In Class Work for Friday September 8

[1] Consider a projectile in Earth's gravity, neglecting air resistance.

Let x be the horizontal coordinate and y = the vertical coordinate.

The initial conditions are

$$x(0) = 0 \; ; \; y(0) = h \; ; \; v_x(0) = v_0 \cos\theta \; ; \; v_y(0) = v_0 \sin\theta \; .$$

(A) Sketch a diagram.

(B) Write an equation for x"(t). [" means d^2 / dt^2] $x''(t) = 0$

(C) Write an equation for y"(t). $y''(t) = -g$

(D) Calculate the time t_f when the projectile hits the ground (y = 0).

$$(v0/g)\ \sin\theta \ + \ \text{sqrt}[\ (v0/g \sin\theta)^2 + 2 g h\ ]$$

(E) Calculate the horizontal distance where the projectile hits the ground.

[2] A car drives around a circular track (radius = R) with constantly increasing speed.

The angle φ as a function of time t is

$$\varphi(t) = \tfrac{1}{2} \beta t^2 \qquad \text{where } \beta \text{ is constant.}$$

(A) Sketch a drawing of the car on the track.

(B) Write equations for the coordinates x(t) and y(t).

$$x(t) = R \cos\phi(t) \quad ; \quad y(t) = R \sin\phi(t)$$

(C) Calculate the velocity and acceleration vectors, **v**(t) and **a**(t).

$$\mathbf{v}(t) = x'(t)\,\mathbf{e}_x + y'(t)\,\mathbf{e}_y$$

$$\mathbf{a}(t) = x''(t)\,\mathbf{e}_x + y''(t)\,\mathbf{e}_y$$

(D) Calculate the radial acceleration $a_r(t)$.

(E) Make a drawing that shows the velocity and acceleration vectors when the car first passes the point at $\varphi = \pi$.

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In Class Work (Friday September 8) - ANSWER SHEET

INSTRUCTIONS FOR THIS PAGE :
WRITE YOUR *ANSWERS ONLY* ; DO NOT SHOW YOUR WORK.
Do use scratch paper do figure out the answers.

PROBLEM #1
A) DIAGRAM

B) $x''(t) =$

C) $y''(t) =$

D) $t_f =$

E) $x_f =$

PROBLEM #2
A) DRAWING

B) $x(t) =$

B) $y(t) =$

C) Vector $\mathbf{v}(t) =$

C) Vector $\mathbf{a}(t) =$

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D) $a_r(t)$ =

E) DRAWING