Name:	Date:
Mr. Croom's Physics	Chapter 3: Two Dimensional Motion

Advanced Symmetrical Projectile Motion (ANSWER KEY)

- 1. A football is kicked at an angle of 45° and travels 82 m before hitting the ground.
 - a) Find its initial velocity
 - b) How long was it in the air?
 - c) What is its **maximum height**?

- 2. A shot put is released with a velocity of 12 m/s and stays in the air for 2.0 sec.
 - a) At what <u>angle</u> was it released? [HINT: Think of ALL the kinematic equations with **0** in it!]
 - **b)** What was the shot put's range?

$$\theta = 55^{\circ}$$

R= 13.81m

3. Find the <u>angle of elevation θ </u> of a tank's cannon which fires a shell with a muzzle velocity of 120 m/s and hits a target on the same level (What is Δy ?) but 1300 m distant.

$$\theta = 59^{\circ} \text{ or } 31^{\circ}$$

- 4. A baseball is thrown straight downward with initial velocity of 8 m/s from a height of 25 m. Compute the following:
 - a) Compute the <u>time</u> it takes the baseball to reach the ground.
 - **b)** Calculate the **velocity** the baseball strikes the ground with.

$$t = 1.59 \text{ s}$$

 $v_f = 23.5 \text{ m/s}$

- 5. A marble dropped from a bridge strikes the water in 5 sec.
 - a) Calculate the <u>impact velocity</u> (v_y) .
 - **b)** What is the **height** of the bridge?

$$v_f = 49 \text{m/s}$$

 $t = 122.5 \text{ s}$

- 6. Morten Anderson, a place kicker, tries for a field goal. He kicks the ball 40 ° above the horizontal. The initial velocity (v_i) of the ball is 23 m/s.
 - a. Determine the maximum height that the ball attains.
 - b. Determine the time of flight between kickoff and landing.
 - c. Determine the range of the football.
 - d. If the uprights were 27 yards away, and the uprights are 10 feet off the ground, does he make the field goal? [hint: find y at the time t where x = 22 yards.] [convert!]

$$y_{max} = 11.5$$

 $t = 3.02$
 $R = 53.16$
Yes

- 7. A hunter aims *directly* at a target 120 m away.
 - a) If the bullet leaves the gun at a velocity of 250 m/s, by how much will it miss the target?
 - b) At what angle should the gun be aimed so the target will be hit?

Misses by 1.13m Aim at 0.9°

8. A projectile is launched from ground level to the top of a cliff which is 195 m away and 155 m

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high. If the projectile lands on top of the cliff 7.6 sec after it is fired, find the initial velocity of the projectile (BOTH magnitude AND direction). Neglect drag. $v_{ox} = 25.7 \text{ m/s}$ $v_{oy} = 57.6 \text{ m/s}$ $v_{o} = 63.1 \text{ m/s} @ 65.95^{\circ}$