Beverly Hills High School -- AP Physics C -- Exam #3 -- 85 points

As usual, be professional in your presentations. Be organized and neat. Show all of your work. Give units for all answers. Three decimal place answers. Calculators are okay, neighbors are not. Pencils only.

1) Uwe Hohn, the German track and field athlete, holds the world record for throwing the old-style javelin at a distance of 108.40 m. Assuming he threw the javelin at an angle of 45° above horizontal and threw from the ground, find the initial velocity of the javelin. (Five points)

2) A cannon in Mosul, Iraq fires a shell at a speed of 237 m/s at an angle of 36°. Assuming air resistance has no effect on the shell, calculate: a) how high it goes, b) how long it is in the air, and c) how far it lands down range. (Fifteen points)

3) In a jump spike, a volleyball player slams the ball from overhead and toward the opposite floor. Controlling the angle of the spike is difficult. Suppose a ball is spiked from a height of 2.40 m with an initial speed of 18.0 m/s at a downward angle of 21.00°. How much farther on the opposite floor would it have landed if the downward angle were, instead, 13.00°? (Fifteen points)

DO EITHER #4 OR #5 -- CROSS OUT THE ONE YOU DO NOT WANT GRADED.

4) A man is shooting a rifle horizontally (in a prone position lying on the ground) from the top of a 120 m high cliff. The muzzle velocity of the rifle is 240 m/s. Neglecting air resistance, answer the following. Twenty points.

   a) How long will it take for the bullet to hit the ground?
   b) How far away from the cliff will the bullet land?
   c) What will be the bullet's speed when it hits the ground?
   d) At what angle does the bullet strike the ground?

5) An NFL kicker is trying to win the game by kicking a field goal. He is kicking the ball from the ground from a distance of 45 yards. He wishes to kick the ball over the goalpost's crossbar, a crossbar exactly ten feet from the ground. (1 m = 3.28 ft)

   If the kicker kicks the ball at an angle of 54° at an initial speed of 18 m/s, will the ball get over the crossbar? (Be careful on your units here). Have to show your work. Twenty points.

45 yards
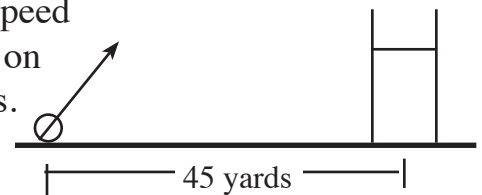
_____ 6) A teenage girl is driving her daddy's convertible at a constant speed of 25 m/s. At some instant, she tosses a ball 2 m straight up in the air. How does she view its motion, how does a boy standing on the side of the road view the ball's motion, and where does it land?

a) She sees it as a parabola; the boy sees it as a parabola; it lands in her hand
b) She sees it as a straight line; the boy sees it as a parabola; it lands in her hand
c) She sees it as a parabola; the boy sees it as a parabola; it lands behind the car
d) She sees it as a straight line; the boy sees it as a straight line; it lands behind the car

_____ 7) In doing two-dimensional kinematics problems, all of these are true EXCEPT

a) The horizontal part of the motion is independent of the vertical part.
b) Once a projectile is shot only gravity and air resistance act upon it.
c) The horizontal velocity changes due to the acceleration due to gravity.
d) Graphical techniques can be used to help analyze the situation.

8) Show how we proved that the maximum distance a projectile will fly is when the initial angle is $45°$, and that $v_{max} = \dfrac{v_0^2}{g}$. Ten points for this one.

9) You stand at an ancient water well in Judea. You drop a stone from rest into the well and the sound of the stone hitting the water is heard 1.6 seconds after you drop it. If the speed of sound in air at that location is 340 m/s, determine the depth of the well. Ten points.