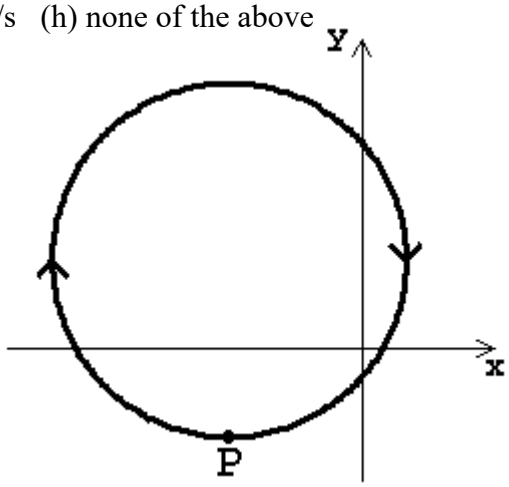
PHYS 2325 - Dr. Honan - Test 1 - B Name_____

Possibly Useful Information: 1 liter = 10^{-3} m^3 1 ft = 0.3048 m 1 hr = 3600 s g = 9.80 m/s^2

Problem 1 Multiple Choice (3 points each)

_____ [i] When a ball is thrown horizontally out of a window at a speed of 18 m/s it hits the ground at a speed of 30 m/s. If a ball were dropped out the same window, what would be its speed when it hit the ground?
(a) 0 m/s (b) 12 m/s (c) 18 m/s (d) 24 m/s (e) 30 m/s (f) 35 m/s (g) 48 m/s (h) none of the above

Problem 2 (2 points each) The graph to the right shows the *trajectory* of a car. At position P the car's speed is *decreasing*. Complete the table below with the signs of the components of the car's velocity **v** and acceleration **a** at point P. Answer +, - or 0.



v_x	v_y	a_x	a_y

Problem 3 (6 points each)
(a) Newton's law of universal gravitation is $F = G\, m_1 m_2 / r^2$, where F is a force (with dimension $[F]=\mathrm{M\cdot L/T^2}$), m_1 and m_2 are masses ($[m_1] = [m_2] = \mathrm{M}$) and r is a distance, $[r] = \mathrm{L}$. What is $[G]$, the dimension of G?

(b) Water flows through a pipe at a rate of 0.3 liter/s. What is this in ft^3/hr?

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Problem 4 (6 points each)

(a) A sailboat sails 4 km to the West and then 5 km in the direction 35° East of South. What is the net displacement of the boat? Also, what are the magnitude and direction of the net displacement?

(b) A helicopter accelerates vertically from the ground from rest at 3 m/s^2. 4 s after the helicopter leaves the ground a mailbag is dropped from the helicopter. How long after it is dropped does the bag hit the ground?

(c) Junior throws a rock at 9 m/s from the ground at an angle of 55° from horizontal toward a building. If the base of the building is 5 m from him, then how high above the ground does the rock hit the building?

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Problem 5 $x(t) = t^4 - 2t^2 + 3$ (in SI units) describes the position of a 12 kg particle moving along a line. (6 points each)

(a) What is the *average velocity* between 0 and 2 s?

(b) What is the *net force* at 3 s?

Problem 6

(a) A staircase drops vertically by 5m over a horizontal distance of 8m. If some irate physics students throw their instructor with a horizontal initial velocity from the top of the stairs, then what is the smallest initial speed at the top needed to clear the staircase?

(b) Rain falls vertically at 80 mi/hr. A car drives at 60 mi/hr in this rain. What is the speed of the rain with respect to the car and what angle, measured from vertical, does the rain hit the car?