

Ex. 1) Sa se scrie o functie Matlab care sa foloseasca definitia curbei Bézier pentru orice grad.
Aplicatie pentru poligonul de control definit de

$x=[0, 1, 0, 1, 2, 3, 4, 3, 4]$, $y=[0, 0, 2, 4, 5, 4, 2, 0, 0]$.

bezier.m :

```
function bez=bezier(x,y)
syms t real;
n=length(x)-1;
j=0:n;
b=(factorial(n)./(factorial(j).*factorial(n-j))).*(t.^j).*((1-t).^(n-j))
bez=simplify([x;y]*b');
end
```

aplicatie.m:

```
x=[0,1,0,1,2,3,4,3,4];
y=[0,0,2,4,5,4,2,0,0];
r=bezier(x,y)
ezplot(r(1),r(2),[0,1])
hold on
plot(x,y,'x--g')
```

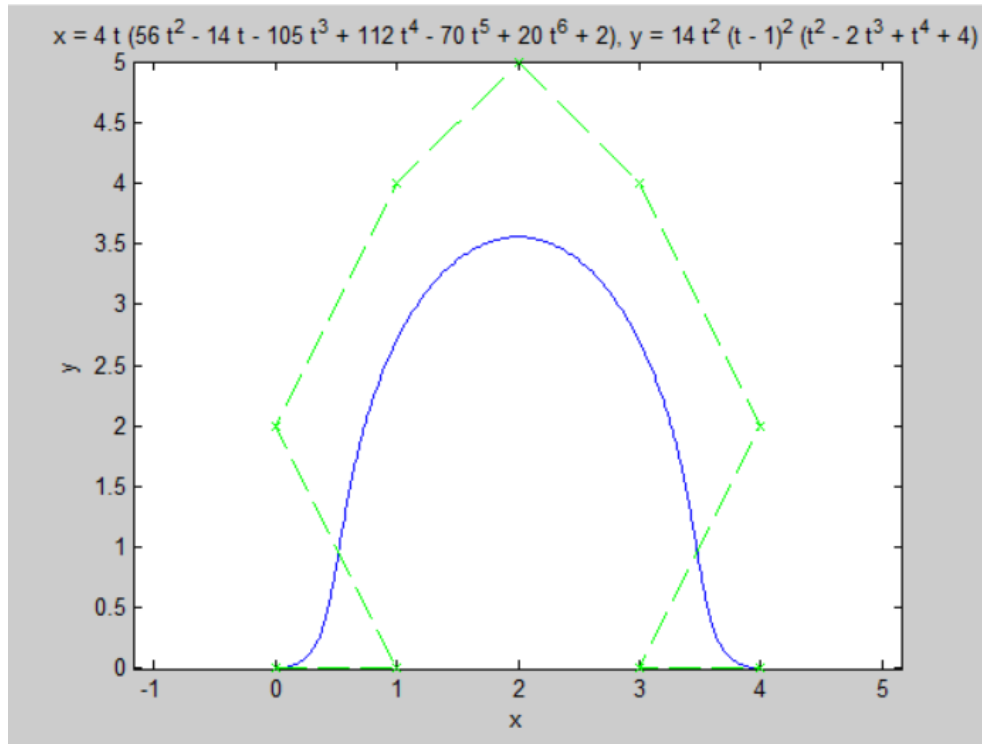
Raspuns Matlab:

b =

```
[ (t - 1)^8, -8*t*(t - 1)^7, 28*t^2*(t - 1)^6, -56*t^3*(t - 1)^5, 70*t^4*(t - 1)^4, -56*t^5*(t - 1)^3, 28*t^6*(t - 1)^2, -8*t^7*(t - 1), t^8]
```

r =

```
4*t*(20*t^6 - 70*t^5 + 112*t^4 - 105*t^3 + 56*t^2 - 14*t + 2)
14*t^2*(t - 1)^2*(t^4 - 2*t^3 + t^2 + 4)
```



Ex. 2) Scrieti o functie Matlab care sa simuleze schema lui de Casteljaou.

```

function out=C(x,y,alpha,n)
A=zeros(n,n);
A(:,1)=x;
B=zeros(n,n);
B(:,1)=y;
for i=2:n
    for j=2:n
        A(i,j)=(1-alpha)*A(i-1,j-1)+alpha*A(i,j-1);
    end
end
for i=2:n
    for j=2:n
        B(i,j)=(1-alpha)*B(i-1,j-1)+alpha*B(i,j-1);
    end
end
out=[A(n,n),B(n,n)];

```

Ex. 3) Consideram curba $\gamma(t) = (a * \cos(\pi t), a * \sin(\pi t), c * t)$, unde a si c sunt constant reale (elicea circulara). Fie punctele: $P_0 = \gamma(0) = (a, 0, 0)$, $P_3 = \gamma(1) = (-a, 0, c)$. Fie acum $P_1 = P_0 + \frac{1}{3} \gamma'(0) = (a, a * \frac{\pi}{3}, \frac{c}{3})$ si $P_2 = P_3 - \frac{1}{3} \gamma'(1) = (-a, a * \frac{\pi}{3}, \frac{2c}{3})$.

