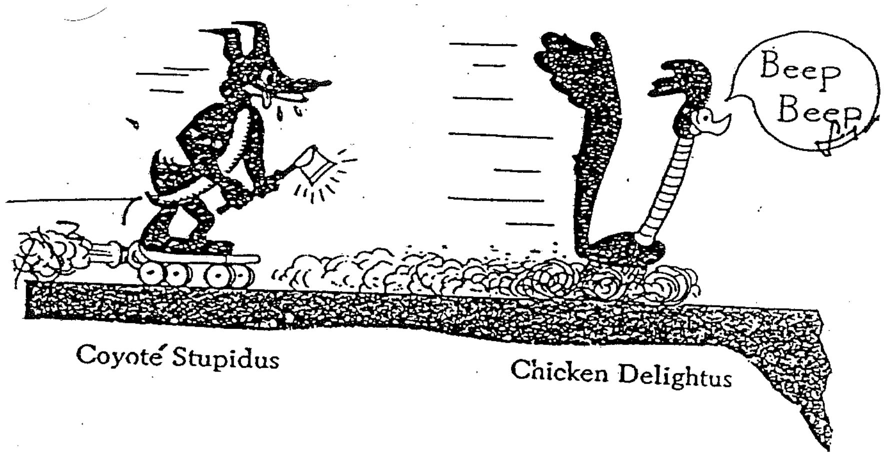
Coyote and Road Runner

The determined coyote is out to capture the elusive road runner. The coyote wears a pair of Acme jet powered roller skates, which provide a constant horizontal acceleration of 15.0 m/s^2. The coyote starts from rest 70.0 m from the edge of a cliff at the instant the road runner zips by in the direction of the cliff.

(a) If the road runner moves with a constant speed, determine the minimum speed he must have in order to reach the cliff before the coyote.

(b) If the cliff is 100m above the base of a canyon, determine where the coyote lands in the canyon (assume the skates are still in operation when he is in "flight")

(c) Determine the coyote's velocity components just before he lands in the canyon. (as usual, the road runner is saved by making a sudden turn at the cliff.)



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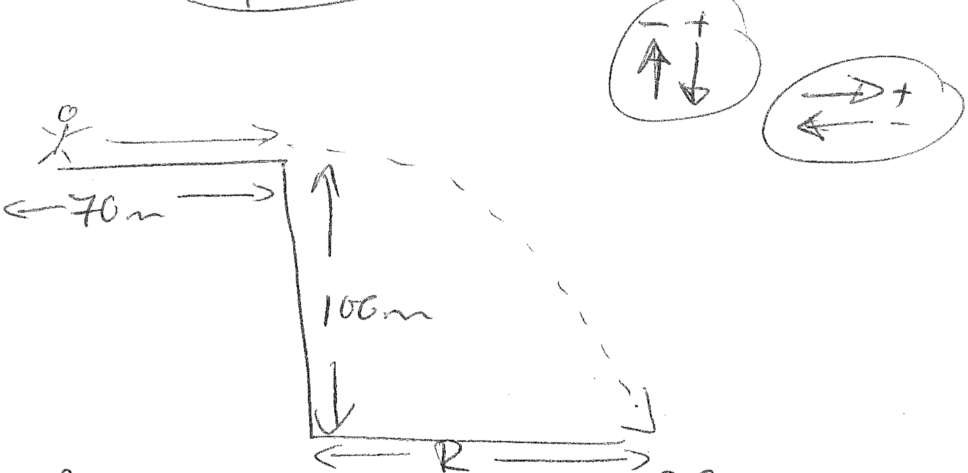

(a) <u>coyote</u>

$V_i = 0.0 m/s$
$a = 15 m/s^2$
$d_x = 70m$
$t = ?$

$\Delta d = \frac{1}{2}at^2 + \cancel{V_i t}$ (0)

$\therefore t = \sqrt{\frac{2(70)}{15}}$

<u>RR</u>

$d_x = 70m$
$t = ?$
$V_{RR} = \frac{d_x}{t}$

$V_{RR} = \frac{70m}{\sqrt{\frac{2(70)}{15}}}$

$\boxed{V_{RR} = 22.9 m/s}$

(b) ~~x~~ y// $V_{oy} = 0 m/s$
$\Delta d_y = 100m$
$a_y = 9.8 m/s^2$
$t = ?$

$\Delta d_y = \frac{1}{2}a_y t^2 + \cancel{V_{oy} t}$ (0)

$t = \sqrt{\frac{2\Delta d_y}{a_y}} = \sqrt{\frac{2(100)}{9.8}} \approx$
$= 4.517s$

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x (<u>whole</u> trip for coyote)

$V_{ox} = 0.0 m/s$
$\Delta d_x = 70m + R$
$a_x = 15 m/s^2$
$t = \sqrt{\frac{2(70)}{15}} + \sqrt{\frac{2(100)}{9.8}}$ ..
$= 7.573s$

$\Delta d_x = \frac{1}{2}a_x t^2 + \cancel{V_{ox} t}$ (0)
$70m + R = \frac{1}{2}(15)(7.573)^2$
$\therefore \boxed{R = 360m}$

(c) $V_{xf} = a_x t + V_{ox}$
$= (15)(7.573) = 113.6 m/s$

$V_{fy} = a_y t + V_{oy} = (9.8)(4.517s)$
$V_{fy} = 44.27 m/s$

$\boxed{V_{fx} = 1.1 \times 10^2 m/s}$

$\boxed{V_{fy} = 44 m/s}$