%Homework 1 exercice 2 -- Rotation matrices %involved m files : none close all;clear all; %initialisations + parameters for the plots x=[-1:0.05:1]; y=sqrt(1-x.^2); unit=zeros(length(x),1)+1; r=rand(3,1); r=1/norm(r)*r; pouet=sqrt(1-r(1)^2); x3=[-1:0.05:1]*pouet; y3=sqrt(1-x.^2)*pouet; for i=1:4 %====random alpha======= alpha(i)=rand(1)/rand(1); %(using pi/2 for deductions) %====initializing matrices====== B=[cos(alpha(i)), sin(alpha(i)) -sin(alpha(i)), cos(alpha(i))]; A1=[1,0,0 0,cos(alpha(i)),-sin(alpha(i)) 0 sin(alpha(i)),cos(alpha(i))]; A2=[cos(alpha(i)),0,sin(alpha(i)) 0,1,0 -sin(alpha(i)),0,cos(alpha(i))]; A3=[cos(alpha(i)),-sin(alpha(i)),0 sin(alpha(i)),cos(alpha(i)),0 0,0,1]; % ===initializing vectors===== t2=[1;2]; t3=[1;2;3]; %===1) Matrices applied on the vectors R1=A1*t3 R2=A2*t3 R3=A3*t3 R4=B*t2 %==We can see that every matrix is a rotation matrix--> %--> the coordinate of the vector corresponding to the spinning %axis don't change ! if 1 %plotting plot(0:t2(1)/2:t2(1),0:t2(2)/2:t2(2)); hold on; plot(0:R4(1)/2:R4(1),0:R4(2)/2:R4(2)); hold on; plot(x,y,'mo'); hold on; plot(x,-y,'mo'); axis([-1 1 -1 1]) %===THIS PLOT HAS ORIGINALLY BEEN DRAWN WITH OTHER T2 VECTORS !!===== end %===2)Properties of the matrices==== if 1 %==determinant== det(A1) det(A2) det(A3) det(B) %==The determinant of the matrices is always 1 %===orthogonality=== A1*A1' A1'*A1 A2*A2' A2'*A2 A3*A3' A3'*A3 B*B' B'*B %===The matrices are orthogonal %===We expect the previous results, because thoses matrices %rotation matrices, who are othogonal and have a det=1. %===3)order of application A1*A2*t3 A2*A1*t3 %==The order of application is important. As we can see below %, the different matrices does not commute. But the commutator % results in a antisymmetric matrix. norme=norm(A2*A3-A3*A2) norm(A1*A3-A3*A1) norm(A1*A2-A2*A1) norm(A1*A1-A1*A1) %==geometrical interpretation : spin twice the same vector two %times, but inversing the order of spinning. Then soustraction. end if 1 %==4) Application on a vector======== %==vector creation+ application of matrices r1=A1*r; r2=A2*r; r3=A3*r; rx=[0:r(1)/100:r(1)]; ry=[0:r(2)/100:r(2)]; rz=[0:r(3)/100:r(3)]; rx1=[0:r1(1)/100:r1(1)]; ry1=[0:r1(2)/100:r1(2)]; rz1=[0:r1(3)/100:r1(3)]; rx2=[0:r2(1)/100:r2(1)]; ry2=[0:r2(2)/100:r2(2)]; rz2=[0:r2(3)/100:r2(3)]; rx3=[0:r3(1)/100:r3(1)]; ry3=[0:r3(2)/100:r3(2)]; rz3=[0:r3(3)/100:r3(3)]; %==we see the norm is the same norm(r1) norm(r2) norm(r3) norm(r) %==plotting (we can have the same result with r2x,y,z and r3x,y,z== plot3(rx,ry,rz,'k-'); hold on; plot3(rx1,ry1,rz1,'b') hold on; plot3(rx(end)*unit,x3,y3,'mo'); hold on; plot3(rx(end)*unit,x3,-y3,'mo'); hold on; plot3(0:rx(end)/2:rx(end),0:1e-6/2:1e-6,0:1e-6/2:1e-6,'k-.') grid('on') xlabel('x'); ylabel('y'); zlabel('z'); end end if 1 %=====5)Facultative point==== r=[1,1e-15,1e-15]'; r1=A1*A2*A3*r; r2=A3*A3*A1*r; r3=A2*A1*A3*r; rx=[0:r(1)/100:r(1)]; ry=[0:r(2)/100:r(2)]; rz=[0:r(3)/100:r(3)]; rx1=[0:r1(1)/100:r1(1)]; ry1=[0:r1(2)/100:r1(2)]; rz1=[0:r1(3)/100:r1(3)]; rx2=[0:r2(1)/100:r2(1)]; ry2=[0:r2(2)/100:r2(2)]; rz2=[0:r2(3)/100:r2(3)]; rx3=[0:r3(1)/100:r3(1)]; ry3=[0:r3(2)/100:r3(2)]; rz3=[0:r3(3)/100:r3(3)]; figure plot3(rx,ry,rz); hold on; plot3(rx1,ry1,rz1,'m') hold on; plot3(rx2,ry2,rz2,'r') hold on; plot3(rx3,ry3,rz3,'k') grid('on') end %It's nice !