### PART I: 1D and 2D Kinematics with emphasis on Projectile Multiple Choice

#### M1

Identical guns fire identical bullets horizontally at the same speed from the same

height above level planes, one on the Earth ( $g_{earth} = 9.8 m \cdot s^{-1}$ ) and one on the Moon ( $g_{max} = 1.62 m \cdot s^{-1}$ ) which of the following three statements is **NOT TPUE**? Note:

 $g_{moon} = 1.62 m \cdot s^{-1}$ ). Which of the following three statements is **NOT TRUE**? **Note:** only one correct answer.

I. The horizontal distance traveled by the bullet is greater for the Moon.

II. The flight time is less for the bullet on the Earth.

III. The velocities of the bullets at impact with the ground are the same.

#### M2

A projectile is shot vertically upward with a given initial velocity. It reaches a maximum height of 100 m. If on a second shot the initial velocity is doubled, then the projectile will reach a maximum height of: A) 70.7 m; B) 141.4 m; C) 200 m; D) 241 m; E) 400 m **ANSWER E** 

### M3

A rock is projected upward from the surface of the moon, at time t = 0.0 s, with a velocity of 30 m/s. The acceleration due to gravity at the moon's surface is 1.62 m/s<sup>2</sup>. The height of the rock when it is descending with a velocity of 20 m/ is closest to:

115 m b) 155 m c) 135 m d) 125 m e) 145 m

### M4

he airplane shown is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance d should it release a heavy bomb to hit the target X? Take  $g = 10 \text{ m/s}^2$ . A) 150m; B) 295 m; C) 417 m; D) 1500 m; E) 15000 m. **ANSWER:** C



# **Problems**

### Problem 1

*Egg Drop*. You are on the roof of the physics building, 46.0 m above the ground. Your physics professor, who is 1.80 tall, is walking alongside the building at a constant speed of 1.20 m/s. If you wish to drop an egg on your professor's head, where should the professor be when you release the egg? Assume that the egg is in free fall.

**ANSWER:** the professor should be a distance 3.60 m away from the building. <u>Problem 2</u>

A shot putter releases the shot some distance above the level ground with a velocity of 12m/s,  $51^{\circ}$  above the horizontal. The shot hits the ground 2.08 seconds later. Ignore air resistance. (a) What are the components of the shot's acceleration while in flight? (b) What are the components of the velocity at the beginning and end of the trajectory? (c) How far did she throw the shot horizontally? (d) How high was the shot above ground when she released it?

ANSWER: c) range 15.7 m; d) 1.79

### Problem 3

A Physics Professor did a daredevil stunt in his spare time. In the figure below he tries to cross a river from a 53° ramp at an unknown initial speed  $v_o$ . The river is 40 m wide, and the far bank is 15 m lower than the top of the ramp. The river itself is 100 m below the ramp. A) What should his speed at the top of the ramp be for him to just make it to the edge of the far bank. B) If his speed were only half the value found in part A, where would he land in the river?



# ANSWER:

**A)**  $v_0 = 17.8m \cdot s^{-1}$ **B)** Range 28.3 m into the water