3: Projectile Motion

Name: Key **Score:** _____

1. The velocity of a projectile at launch has a horizontal component v_h and a vertical component v_v. Air resistance is negligible. When the projectile is at the highest point of its trajectory, which of the following shows the vertical and horizontal components of its velocity and the vertical component of its acceleration?

	Vertical Component	Horizontal Component	Vertical Acceleration
a.	~~v_v~~	v_h	~~0~~
b.	~~v_v~~	~~0~~	~~0~~
c.	0	v_h	~~0~~
d.	0	~~0~~	g
e.	0	v_h	g

2. A plane flying horizontally at a speed of 50.0 m/s and at an elevation of 160 m drops a package. Two seconds later it drops a second package. How far apart will the two packages land on the ground?

a) 100 m
b) 162 m
c) 177 m
d) 283 m

- both have the same V_h
- both fall for the same time
- $X = V_x t = 50 \cdot 2 = 100$

3. When a football in a field goal attempt reaches its maxim height, its speed is

a) Zero.
b) Less than its initial speed.
c) Equal to its initial speed.
d) Greater than its initial speed.

$V_y = 0$

$V_x = V_{x_i} = V_0 \cos\theta \neq 0$

4. A pilot drops a bomb from a plane flying horizontally. When the bomb hits the ground, the horizontal location of the plane will

a) Be behind the bomb.
b) Be over the bomb.
c) Be in front of the bomb.
d) Depend on the speed of the plane when the bomb was released.

both have the same horizontal component

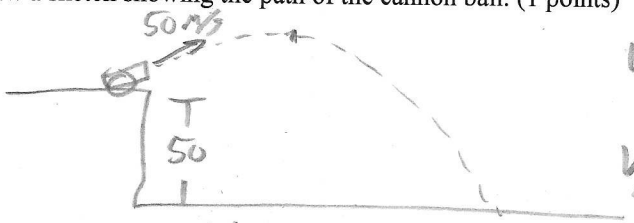
5. A stone is thrown horizontally from the top of a tower at the same instant a ball is dropped vertically. Which object is traveling faster (total final velocity) when it hits the level ground below?

a) It is impossible to tell from the information given.
b) The stone.
c) The ball.
d) Neither, since both are traveling at the same speed.

- both have the same vertical velocity
- stone also has horizontal velocity as well

6. A cannon ball is shot at a ship in a harbor with a velocity of 50 m/s an angle of 60° above the horizontal. The cannon rests on top of a fort that sits on a cliff 50 m above the harbor. (10 points)

a. Draw a sketch showing the path of the cannon ball. (1 points)



$V_x = 50\cos(60) = 25\ m/s$

$V_y = 50\sin(60) = 43.3\ m/s$

b. How long is the cannon ball in the air? (4 points)

$V_{y_i} = 50$

$V_f = 0$

$V_{y_i} = 43.3$

$V_{yf} =$

$a = -9.8$

$t =$

$V_f = Y_i + V_{y_i}t + \frac{1}{2}at^2$

$0 = 50 + 43.3t + -4.9t^2$

$t = 9.6s$

or

$V_f^2 = V_i^2 + 2a(X_f - X_i)$

$V_f^2 = (43.3)^2 + 2(-9.8)(-50)$

$V_f = -53.4\ m/s$

$V_f = V_i + at$

$-53.4 = 43.3 + -9.8t$

$t = 9.6\ s$

c. What is the range of the cannon ball? (4 points)

$X = V_x t = 25\ m/s\,(9.6s)$

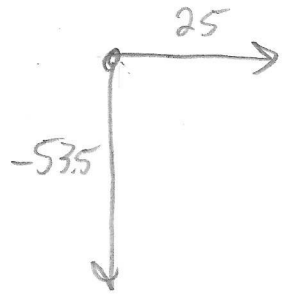
$X = 240\ m$

Note, you can not use the range equation

d. What is the cannon ball's **total final velocity** the instant before it hits the water. (1 points)

$V_{xf} = 25\ m/s$

$V_{yf} = -53.4\ m/s$



$\theta = \tan^{-1}\left(\frac{53.5}{25}\right)$

$\theta = 65°$

$V_f = \sqrt{V_x^2 + V_y^2}$

$= \sqrt{(25)^2 + 53.4^2}$

$V_f = 59\ m/s\ @\ 65°\ S\ of\ E$