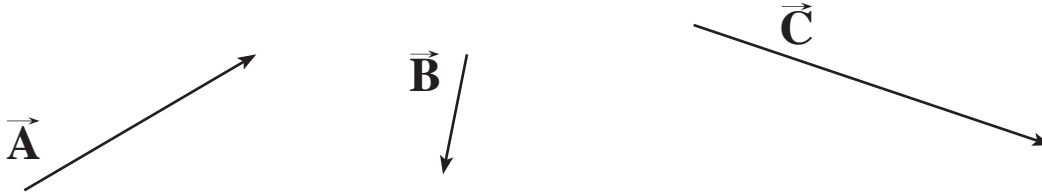# Vasquez High School -- Physics -- Exam #2 -- Chapter 3 -- 100 points

Be neat and complete. Write all pertinent equations. Show ALL of your work for full credit. All problems
        neglect air resistance and frictional forces not germane to the calculations.
Using the vectors shown and a ruler, construct graphically the following linear combinations (three points):

1)
$\vec{A} + 2\vec{B}$

2)
$\vec{C} - \vec{A}$

3) For ten points, analytically arrive at the vector combination $\vec{B} - 2\vec{A}$
        if $\vec{A} = 55$ m @ $20°$ and $\vec{B} = 130$ m @ $70°$.

4) For five points, show the conversion from radial (r,θ) coordinates to rectangular (x,y) and vice-versa.

Seven points each.
5) The American F-35 fighter can fly over 2.75 x 10³ km/hr. Suppose this plane accelerates at a rate that allows it to increase its speed from 825 km/hr to 2750 km/hr in a time interval of 150.0 seconds. If this acceleration is upward and at an angle of 40° with the horizontal, find the acceleration's horizontal and vertical components.

6) A UPS delivery truck leaves the center of town going south. He travels 8.50 km south, then turns left for 3.00 km. He drops off a package. Then he travels north for 4.75 km and then goes west for 11.0 km. At this point, what is his overall displacement?

7) A female IDF soldier fires a bazooka shell horizontally off a cliff at enemy tank some 650 m away. If the shell has an initial speed of 115 m/s and the shell hits the tank, how high was the cliff.

8) Ray Guy, punter for the Oakland Raiders football team, was able to kick a football into the air for 4.86 seconds. If he kicked the ball at an angle of 49° to the horizontal, how far did the ball fly down the field and what was its maximum height?

9) Derive the expression for the range of a projectile from first pronciples, as shown in class. Then prove why the maximum range is achieved when the projectile is shot at and angle of 45 °.

10) 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 14 m/s, will the ball get over the crossbar? (Be careful on your units here). Have to show your work. Ten points on this one.

45 yards
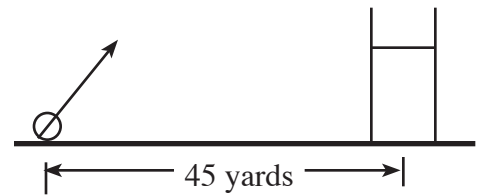
Multiple Choice - Write the letter that corresponds to the correct choice for each. Five points.

_____ 11) If we are finding the acceleration due to gravity from data plotted as a position vs. time graph, the part of motion that is accelerated would be a

a) horizontal line   b) curved line
c) straight line upward   d) straight line downward

_____ 12 A power boat, starting from rest, maintains a constant acceleration. After a certain time t, its displacement and velocity vectors are given as $\mathbf{r}$ and $\mathbf{v}$. At time 2t, what would be its displacement and velocity, assuming the acceleration remains the same?

a) 2$\mathbf{r}$ and 2$\mathbf{v}$ b) 2$\mathbf{r}$ and 4$\mathbf{v}$ c) 4$\mathbf{r}$ and 2$\mathbf{v}$ d) 4$\mathbf{r}$ and 4$\mathbf{v}$

_____ 13) 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

_____ 14) 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.

15) 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.