s}^2 \]

\[ t = 0.5 \text{ s} \]
\[ v_i = 30 \text{ m/s} \uparrow \]
\[ \Delta x = 0 \text{ m} \]
\[ a = -10 \text{ m/s}^2 \]

\[ t = 6 \text{ s} \]
\[ v = -30 \text{ m/s} \]
\[ \Delta x = 0 \text{ m} \]
\[ a = -10 \text{ m/s}^2 \]

**Rule of thumb:**
if you have a calculator, use \(-9.8 \text{ m/s}^2\)
otherwise use \(-10 \text{ m/s}^2\)