RESPUESTAS CINEMÁTICA DE LA PARTÍCULA

En las expresiones cinemáticas de velocidades y de aceleraciones el subíndice 1 indica el marco tierra.

Los vectores unitarios $\{\hat{i}, \hat{j}\}$ indicados en las soluciones corresponden a los sentidos horizontal hacia la derecha y vertical hacia arriba respectivamente y además los vectores $\{\hat{p}, \hat{q}\}$ definen otra base ortogonal en el plano.

1.- a) $\bar{V}_1^P = 8\,\hat{i} + 16\,\hat{j}$; $\bar{a}_1^P = 8\,\hat{i} + 16\,\hat{j}$ b) $y = 2x - 6$ c) $s(t) = 4\sqrt{5}\,(2t + t^2)$

2.- $\bar{V}_1^P = \frac{8}{3}\pi\,\hat{i}$ (m/s) ; $\bar{a}_1^P = \frac{8}{3}\pi\,\hat{i} - \frac{16}{9}\pi^2\,\hat{j}$ (m/s^2)

3.- $\bar{a}_1^A = 2\,b\,v^2\,\hat{j}$ (m/s^2)

4.- a) $r = r_o\,e^{\theta}$; b) $\left|\bar{a}_1^P\right| = \frac{2\,r_o^2\,v_o^2}{r^3}$

5.- a) $\left|\bar{a}_{1t}^P\right| = \frac{26}{\sqrt{29}}$; b) $\rho = \frac{29\sqrt{29}}{\sqrt{165}}$

6.- $\left|\bar{V}_1^A\right| = \sqrt{\frac{2\,(2L - d)\,b}{L\,d}}$

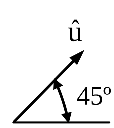
7.- a) $x^2 + \left(y - \frac{v}{\omega}\right)^2 = \left(\frac{v}{\omega}\right)^2$; b) $\rho = \frac{v}{\omega}$; c) $\left|\bar{a}_{1n}^P\right| = \omega\,v$

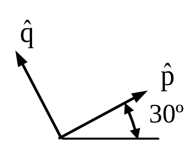
9.- $\bar{V}_1^P = 4{,}03\,\hat{i} - 16{,}5\,\hat{j}$ (m/s) ; $t = 0{,}71$ (s)

10.- $\bar{V}_1^P = -\frac{\pi R}{2}\,\hat{i}$; $\bar{a}_1^P = -\frac{\pi R}{4}\,\hat{i} - \frac{\pi^2 R}{4}\,\hat{j}$

$\bar{V}_2^P = -\frac{\sqrt{2}}{4}\pi R\,\hat{u}$; $\bar{a}_2^P = -\frac{\pi R\sqrt{2}}{16}\,(2 + \pi)\,\hat{u}$

donde 2 es la barra





11.- $\bar{V}_1^{C2} = v\,\hat{i} + \frac{1}{2}v\,\hat{q}$; $\bar{a}_1^{C2} = -\frac{1}{8h}v^2\,\hat{p} + \frac{\sqrt{3}}{12h}v^2\,\hat{q}$

donde 2 es la barra

12.- $\bar{V}_1^P = -\sqrt{2}\,v\,\hat{i}$; $\bar{a}_1^P = \frac{1}{R}v^2\,\hat{i} + \frac{2}{R}v^2\,\hat{j}$

13.- $\bar{a}_1^P = \dfrac{v^2}{(1+x^2)^2}\,(-x\,\hat{i} + \hat{j})$

14.- $\bar{a}_1^P = \dfrac{v^2\,(2+\theta^2)}{3(1+\theta^2)^2}\left[-\theta\,\hat{e}_r + \hat{e}_\theta\right]$

15.- En $\theta = 0$, $\bar{V}_1^P = 2b\omega\,\hat{j}$; En $\theta = \dfrac{\pi}{2}$, $\bar{V}_1^P = -b\omega\,\hat{i} - b\omega\,\hat{j}$

