generically defined:

$c = tD.tD$

newline

note : since we are solving for 't', we must leave it out of the equation

(x + tD)*(x + tD) = x^2 + 2xtD + tD^2

$(-b \pm \sqrt{(b^2 - 4ac)})/2a = t0, t1$

newline

Using generically defined expansion we now get:

newline

(x0^2 + 2x0tDx) + tDx^2 + (y0^2 + 2y0tDy) + tDy^2 + (z0^2 + 2z0tDz) + tDz^2 – r^2 = 0

newline

expanded a little bit more:

newline

(x0^2 + 2x0t) + t(x0 – pcX)^2 + (y0^2 + 2y0tDy) + t(y0 – pcY)^2 + (z0^2 + 2z0tDz) + t(z0 – pCz)^2 – r^2 = 0

newline

tD^2 = (tp0 – tpC)^2 = tp0^2 + 2tp0tpC + tpC^2

newline

newline

Quadratic form:

newline

a = x0^2 + y0^2 + z0^2 + r^2

newline

b = 2x0tDx + 2y0tDy + 2z0tDz

newline

c = t(p0x – pcx)^2 + t(p0y – pcy)^2 + t(p0z – pcz)^2 =

newline

as a series of vector products:

newline

a = p0.p0 – r^2

newline

b = 2p0.tD

newline

c = tD.tD

newline

note: since we are solving for 't', we must leave it out of the equation

newline

(–b +– sqrt(b^2 – 4ac)) / 2a = t0, t1