Worksheet 2.3

4. The U.S. military is testing a new missile and launches it from the deck of a naval ship 10 m up from the surface of the water. The missile is launched at an angle of 50° with an initial velocity of 60 m/s.

a. When does the missile reach its maximum height?

b. What is the maximum height?

c. When is the missile at a horizontal displacement of 70 m?

d. How long does it take for the missile to hit the ocean?

$y_i = 10m$ $\quad V_{yi} = 60\sin(50°) = 45.96 m/s$

$\theta = 50$ $\quad V_{xi} = 60\cos(50) = 38.57 m/s$

$V_0 = 60 m/s$

a). $0 = -10t + 45.96$

$t = 4.596s$

b). $y_f = \frac{-10}{2}(4.596)^2 + (45.96)(4.596) + 10 = 115.62m$

c) $V_{xi} = \frac{\Delta x}{\Delta t}$ $\quad 38.57 m/s = \frac{70-0}{t-0}$ $\quad t = 1.815$

d). $0 = \frac{-10}{2}t^2 + 45.96t + 10$

$t = 9.4s$

6. A volleyball player serves the ball from a height of 2 m, 4 m from the net with an initial velocity of 8 m/s and an angle of 50°.

a. What is the height of the ball as it passes over the net?

b. How long until the ball hits the ground?

$y_i = 2m$

$x_i = 0m$ $\quad x_{net} = 4m$

$V_0 = 8 m/s$

$\theta = 50°$

$V_{yi} = 8\sin 50° = 6.13 m/s$

$V_{xi} = 8\cos(50) = 5.14 m/s$

a) get t from x-direction first: $5.14 = \frac{4}{t-0}$

$t = .78s$

height:

$y = \frac{-10}{2}(.78)^2 + .78(6.13) + 2 = 3.75m$

b). $0 = \frac{-10}{2}t^2 + 6.13t + 2$

$t = 1.5s$

3. A projectile is launched from the ground at 24 m/s at an angle of 28°. After sometime it is at a height of 3 m.

a. What is the vertical component of the velocity when it passes it on its way up?

b. How long did it take to reach this height?

c. How far out horizontally did it travel?

$v_0 = 24 m/s$ $v_{yi} = 11.27 m/s$

$\theta = 28°$ $v_{xi} = 21.2 m/s$

$y_i = 0 m$

$x_i = 0 m$

a) v_y @ $y = 3m$?

$3 = -\frac{10}{2}t^2 + 11.27t + 0$

$0 = -\frac{5}{2}t^2 + 11.27t - 3$

b). $t = .31 s$

$t = .31 s$ on way up

$v_y = -10(.31) + 11.27 = 8.17 m/s$

c). @ $t = .31 s$, what's x?

$x = 6t^2 + 21.2(.31) + 0$

$x = 6.57 m$