2. A cannon ball is shot at an angle of 65.0° with an initial speed of 330. m/s. Determine:

a) the components of its initial velocity

$V_x = 139\ \frac{m}{s}$ | $V_y = 299\ \frac{m}{s}$

330. m/s, θ = 65.0°

$V_y = V\sin\theta$

$V_x = V\cos\theta$

b) how long it took to land

½ time $y_f = y_i + v_{iy}t$ $\quad t_{½} = 30.5\,s$ | $t_{total} = 61.0\,s$

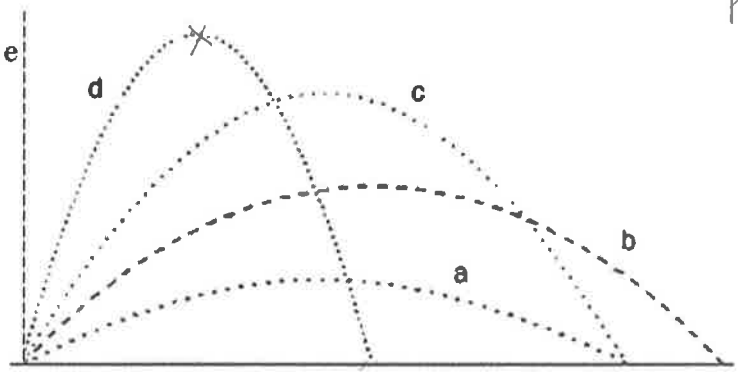
c) how far away it landed

$d_x = v_{xi}t + \frac{1}{2}at^2$ $\quad d = \left(139\ \frac{m}{s}\right)(61.0\,s) =$ | $d_x = 8{,}480\,m$

d) how high it went $\quad d_y = \left(299\ \frac{m}{s}\right)(30.5\,s) + \frac{1}{2}\left(-9.8\ \frac{m}{s^2}\right)(30.5\,s)^2 =$ | $4{,}560\,m$

3. The diagram below shows the trajectories of five identical cannonballs all launched with the same speeds but at different launch angles measured from the horizontal.

Phet simulation: Projectiles



Cannonball	Launch Angle
a	30^0
b	45^0
c	60^0
d	70^0
e	90^0

1. Which path shows the projectile having the
   a) largest angle of launch? E
   b) largest initial vertical component of velocity? E
   c) largest initial horizontal component of velocity? A

2. As the launch angle increases, what happens to the
   a) initial velocity? resultant $\vec{v}$ (initial) stays the same
   b) the components of the initial velocity? vertical or $\vec{V}_y$ increases, horizontal $\vec{V}_x$ decreases

3. At what launch angle will the components of the initial velocity be equal? 45°

4. What angle of launch will give the largest range? 45°

5. Which two projectiles have the same range? a, c
   30° + 60° = 90°

6. What angle of launch will give the longest time in the air (flight time)? E or 90°

7. What angle of launch will make the cannonball go the highest? E or 90°