

74. (a) The tangent of the angle ϕ is found from the ratio of y to x coordinates of the highest point (taking the coordinate origin to be at the launch point). Using the same notation as in problem 73, we have

$$\phi = \tan^{-1} \left(\frac{H}{\frac{1}{2}R} \right) \tan^{-1} \left(2\frac{H}{R} \right) .$$

Substituting $H/R = \frac{1}{4} \tan \theta_0$ from problem 73, we obtain the relation

$$\tan^{-1} \left(\frac{1}{2} \tan \theta_0 \right) .$$

- (b) Since $\tan 45^\circ = 1$, then $\phi = \tan^{-1} \left(\frac{1}{2} \right) = 27^\circ$.