Velocity and acceleration is Spherical Polar Coordinates The Position Vector is spherical Polar coordinate is given by i = 2ityitak X = YSMOCOSO 7= 7 sind sind 7= 1 cos 0 in it - I sind cosp ? + I sindsing j + I coso k

The unit Vectors er, eo and eq along r, o and of are

 $e^{2} = \frac{3?}{3r} = \sin \cos \phi i + \sin \phi i$ $\frac{1}{3?}$ + kcoso

as $\left| \frac{\partial \vec{r}}{\partial r} \right| = \sqrt{\sin \cos \phi + \sin \phi + \cos \phi}$

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es = 37 = Y cosocospí+ Y cososin pí-Ysino k 127 12 Ccoso coso + coso sin o + sino = Cosocoso i + cososino i - sino k $e^{\phi} = \frac{\partial \vec{r}}{\partial \phi} = -\sqrt{\sin \phi \sin \phi} + \sqrt{\sin \phi \cos \phi}$ 139 125 2 (Sin \$ + cos \$) = - sing i + cos & j Using Natice of en in equation (1) we get So the Velocity is given by $\vec{v} = \frac{d\vec{v}}{dt} = \frac{d}{dt} (\vec{v} \cdot \vec{v})$ = drer + rd (en)

N= rentrater) -3

Expression for Acceleration The acceleration is given by. a = 47 = d [rer troe o trainope) a = d (ver) + d (voeo) + de (1sinopep) d= rer trd (er) + roeo + rod (eo) F rise of risinoper + rcosooper + rsinop de (e) + rsinoer of Now de (ea) = de (cosocospitososiopi)
- ksino) = - Sinoo cospi - coso sind & i - sino o sindi t & cosocosp j - k cosoco

de (co) = -o[sinocosp i + sino sin \$j + coso + \$ coso (-sin\$ i + cos\$ i) = -0e,+ + cosoep -> (7) (Using values of ex and eg) de (eq) = d (-sindi + cos di) = - cosp p ? - sindp ; - 28 so using the values of de (en) de (en) and de (ep) in eq? (6) ue get d= rer+r(oeo+psinoeq)+roeo+ 70000+ 70 (-0er+ 000000)+ rsinopep + ressoupep + 1 sino \$ (- cos \$ \$ i - sin \$ \$ j) + 7 sinde q

2 = rev + roea + ro ono eq + roea + roeo - rôzer + rop cosoeq + YSINO ΦΕΦ + YCOSO O ΦΕΦ + YSINO ΕΦΦ -Y SINO Φ C COS Φ î + SIÑO ΕΦΦ ĵ) Cospit sing i = Sincer + coso eo a= rer + roeo + roeo + 10 e/o - 10° e/ + 100 cosoco + isino pept reordopept y sinde p -7sinop2 (Sinoer+coroen) à = rentroeotrosinoeotroeot roeo-roer tropcosoept r sino que q + r coso o que q + r sino eq q - Ysinoper - Ysinocosopeo

a = (7-70- prsing) ert. (70+270-75100cosopi2) en+ (7 sino \$ + 2 r \$ sino + 2 r cos o \$) e which is the empression For acceleration of a Particle in Spherical polar Coordinates.