

$$g_y = x^2 ; \quad x(t) = t^2 - 14t ; \quad t = 15 \text{ sec}$$

(1)

The position of a particle P in two-dimensional Cartesian (x, y) coordinates, with respect to time

$$x_p(t) = t^2 - 14t$$

(cm)

$$y_p(t) = \frac{x^2}{g} = \frac{(t^2 - 14t)^2}{9}$$

(cm)

The velocity of the particle P is given by:

$$v_x(t) = \frac{dx_p(t)}{dt} = 2t - 14 \quad (\text{cm/sec})$$

$$v_y(t) = \frac{dy_p(t)}{dt} = \frac{2}{9}(t^2 - 14t)(2t - 14) \quad (\text{cm/sec})$$

The acceleration of the particle P is given by:

$$a_x(t) = \frac{dv_x(t)}{dt} = 2 \quad (\text{cm/sec}^2)$$

$$a_y(t) = \frac{dv_y(t)}{dt} = \frac{2}{9}[(2t-14)^2 + 2t^2 - 28t] \quad (\text{cm/sec}^2)$$

The magnitude of the velocity of particle P:

$$\begin{aligned} v_p(t) &= \sqrt{(v_x(t))^2 + (v_y(t))^2} = \\ &= \sqrt{(2t-14)^2 + \left(\frac{2}{9}(t^2-14t)(2t-14)\right)^2} \end{aligned}$$

(2)

at $t = 15$

$$V_p(15) = \sqrt{(2 \cdot 15 - 14)^2 + \left(\frac{2}{9}(15^2 - 14 \cdot 15)\right)^2} = \\ = 55,7 \text{ cm/sec}$$

The magnitude of the acceleration
of the particle P:

$$a_p(+)=\sqrt{(a_x(+))^2+(a_y(+))^2}= \\ = \sqrt{2^2 + \left(\frac{2}{9}[(2t-14)^2 + 2t^2 - 28t]\right)^2}$$

at $t = 15$

$$a_p(15)=\sqrt{4+\left(\frac{2}{9}[(2 \cdot 15 - 14)^2 + 2 \cdot 15^2 - 28 \cdot 15]\right)^2}= \\ = 63,6 \text{ cm/sec}^2$$