This Quizz is closed book.

PROBLEM 1 (15 points).
Two vectors of length 4 and 2 units respectively make an angle of 120 deg between them.

a. How large is the angle in radians?
b. Calculate the magnitude of the sum of the two vectors.
c. Calculate the magnitude of the difference of the two vectors.
d. Calculate the inner (dot) product of the two vectors.

PROBLEM 2 (15 points).
A person travels $x_1$ units in the positive $x$-direction, then $y_1$ units in the negative $y$-direction, then $x_2$ units in the positive $x$-direction, then $y_2$ units in the positive $y$-direction, then $x_3$ units in the negative $x$-direction. The velocity is constant with magnitude $v$.

a. Show the travel in a Figure.
b. Calculate the displacement.
c. Calculate the distance traveled.
d. Calculate how long the trip takes.
PROBLEM 3 (15 points).
A car accelerates from 6 m/s to 25 m/s at a constant rate of 3.0 m/s$^2$. Calculate how far it travels while accelerating.

PROBLEM 4 (15 points).
A ball is thrown vertically upward with velocity $v$. Ignore friction with the air.

a. Calculate how high the ball will rise.
b. Calculate how long it takes for the ball to reach its highest point.
c. Calculate the magnitude of the velocity when the ball return to its launching point.

PROBLEM 5 (30 points).
A projectile’s orbit is given by $y(t) = A x(t)^2 + B x(t)$ with $A < 0$ and $B > 0$. Here $x$ and $y$ are in the horizontal and vertical direction respectively with $y$’s positive direction vertically upward.

a. Calculate the range $R$ of the projectile.
b. Calculate the position coordinates of the highest point of the projectile’s orbit.
c. Calculate the angle with the positive $x$-axis at the launching point.
d. Calculate the angle with the positive $x$-axis at the impact point.
e. Compare your answers of c) and d) and comment.

PROBLEM 6 (10 points).
What is the range of a projectile that is launched at an angle $\epsilon$ in the limit that $\epsilon \to 0$? Explain. You may use your result from Problem 5) if you find that helpful but you can get the answer without it too.