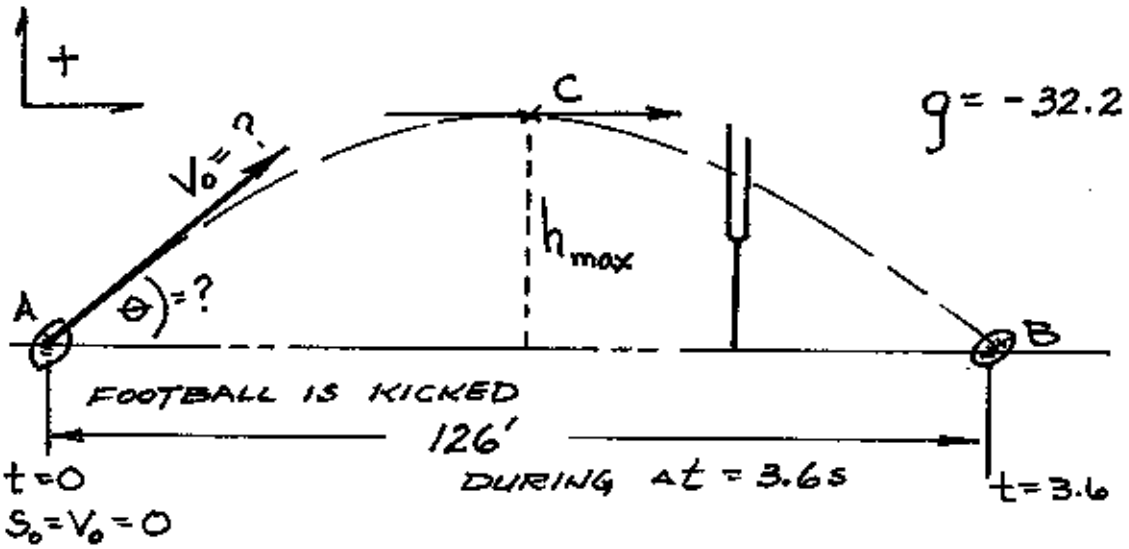
HIBBELER

12-85



G. MILLAND

HORIZONTAL

$$X_B = X_0 + V_{0x} t + \tfrac{1}{2} a_x t^2$$

$$126' = 0 + V_0 \cos\theta (3.6s)$$

$$\boxed{35 \tfrac{ft}{s} = V_0 \cos\theta = V_{0x}} \text{ and}$$

$$V_{Bx} = V_{0x} + a_x t$$

$$\boxed{V_{Bx} = V_0 \cos\theta = 35 \tfrac{ft}{s}}$$

VERTICAL

$$Y_B = Y_0 + V_{0y} t + \tfrac{1}{2} a_y t^2$$

$$0 = 0 + V_0 \sin\theta (3.6) - \frac{32.2}{2} (3.6)^2$$

$$\boxed{57.96 \tfrac{ft}{s} = V_0 \sin\theta = V_{0y}}$$

$$\therefore \frac{V_0 \sin\theta}{V_0 \cos\theta} = \frac{57.96}{35} = \tan\theta$$

$$\boxed{\theta = 58.87^\circ}$$

You can back substitute

$$\frac{35}{\cos(58.87^\circ)} = \boxed{V_0 = 67.71 \tfrac{ft}{s}}$$

... or you could have used the X + y components

$$V_0 = \sqrt{(35)^2 + (57.96)^2} = 67.71 \tfrac{ft}{s} \checkmark$$

and $\theta = \tan^{-1}\left[\frac{V_y}{V_x}\right] = \tan^{-1}\left[\frac{57.96}{35}\right] = 58.87^\circ \checkmark$

MAX. HT. OCCURS WHEN $V_y = 0 = V_{0y} + a_y t$

$$-57.96 = -32.2\, t$$

$$\boxed{t = 1.8s}$$

or half the time

$$\therefore Y_c = Y_0 + V_{0y} t + \tfrac{1}{2} a_y t^2$$

$$= 57.96 (1.8s) - 16.1 (1.8s)^2$$

$$\boxed{Y_{max} = 52.16 \text{ ft}}$$