En $\theta = \pi$, $\bar{V}_1^P = \bar{0}$; En $\theta = -\dfrac{\pi}{2}$, $\bar{V}_1^P = b\omega\,\hat{i} - b\omega\,\hat{j}$

16.- $\bar{V}_1^{B3} = v\,\hat{j}$; $\bar{a}_1^{B3} = -\dfrac{2\sqrt{2}}{R}\,v^2\,\hat{j}$

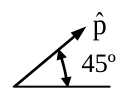
donde 3 es la barra

17.- $\bar{V}_1^P = -\dfrac{1}{2}v\,\hat{i} - v\,\hat{j}$ (m/s) ; $\bar{a}_1^P = -\dfrac{1}{20}v^2\,\hat{i}$ (m/s^2)

$\bar{V}_2^P = -\dfrac{1}{2}v\,\hat{i}$ (m/s) ; $\bar{a}_2^P = -\dfrac{1}{20}v^2\,\hat{i}$ (m/s^2)

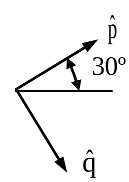
donde 2 es la pieza

18.- $\bar{V}_2^P = -\dfrac{\sqrt{2}}{2}\,v\,\hat{p}$; $\bar{a}_2^P = \dfrac{\sqrt{2}}{4b}\,v^2\,\hat{p}$



donde 2 es la barra

19.- a) $\dot{\beta} = \dfrac{1}{R}v$; b) $\bar{a}_2^A = \dfrac{2\sqrt{3}}{R}\,v^2\,\hat{p} + \dfrac{4}{R}\,v^2\,\hat{q}$



20.- $\bar{V}_1^A = \sqrt{2}\,v\,\hat{i}$; $\bar{a}_1^A = \dfrac{1}{b}v^2\,\hat{i}$

21.- $\bar{V}_1^P = \bar{0}$; $\bar{a}_1^P = -\dfrac{L}{4}\omega^2\,\hat{i} + \dfrac{L\sqrt{3}}{2}\omega^2\,\hat{j}$

$\bar{V}_2^P = \dfrac{L\sqrt{3}}{2}\omega\,\hat{i}$; $\bar{a}_2^P = -\dfrac{L}{4}\omega^2\,\hat{i}$

donde 2 es la pieza triangular

22.- $\bar{V}_1^P = \sqrt{2\pi b}\,R\,(\sqrt{2} - 1)\,\hat{i}$

$\bar{a}_1^P = 2Rb\,\hat{i} - 2(3 - 2\sqrt{2})\,\pi b R\,\hat{j}$

23.- $\left| \bar{a}^{P}_{1t} \right| = 0$

24.- $s = b\,\omega\, t$

25.- b) $\left| \bar{a}^{P}_{1r} \right| = \dfrac{3\,v^2}{4\,b}$

26.- a) $\bar{a}^{P}_{1} = -\sqrt[3]{\dfrac{L\,b^2}{3}}\ \hat{j}$; b) $\bar{a}^{P}_{1} = \left[\dfrac{L\,b^2}{6} (\,3 + \pi\,) \right]^{\frac{1}{3}} \hat{i} + \dfrac{b^2}{288 L} \left[\dfrac{36 L}{b} (\,3 + \pi\,) \right]^{\frac{4}{3}} \hat{j}$

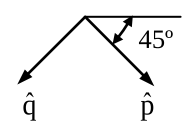
27.- $\bar{V}^{C2}_{1} = -\sqrt{2}\, v\ \hat{i}$; $\bar{a}^{C2}_{1} = -\dfrac{1}{R} v^2\ \hat{i} + \dfrac{2}{R} v^2\ \hat{j}$

donde 2 es la barra

28.- $\bar{V}^{P}_{1} = \dfrac{3}{4} \pi R\ \hat{p}$; $\bar{a}^{P}_{1} = \dfrac{1}{2} \pi R\ \hat{p} + \dfrac{27}{48} \pi^2 R\ \hat{q}$

