

P 122 Ground to Ground (Symmetrical) Projectiles

Ex Football

A quarterback throws a pass downfield. The ball leaves his hand at 20.0 m/s at an angle of 37.0 degrees with the horizontal. (Ignore height of quarterback for this example.) FIND a) Time in air, b) Maximum height, c) Range downfield.

$V_x = 20 \cos 37 = 16 \text{ m/s}$
 $V_y = 20 \sin 37 = 12 \text{ m/s}$
 $V_y = 0$
 $g = 9.81$

$d_x = V_x t$
 $= (16 \text{ m/s})(2.44 \text{ s})$
 $= 39.04 \text{ m (Range)}$

$V_f = 0$
 $V_i = 12 \text{ m/s}$
 $t = \frac{V_f - V_i}{a}$
 $= \frac{0 - (12)}{-9.81}$
 $t = 1.22 \text{ s}$

$d = V_i t + \frac{1}{2} a t^2$
 $= (12)(1.22) + \frac{1}{2}(-9.81)(1.22)^2$
 $= 14.64 + (-7.03)$
 $d = 7.31 \text{ m height}$

$t_{\text{total}} = 2.44 \text{ s}$

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