Investigation 1 Practice

A softball pitch is modeled by the parametric equations

$x = 15t\cos 60° + .7$ $\qquad$ $y = 15t\sin 60° - 4.9t^2 + 1.5$

$60 + .7$

a. For a player of average height, the strike zone is between 0.5 m and 1.5 m above the ground. Should this pitch be called a strike if the front of home plate is 13.7 m from the mound and the back of home plate is 14.4 m from the mound?

b. Maintaining the release angle at 60°, modify the initial velocity of the ball until the pitch crosses the plate inside this strike zone.

c. Now modify the angle of release so that the pitch crosses the plate inside the same strike zone when thrown with an initial velocity of 12 m/s.

a)

$13.7 = 15t \cos 60° + .7$

$13 = 15t \cos 60°$

$t = \dfrac{13}{15 \cos 60°}$

$t = 1.7\overline{3}$

$y = -4.9t^2 + 15t \sin 60 + 1.5$

$= -4.9(1.73)^2 + 15(1.73) \sin 60 + 1.5$

$= 9.3 \text{ m}$

Not a strike

b) $13.7 = V_0 t \cos 60° + .7$

$V_0 = \dfrac{13.7 - .7}{t \cos 60°}$

$V_0 = \dfrac{13}{(2.17)\cos 60°}$

$11.98 \approx 12$

$y = -4.9t^2 + V_0 t \sin 60° + 1.5$

$\quad = -4.9t^2 + \left(\dfrac{13}{t \cos 60}\right) t \sin 60 + 1.5$

$y = -4.9t^2 + 13 \tan 60 + 1.5$

$1 = -4.9t^2 + 24.02$

$-24.02 \qquad\qquad - 24.02$

$-23.02 = -4.9t^2$

$t^2 = \dfrac{-23.02}{-4.9}$

$\sqrt{t^2} = \sqrt{4.7}$

$t = 2.17$

$X = 10t\cos\theta + .7$

$13.7 = 10t\cos\theta + .7$

$13 = 10t\cos\theta$

$t = \dfrac{13}{10\cos\theta}$

$y = -4.9t^2 + 10t\sin\theta + 1.5$

$\quad = -4.9\left(\dfrac{13}{10\cos\theta}\right)^2 + 10\left(\dfrac{13}{10\cos\theta}\right)\sin\theta + 1.5$

$1 = \dfrac{-8.281}{\cos^2\theta} + 13\tan\theta + 1.5$

$0 = \dfrac{-8.281}{\cos^2\theta} + 13\tan\theta + .5$