Vertical Motion
height off the ground
vs.
time elapsed



Vertical Motion Equation: $h(t)=-16 t^{2}+v_{0} t+h_{0}$ where $h(t)$ is the height of the object at any time, $t$
$v_{0}$ is the initial vertical velocity
$h_{0}$ is the initial vertical height

VS

height Vs. distance


Do I need to memorize this: Yes

A ball is hit into the air from an initial height of 3 ft with an initial vertical velocity of $40 \mathrm{ft} / \mathrm{s}$.
a. When does it reach its highest point? $\quad \downarrow \quad h(t)=-16 t^{2}+40 t+3$
$x$-value of the vertex (time)

$$
x=\frac{-b}{2 a}=\frac{-40}{2(-16)}=\frac{-40}{-32}=1.25 \text { seconds }
$$

b. How high does it go?


$$
\begin{aligned}
& \text { c. When does it hit the ground? } \\
& \text { * when is the } \\
& -16 t^{2}+40 t+3=0 \\
& \text { height }=0 \text { ? } \\
& \begin{aligned}
x=\frac{-40 \pm \sqrt{1792}}{2(-16)}, \frac{-40+\sqrt{1792}}{-32} & =-.073 \mathrm{sec} \\
\frac{-40-\sqrt{1792}}{-32} & =2.573 \mathrm{sec}
\end{aligned}
\end{aligned}
$$

