Question 15952

From one side, one knows that

$$v_x = v_0 \cos\varphi, \, S_x = v_0 \cos\varphi \, T \quad (1)$$

For vertical motion,

$$S_y = v_0 t \sin\varphi - \frac{g t^2}{2} \quad (2)$$

The ball reaches the maximum altitude, when $\dfrac{d S_y}{dt} = 0, \Rightarrow t_{1/2} = \dfrac{v_0 \sin\varphi}{g}$ - this gives the half of the time of the flight, so the full time of the flight is

$$T = \frac{2 v_0 \sin\varphi}{g} \quad (3)$$

Hence, $\quad S_x = \dfrac{2 v_0^2 \cos\varphi \sin\varphi}{g} \approx 194.36 \, m$.