Name:_____
Last First

UNLV, DEPARTMENT OF MECHANICAL ENGINEERING
MEG 207, SPRING 2002, FIRST TEST

Closed Book, one page of handwritten notes allowed. Enter the answer for each question into the space provided. Enter SI units in **all** answer spaces with brackets ( ).

1. (15 points) A vehicle traveling at 108 km/h suddenly ~~decelerates~~ at a rate of 3 m/s^2.
a) Determine the time needed for the vehicle to come to rest.
b) Determine the distance traveled between the beginning of braking, and the full stop.

1(a) $v0 := 108\cdot\frac{1000}{3600}$ in m/s $\quad a := -3$

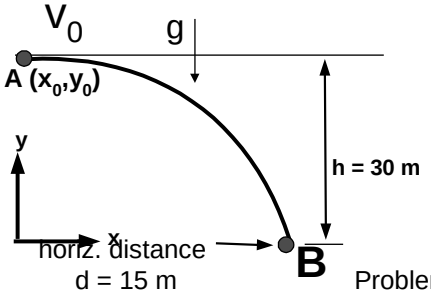
$v(t) = v0 + a\cdot t$ General equation. Solving for t when v=0

gives: $t := \frac{v0}{-a}$ and $\quad t = 10$

1 (b) v*dv = a*dx or $a\cdot distance = \frac{1}{2}\cdot(0 - v0)^2$ $\quad distance := \frac{-v0^2}{2\cdot a}$ $\quad distance = 150$

Answers: a)	T_{stop} =	10	(s units)
b)	d_{Stop} =	150	(m units)

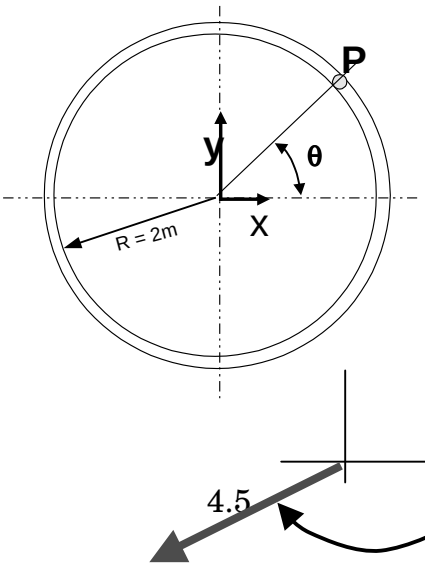
2. (20 points) A ball of mass m is thrown horizontally from a bridge 30 m above ground. It touches ground at distance d = 15 m. Determine the ball's initial velocity. No friction.



Problem 2 $d := 15$ $h := 30$ Angle is zero.
Horizontal: d = v0*t. Vertical: y(t) = y0 -1/2*g*t^2. At point B, y = 0. $g := 9.81$

Given
$d = v0\cdot t$
$0 = h - 0.5\cdot g\cdot t^2$
$res := Find(t, v0)$ $\quad res = \begin{pmatrix} 2.473 \\ 6.065 \end{pmatrix}$

Answer	v_0 =	6.065	(m/s)



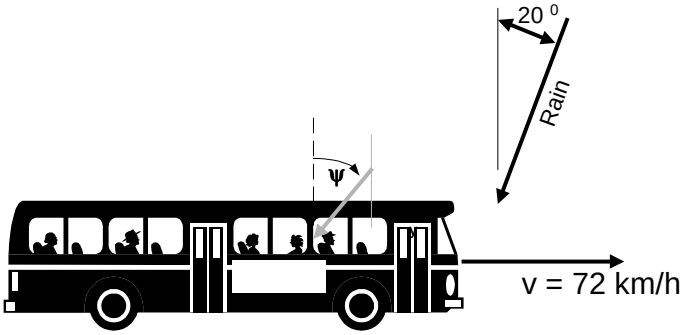
3. (20 points) Pin P moves at constant speed of 3 m/s in a counterclockwise sense around the circular slot with radius r = 2 m. Determine (a) the angular velocity of P. (b) the total acceleration **vector** (Use polar coordinates: e_r and e_θ directions) of pin P when θ = 30 degrees.
(c) the magnitude and angle of the resultant acceleration vector in **Cartesian** x-y coordinates.

(b) no radial or angular accel. In neg. e_r direction we have $r*\omega^2 = -2*2.25$ m/s^2

(c) Resultant Acceleration is purely inward, thus:
$a_x = -4.5*\cos 30^o$ and $a_y = -4.5*\sin 30^o$

Answer

ω =	v/r = 3/2 = 1.5	(rad/s)
a_P =	-4.5 e_r	0 e_θ (m/s^2)
a_P =	4.5 m/s^2 at -150 degrees	(magnitude and angle in x-y coordinates)



4. (25 points) Wind-driven rain is falling with a speed of 30 m/s at an angle of 20^0 to the vertical as shown at left. Determine the angle ψ at which the rain is seen by passengers inside the bus. The bus is traveling at 72 km/h.

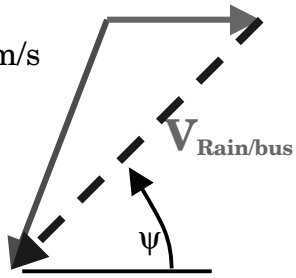
$V_{rain} = V_{Bus} + V_{Rain/bus}$ $V_{bus} = 20$m/s

x-and y-components of $V_{Rain/bus}$:

$v_{R/B,x} = -V_{bu} - V_R*\sin(20\text{deg}) = -30.2$ m/s

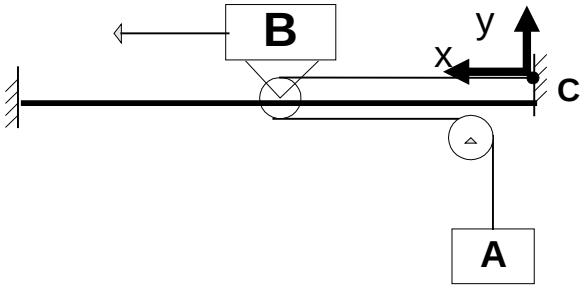
$v_{R/B,y} = -V_R*\cos(20\text{deg}) = -28.19$ m/s

$= \tan^{-1}(29.19/30.2) = 43$ deg.



Angle ψ seen by moving passengers = 43 deg. ( )

5. (20 points) In the pulley system shown at left, the cable is attached at C. Mass B moves to the left at v_B = 3 m/s, and accelerates also to the left at a_B = 0.5 m/s^2. Using the x-y frame with origin at C, determine:
(a) the velocity of A
(b) the acceleration of A



L = 2xB(t) +(Y0 – yA(t))

Differentiation gives:
2 vB = vA

and

2 aB = aA

Answer

v_A =	6 m/s	( )
a_A =	1 m/s^2	( )