- Sa se reprezinte grafic elicea pe intervalul $[-2, 2]$.
- Sa se reprezinte cubica Bezier corespunzatoare poligonului de control $P_0P_1P_2P_3$.

```
clear
a=1;
c=3;
h=0.01;
t=0:h:1;
s=-2:h:2;

x=a*cos(pi*s);
y=a*sin(pi*s);
z=c*s;

plot3(x,y,z)
hold on

b0=(1-t).^3;
b1=3*t.*(1-t).*(1-t);
b2=3*t.*t.*(1-t);
b3=t.^3;

x0=a;
y0=0;
z0=0;

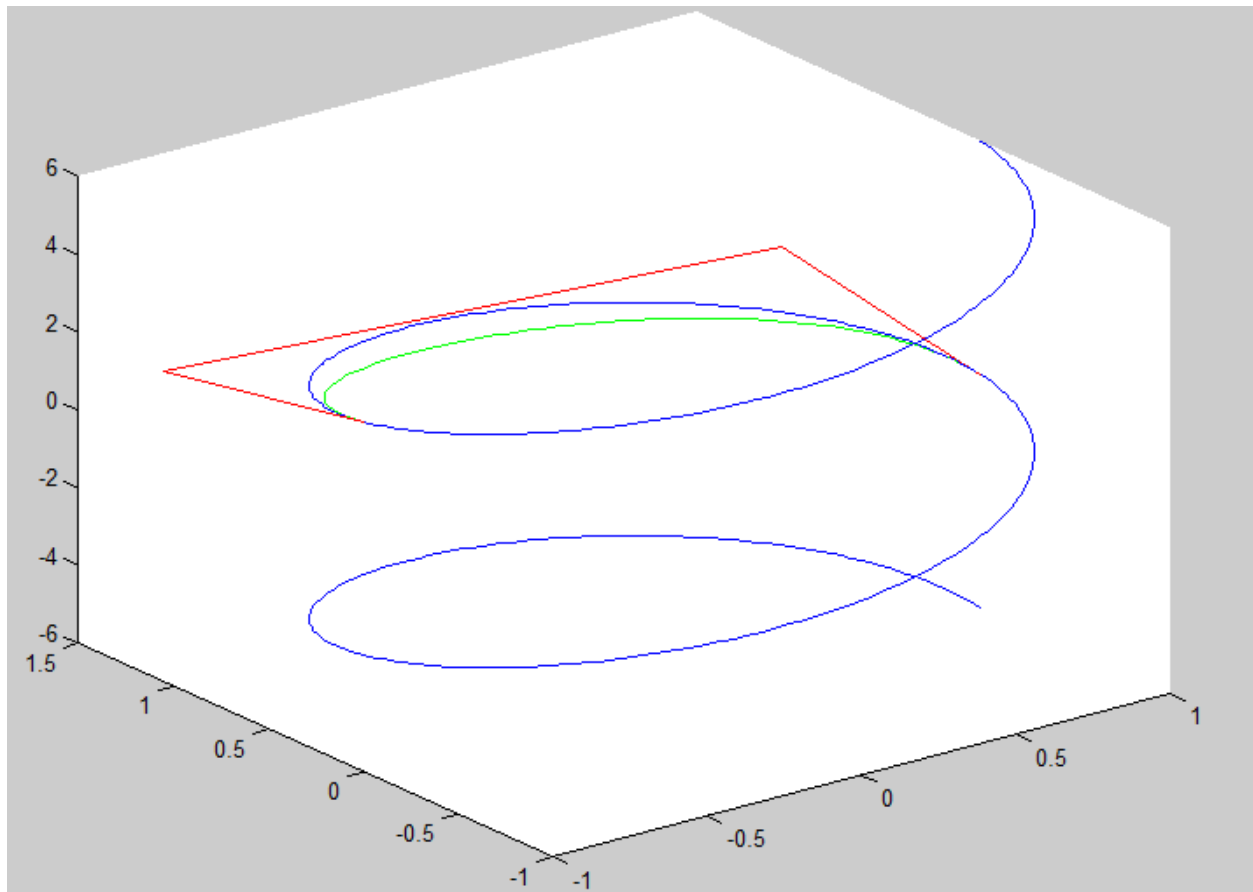
x3=-a;
y3=0;
z3=c;

x2=-a;
y2=(a*pi)/3;
z2=(2*c)/3;

x1=a;
y1=(a*pi)/3;
z1=c/3;

x=x0*b0+x1*b1+x2*b2+x3*b3;
y=y0*b0+y1*b1+y2*b2+y3*b3;
z=z0*b0+z1*b1+z2*b2+z3*b3;
plot3(x,y,z,'g')
```

```
xx=[x0 x1 x2 x3];  
yy=[y0 y1 y2 y3];  
zz=[z0 z1 z2 z3];  
plot3(xx,yy,zz,'r')
```



elicea

poligonul de control

cubica Bezier