Cartesian Motion

Engineering Mechanics: Dynamics

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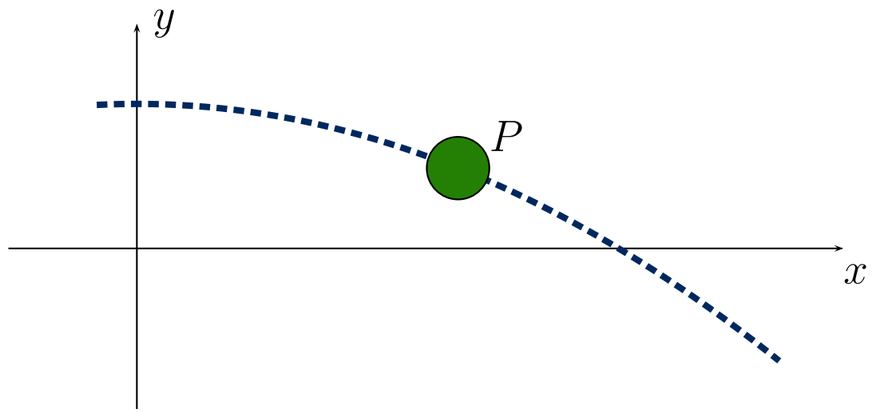
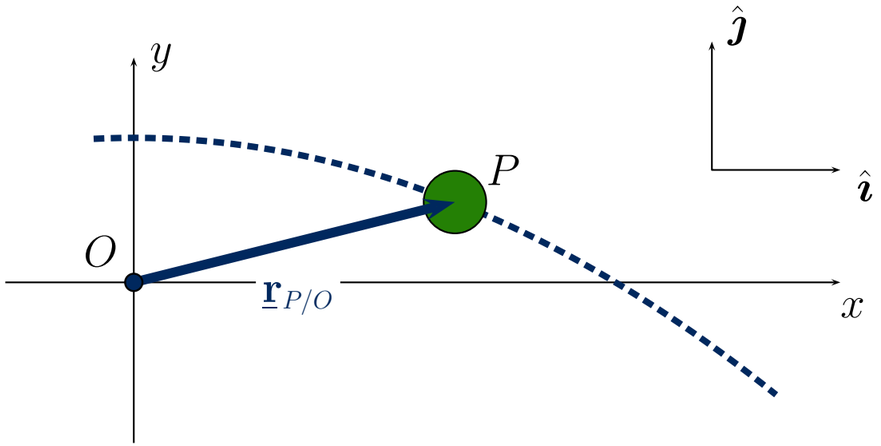
A particle moves along a parabolic path $y(x) = a - c\,x^2$, with $x(t) = v\,t$. Find the velocity and acceleration of the particle.





The position of the particle can be written as

$$\underline{\mathbf{r}}_{P/O}(t) = x(t)\,\hat{\boldsymbol{\imath}} + y(t)\,\hat{\boldsymbol{\jmath}} = (x(t))\;\hat{\boldsymbol{\imath}} + \left(a - c\,(x(t))^2\right)\;\hat{\boldsymbol{\jmath}},$$
$$= (v\,t)\;\hat{\boldsymbol{\imath}} + \left(a - c\,(v\,t)^2\right)\;\hat{\boldsymbol{\jmath}}.$$

Therefore the velocity and acceleration can be written as

$$\underline{\mathbf{v}}_P = \frac{d}{dt}\left(\underline{\mathbf{r}}_{P/O}\right) = (v)\;\hat{\boldsymbol{\imath}} + \left(-2\,c\,v^2\,t\right)\;\hat{\boldsymbol{\jmath}},$$
$$\underline{\mathbf{a}}_P = \frac{d}{dt}\left(\underline{\mathbf{r}}_{P/O}\right) = \left(-2\,c\,v^2\right)\;\hat{\boldsymbol{\jmath}}.$$

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