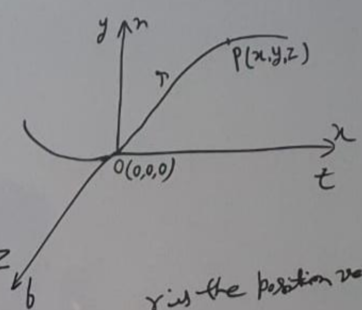
Behaviour of a curve in the nbd of a point:—

Let (t, n, b) be the unit vector along (x, y, z) axis, $P(x,y,z)$ be point on curve



$r = r(s)$

s.t. $OP = s$

then $r = xt + yn + zb$ — (1)

expand $r = r(s)$ by Taylor series about $s = 0$

r is the position vector

$$F(a+h) = F(a) + hF'(a) + \frac{h^2}{\lfloor 2}F''(a) + \cdots$$

$r = r(0+s)$

$$r = r(0) + s r'(0) + \frac{s^2}{\lfloor 2} r''(0) + \frac{s^3}{\lfloor 3} r'''(0) \quad \text{— (2)}$$

Put $r(0) = 0$ at origin

$r'(0) = t \Rightarrow r''(0) = Kn$

$$r'''(0) = K'n + Kn'$$

$$= K'n + K(\tau b - Kt)$$

$$r'''(0) = K'n - K^2 t + K\tau b$$

Put these value in (2)

$$r = st + \frac{s^2}{\lfloor 2} Kn + \frac{s^3}{\lfloor 3}(K'n - K^2 t + K\tau b) + \cdots \quad \text{— (3)}$$

Put r from (1)

$$xt + yn + zb = \left(s - \frac{s^3}{\lfloor 3}K^2 + \cdots\right)t + \left(\frac{s^2 K}{\lfloor 2} + \frac{K' s^3}{\lfloor 3} + \cdots\right)n + \left(\frac{K\tau s^3}{\lfloor 3} + \cdots\right)b$$

Equate the coefficient of t, n, b on both side, we get canonical eqn

$$x = s - \frac{s^3 K^2}{6} \quad \text{— (4)}$$

$$y = \frac{s^2 K}{2} + \frac{K' s^3}{6} \quad \text{— (5)}$$

$$z = \frac{K\tau s^3}{6} \quad \text{— (6)}$$

Eqn (4), (5) & (6) are the canonical eqn.