1. **DINAMICA NEWTONIANA: VERIFICA DELLA FORMULA DELL’ENERGIA**

Potenziale U(x)= x^2/2 (oscillatore armonico)

N=500000; dt=0.0001; sig=0.2

X=1:N; V=X

posizione=c(-2,2); velocità=c(-2,2)

plot(posizione,velocità,type="n")

lines(c(-2,2),c(0,0))

lines(c(0,0),c(-2,2))

x=seq(-1,1,0.01)

lines(x,sqrt(1-x^2))

lines(x,-sqrt(1-x^2))

X[1]=1; V[1]=0

for (i in 1:(N-1)) {

X[i+1]=X[i]+dt\*V[i]

V[i+1]=V[i]+dt\*(-X[i])+sig\*sqrt(dt)\*rnorm(1)

lines(X[i:(i+1)],V[i:(i+1)],col="red")

}

Tentativo di verifica della formula teorica:

N=40000; dt=0.0001; sig=0.2

Nprove=60

XX=1:Nprove; VV=1:Nprove

X=1:N; V=X

plot(c(-2,2),c(-2,2))

lines(c(-2,2),c(0,0)); lines(c(0,0),c(-2,2))

x=seq(-1,1,0.01); lines(x,sqrt(1-x^2)); lines(x,-sqrt(1-x^2))

for (j in 1:Nprove) {

X[1]=1; V[1]=0

for (i in 1:(N-1)) {

X[i+1]=X[i]+dt\*V[i]

V[i+1]=V[i]+dt\*(-X[i])+sig\*sqrt(dt)\*rnorm(1)

}

XX[j]=X[N]; VV[j]=V[N]

lines(XX[j],VV[j],type="p")

}

deltaE.teo=sig^2/2\*N\*dt

deltaE.sper=0.5\*mean(XX^2+VV^2)- 0.5

deltaE.teo; deltaE.sper