

Imp 13

TANGENTIAL AND NORMAL DIRECTION:-

A line which touches a curve (path) in only one point is called tangent. The line \perp to the tangent is called normal. The direction along tangent is called tangential direction and along normal is called normal direction.

The unit vector in tangential and normal direction are \underline{t} and \underline{n} respectively.

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Tangential and Normal Components of Velocity and Acceleration:-

Velocity: If position vector of a particle at time

t is $r = xi + yj$

its velocity

$$V = \frac{dr}{dt} = \frac{dx}{dt}i + \frac{dy}{dt}j$$

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its Speed or magnitude of velocity.

$$v = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} \Rightarrow \frac{ds}{dt}$$

$$v = \frac{ds}{dt} \rightarrow (i)$$

where s is arc length along the trajectory.

$\frac{dr}{dt} \rightarrow$ By chain rule $\Rightarrow v = \frac{dr}{ds} \cdot \frac{ds}{dt} \Rightarrow \frac{ds}{dt} = v$

$\Rightarrow v \cdot \frac{dr}{ds} \rightarrow (ii)$

Now we will determine $\frac{dr}{ds}$

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