$\bar{V}^{P}_{2} = -\dfrac{3\sqrt{2}\,\pi R}{8}\ \hat{j}$; $\bar{a}^{P}_{2} = -\dfrac{\sqrt{2}\,\pi R}{32} (\,8 + 9\pi\,)\ \hat{j}$

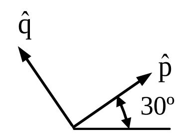
donde 2 es la pieza



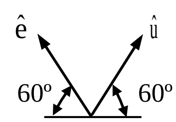
29.- $\bar{V}^{A}_{1} = \dfrac{\sqrt{3}}{2}\ v\ \hat{p}$; $\bar{a}^{A}_{1} = \bar{0}$

$\bar{V}^{A}_{2} = \dfrac{1}{2}\ v\ \hat{q}$; $\bar{a}^{A}_{2} = \bar{0}$

donde 2 es el brazo



30.- $\bar{V}^{P}_{1} = \dfrac{2\pi}{3}\ \hat{i} + \dfrac{2\sqrt{3}\,\pi}{3}\ \hat{j}$ (m/s)



31.- $\bar{V}^{P}_{1} = \dfrac{\sqrt{3}}{3}\, v\ \hat{e}$; $\bar{V}^{P}_{2} = -\dfrac{\sqrt{3}}{3}\, v\ \hat{u}$

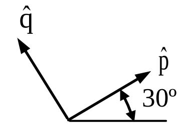
donde 2 es el aro

32.- $\rho = \dfrac{2\sqrt{2\,(\,1 + \cos\omega t\,)}\ b}{3}$

33.- a) $y = h - \dfrac{g}{2} \sqrt[3]{\left(\dfrac{3\,x}{\omega\, g \cos\lambda} \right)^2}$; b) $\delta = \dfrac{2\,\omega\, h \cos\lambda}{3} \sqrt{\dfrac{2\,h}{g}}$

35.- $\bar{V}^{P}_{1} = \sqrt{3}\, R\ \omega\ \hat{j}$; $\bar{a}^{P}_{1} = 3 R\ \omega^2\ \hat{i} - \dfrac{R}{2} \omega^2\ \hat{j}$

36.- $\overline{V}_1^A = \sqrt{2}\, v\, \hat{i}$; $\overline{a}_1^A = -\frac{1}{R} v^2\, \hat{i} - \frac{2}{R} v^2\, \hat{j}$

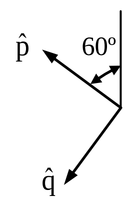


37.- $\overline{V}_1^{B2} = -v\,\hat{i} - \frac{2\sqrt{3}}{3}\, v\, \hat{q}$; $\overline{a}_1^{B2} = \frac{v^2}{9R}\left(-3\,\hat{p} + 7\sqrt{3}\,\hat{q}\right)$

donde 2 es la barra

38.- $\overline{V}_1^P = \left(\frac{\sqrt{3}}{2} L\omega + v\right)\hat{p} + \frac{L}{2}\omega\,\hat{q}$

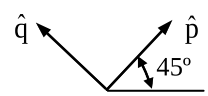
$\overline{a}_1^P = -\frac{3L}{4}\omega^2\,\hat{p} + \omega\left[2v + L\sqrt{3}\,\omega\right]\hat{q}$



39.- $\overline{V}_1^C = \overline{0}$; $\overline{a}_1^C = 2\omega^2 L\,\hat{j}$

40.- $\overline{V}_1^P = -\,0{,}35v\,\hat{i} + 0{,}53v\,\hat{j}$ (m/s)

41.- $\overline{a}_1^P = R\omega^2\,\hat{p} + \left(L - \frac{R\pi}{4}\right)\omega^2\,\hat{q}$



