

BASEBALL
PITCHING
MACHINE, A
• BALLS = v_0

BATTER, B
• HITS AT

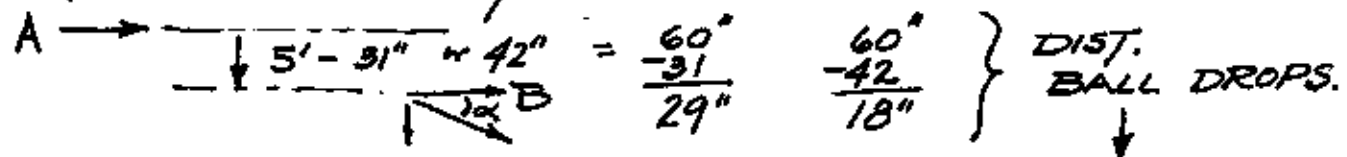
$31'' \leq h \leq 42''$

? range of v_0

? α for $h = 31''$ and $42''$

WATCH
UNITS! *

MOTION OF BALL from A to B.



HOR. $x = x_0 + v_{0x}t + \frac{1}{2}at^2 = v_{0x}t$
 VERT. $y = y_0 + v_{0y}t + \frac{1}{2}at^2 = -\frac{1}{2}gt^2$

Use pt. A as the ORIGIN.
 ASSUME UNIFORM MOTION.

for $h = 31''$
 $y = -29'' = -\frac{1}{2}(386 \frac{''}{s^2})t^2$
 $t = 0.3876 \text{ sec.}$

for $h = 42''$
 $y = -18'' = -\frac{1}{2}(386 \frac{''}{s^2})t^2$
 $t = 0.3054 \text{ sec.}$

SUB. for t in HORIZ. EQ.
 WHEN $x = 40'$

$+40' = v_0(0.3876 \text{ sec.})$

$+40' = v_0(0.3054 \text{ sec.})$

$v_{0x} = 103.199 \frac{\text{ft.}}{\text{sec.}} \approx 103.2 \frac{\text{ft.}}{\text{sec.}}$

$v_{0x} = 130.979 \frac{\text{ft.}}{\text{sec.}} \approx 131 \frac{\text{ft.}}{\text{sec.}}$

$\times \frac{60 \text{ mph}}{88 \frac{\text{ft.}}{\text{sec.}}} = 70.36 \frac{\text{mi.}}{\text{hr.}}$

$\times \frac{60 \text{ mph}}{88 \frac{\text{ft.}}{\text{sec.}}} = 89.3 \frac{\text{mi.}}{\text{hr.}}$

$v_y = -(32.2 \frac{''}{s^2})(0.3054 \text{ sec.}) = 9.834 \frac{''}{s}$

NEED VERT. COMPONENT
 $v_y = v_{0y} + at = -gt = -(32.2 \frac{''}{s^2})(0.3876)$
 $v_y = -12.48 \frac{\text{ft.}}{\text{sec.}}$

$\alpha = \tan^{-1} \frac{12.48 \frac{\text{ft.}}{\text{sec.}}}{103.2 \frac{\text{ft.}}{\text{sec.}}} = 6.895^\circ \sim 7^\circ$ for $h = 31''$

$\alpha = \tan^{-1} \frac{9.834 \frac{\text{ft.}}{\text{sec.}}}{131 \frac{\text{ft.}}{\text{sec.}}} = 4.294^\circ \sim 4.3^\circ$ for $h = 42''$