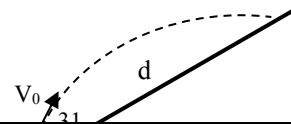


- The motion of a particle in  $XY$  plane is  $\mathbf{r}(t)=(1+\cos 2t, 2+\sin 2t)$ , SI units. a) Find the velocity  $\mathbf{v}(t)$  and the acceleration  $\mathbf{a}(t)$ . b) Find the value for  $\mathbf{v}(1)$  and  $\mathbf{a}(1)$ . c) Find the intrinsic components of the acceleration,  $\bar{a}_t(t)$  and  $\bar{a}_n(t)$ . d) Determine the trajectory of the particle.  
Ans.: a)  $\mathbf{v}(t)=(-2\sin 2t, 2\cos 2t)$ ,  $\mathbf{a}(t)=(-4\cos 2t, -4\sin 2t)$ ; b)  $\bar{v}(1)=(-1,819, -0,832)$  m/s;  $\bar{a}(1)=(1,67; 3,64)$  m/s<sup>2</sup>; c)  $\bar{a}_t(t)=0$ ;  $\bar{a}_n(t)=\bar{a}(t)$  (m/s<sup>2</sup>);  $(x-1)^2+(y-2)^2=1$   $\equiv$  A circumference with radius 1 m and center in point (1, 2)
- The components of the position vector of a body moving in the  $XY$  plane are:  $x = 16t + 2t^2$ ,  $y = 18t - 1,5t^2$ , SI units. At  $t = 1$  s, calculate: a) Cartesian coordinates and intrinsic components of the acceleration. b) The unit vectors  $\mathbf{u}_t$  and  $\mathbf{u}_n$ , showing that they are perpendicular to each other. c) The position of the center of curvature.  
Ans.: a)  $a_x = 4$  m/s<sup>2</sup>;  $a_y = -3$  m/s<sup>2</sup>;  $a_t = 1,4$  m/s<sup>2</sup>;  $a_n = 4,8$  m/s<sup>2</sup>; b)  $\mathbf{u}_t = (0,8, 0,6)$ ;  $\mathbf{u}_n = (0,6, -0,8)$ ; c) C.C:  $x = 96,12$  m,  $y = -87,67$  m
- A particle is moving in  $XY$  plane with  $a_x = 0$ ,  $a_y = 5$  m/s<sup>2</sup>. At  $t = 0$  the position is  $x = 0$ ,  $y = 8$  m, and the velocity is  $v_x = 5$ ,  $v_y = 0$  m/s. Determine: a) The law of motion  $\bar{r}(t)$ ; b) the equation of the trajectory; c) the intrinsic components of the acceleration at  $t = 1$  s. Ans.:  $r(t) = (5t, 8 + 5/2 \cdot t^2)$ ;  $y = 8 + x^2/10$ ;  $a_t(1) = 5/\sqrt{2}$  ms<sup>-2</sup>;  $a_n(1) = 5/\sqrt{2}$  ms<sup>-2</sup>.
- An iron sphere is dropped and allowed to fall freely from a balcony. It takes to it 0,10 s for going through the last meter. a) What is the initial height? b) What is the final speed? Ans.: a) 5,5 m; b) 10,5 m/s
- A stone is thrown vertically upwards and is 10 s in the air. Neglecting the air resistance and taking  $g = 10$  m/s<sup>2</sup>, calculate the initial throwing speed and the maximum height the stone reaches. Ans.: 50 m/s; 125 m.
- A child throws horizontally a ball from a balcony at height  $y_0$ , with an initial speed  $v_0$ . At the same instant, another child on the street throws another ball vertically with speed  $2v_0$ , from a point located at distance  $d$  from the first building. Find the value of  $d$  for making the balls to collide to each other. Ans.:  $d = y_0/2$
- When a stone is thrown with speed  $v_0$  at an angle  $\alpha$ , it hits the ground at a distance of 50 m (neglecting the air resistance). If the same stone is thrown at the same angle but with speed  $2v_0$ , which is the range? Ans.: 200 m
- A ball is thrown vertically upwards with an initial speed of 20 m/s from the roof of a building 50 m tall. The ball is pushed by the wind, with an horizontal acceleration of 2 m/s<sup>2</sup>. Taking  $g = 10$  m/s<sup>2</sup>, calculate: a) Horizontal distance between the initial point and the point of impact. b) Maximum height. c) Intrinsic components of the acceleration when the ball reaches 60 m above ground the first time. Ans.: a) 32,97 m; b) 70 m; c)  $a_t = -9,02$  m/s<sup>2</sup>;  $a_n = 4,32$  m/s<sup>2</sup>.
- William Tell aims to the apple atop his son's head, at a distance  $d$  and 50 cm below from shooting position. The initial speed of the arrow is 50 m/s, with an angle 30°. The wind produces an horizontal acceleration of 2 m/s<sup>2</sup>, braking the arrow. Taking  $g = 10$  m/s<sup>2</sup>, calculate: a) Horizontal distance  $d$  required for the arrow to go through the apple; b) Maximum height the arrow reaches, as measured from point of shooting. Ans.: a) 192,4 m; b) 31,3 m
- See figure. A body is thrown from a point P in the slope (22°) of a hill. The initial speed is  $v_0 = 150$  m/s, forming an angle of 31° with respect to the mountainside (see figure). Calculate the flight time, the distance from P when it hits the ground and the



CLASES PARTICULARES, TUTORÍAS TÉCNICAS ONLINE  
LLAMA O ENVÍA WHATSAPP: 689 45 44 70

---

ONLINE PRIVATE LESSONS FOR SCIENCE STUDENTS  
CALL OR WHATSAPP: 689 45 44 70

Cartagena99