42.- a) $\left|\overline{a}_{1t}^P\right| = b\omega^2 r_o \sqrt{1+b^2}\, e^{b\omega t}$; $\left|\overline{a}_{1n}^P\right| = r_o\,\omega^2\sqrt{1+b^2}\, e^{b\omega t}$

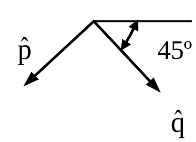
b) $\rho = r_o\sqrt{1+b^2}\, e^{b\omega t}$

43.- $r(t) = \frac{\sqrt{2}}{2}\left[v\,t + \sqrt{2}\, r_o\right]$; $\theta(t) = \mathrm{Ln}\left[\frac{\sqrt{2}\,v}{2\,r_o}\,t + 1\right]$

44.- $\left|\overline{a}_{1r}^P\right| = \frac{8\lambda^2 r_o^2}{r^5}$; donde λ es constante

45.- $\overline{a}_1^A = -\frac{b^4}{a^2 y^3} v^2\,\hat{j}$

46.- $\overline{V}_1^A = \frac{\pi R}{4}\,\hat{p}$; $\overline{a}_1^A = \frac{\pi R}{8}\,\hat{p} + \frac{\pi^2 R}{16}\,\hat{q}$



47.- $\overline{V}_1^C = -\sqrt{2}\, v\,\hat{i}$; $\overline{a}_1^C = \frac{1}{R} v^2\,\hat{i} - \frac{2}{R} v^2\,\hat{j}$

48.- $\overline{V}_1^A = 2\,v\,\hat{j}$; $\overline{a}_1^A = \overline{0}$

$\overline{V}_2^A = v\,\hat{j}$; $\overline{a}_2^A = \overline{0}$

donde 2 es la pieza

49.- a) $x^2 + y^2 = \left(\frac{L}{2}\right)^2$; b) $\overline{V}_1^{C\,2} = \frac{1}{2}\,v\,\hat{i} - \frac{1}{2}\,v\,\hat{j}$

donde 2 es la barra y C su punto medio

51.- a) $t = \sqrt{\frac{1}{2\,b}}$; b) $\overline{V}_1^{P'} = -\,0{,}47\,\sqrt{b}\;R\;\hat{j}$

52.- R = 12 (m)

53.- s = 8 b

54.- a) $\overline{V}_1^A = \frac{v\sqrt{1+4\,x^2}}{(1+8\,x^2)}(\,\hat{i} + 4\,x\,\hat{j}\,)$; b) $\dot{\varphi} = \frac{2\,v}{(1+8\,x^2)\sqrt{1+4\,x^2}}$; c) $\overline{a}_2^A = \overline{0}$

donde 2 es la varilla OB

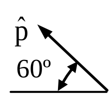
55.- $\overline{V}_1^P = \frac{R}{2}\cos(\frac{1}{4})\,\hat{j}$; $\overline{a}_1^P = \frac{R}{16}\left(4\cos(\frac{1}{4}) - \operatorname{sen}(\frac{1}{4})\right)\hat{j}$

56.- a) $\overline{V}_1^P = \overline{0}$; $\overline{a}_1^P = -\frac{v^2}{R}\,\hat{i}$

b) $\overline{V}_2^P = v\,\hat{j}$; $\overline{a}_2^P = -\frac{v^2}{R}\,\hat{i}$

donde 2 es el aro

57.- $t = \frac{\pi}{2}\sqrt{\frac{R}{a}}$

58.- a) $\overline{V}_1^B = \frac{2\sqrt{3}}{3}\,v\,\hat{p}$ 

b) $\dot{\theta} = \frac{2\sqrt{3}}{3\,L}\,v$

59.- $\dot{\theta} = -\frac{4\sqrt{3}}{9}$ (rad/s) ; $\ddot{\theta} = -\frac{64\sqrt{3}}{81}$ (rad/s^2)

60.- $\overline{V}_1^E = \frac{25}{3}\,\hat{j}$ (m/s) ; $\overline{a}_1^E = \frac{400}{27}\,\hat{j}$ (m/s^2)