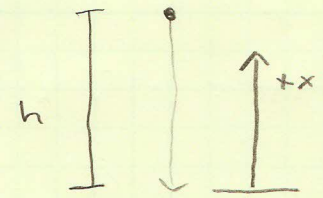
① 


choosing zero of coordinate system at bottom of fall
choosing positive x direction up.

$x_i = h$
$x_f = 0$
$v_i = 0$
$v_f = v$ (unknown)
$a = -g$
$t_i = 0$
$t_f = t$ (unknown)

$v_f^2 = v_i^2 + 2a(x_f - x_i)$

$v^2 = 0 + 2(-g)(-h)$

$v^2 = 2gh$

$v = -\sqrt{2gh}$ ← choose negative square root because of coordinate system choice.

speed $= \sqrt{2gh}$ ← useful to remember

② simply the reverse of the above problem.

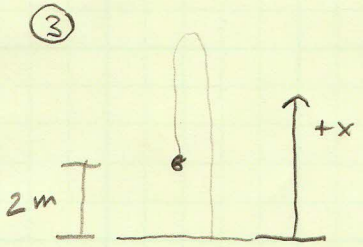
$x_i = 0$
$x_f = h$ (unknown)
$v_i = v_0$
$v_f = 0$ (at rest)
$a = -g$
$t_i = 0$
$t_f = t$

$v_f^2 = v_i^2 + 2a(x_f - x_i)$

$0 = v_0^2 + 2(-g)(h - 0)$

$2gh = v_0^2 \Rightarrow h = \frac{v_0^2}{2g}$

also useful to know.

③ 


throw up, how long until it comes down
choose zero of C.S. at bottom
choose +x up
$t_i = 0$ ← point of launch
$t_f = t$ ← time it hits ground.

$x_i = 1.5$
$x_f = 0$
$v_i = 19$
$v_f =$
$a = -g$
$t_i = 0$
$t_f = t$

$\Delta t = t$

$x_f = x_i + v_i t + \frac{1}{2}at^2$

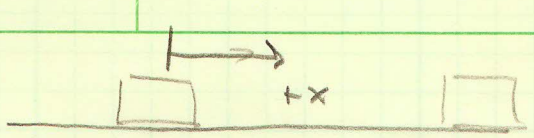
$0 = 1.5 + 19t - 4.9t^2$

$t = \frac{-19 \pm \sqrt{19^2 - (4)(-4.9)(1.5)}}{-9.8} = \frac{-19 \pm 19.759}{-9.8}$

must choose neg. square root for $t \geq 0$

$t = \frac{-38.759}{-9.8} = 3.95$ sec

(4)



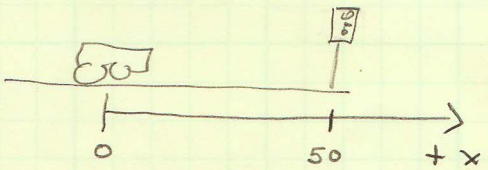

$v_i = 3.2$ m/s
$v_f = 0$
$a = -0.6$ m/s² (slowing down)

$t_i = 0$
$t_f = t$
$\Delta t = t$

$v_f = v_i + a\Delta t$

$0 = 3.2 + (-.6)(t)$ $\quad t = \frac{3.2}{.6} = 5.33$ sec

(5)




$x_i = 0$
$x_f = 50$
$v_i = 20$
$v_f = v$
$a = 5$
$t_i = 0$
$t_f = t$

$\Delta t = t$

$v_f^2 = v_i^2 + 2a\Delta x$

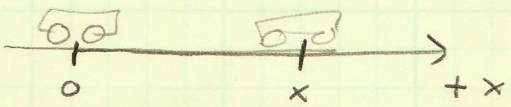
$v_f^2 = 20^2 + (2)(5)(50) = 900$

$v_f = 30$ m/s $\quad$ choose + square root

$v_f = v_i + at$

$30 = 20 + 5t \rightarrow t = 2$ sec

(6)




$x_i = 0$
$x_f = x$ (unknown)
$v_i = 30$
$v_f = v$ (unknown)
$a = -20$ (given c.s.)
$t_i = 0$
$t_f = 1.3$

$\Delta t = t_f - t_i$

$x_f = x_i + v_i\Delta t + \frac{1}{2}a\Delta t^2$

$x = 0 + (30)(1.3) + \frac{1}{2}(-20)(1.3)^2$

$= 39 - 16.9 = 22.1$ m

$v_f = v_i + a\Delta t$

$v = 30 + (-20)(1.3)$

$= 30 - 26 = 4$ m/s