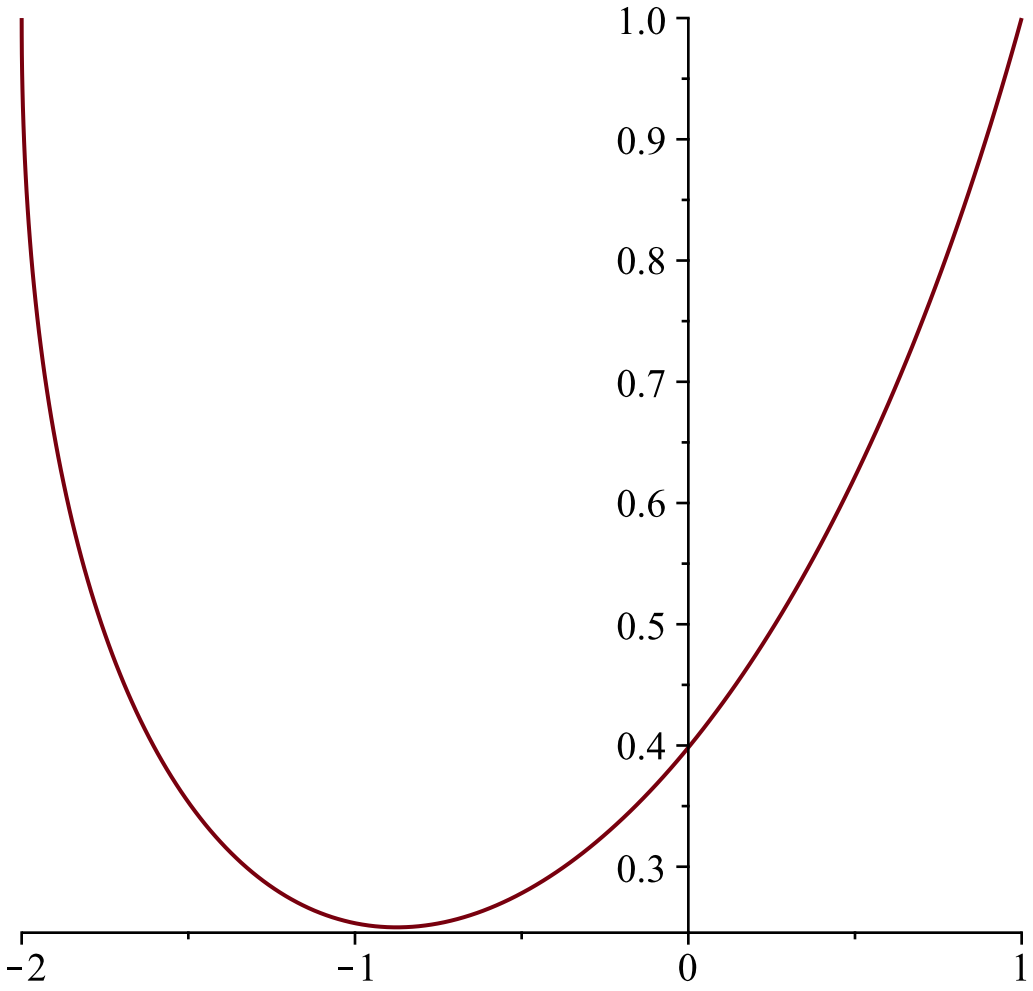
Inna Williams

```
##########################################################################
 1. Plot the Bezier curve in exercise 1b
##########################################################################
> with(plots) :
> bezier:=proc(param)
              local x1, x2, x3, x4, y1, y2, y3, y4, bx, cx, bvy, cy, fx, fy, dx, dy;
              x1:=param[1, 1]; y1:=param[1, 2];
              x2:=param[2, 1]; y2:=param[2, 2];
              x3:=param[3, 1]; y3:=param[3, 2];
              x4:=param[4, 1]; y4:=param[4, 2];
              bx:=3*(x2-x1); bvy:=3*(y2-y1);
              cx:=3*(x3-x2)-bx; cy:=3*(y3-y2)-bvy;
              dx:=x4-x1-bx-cx; dy:=y4-y1-bvy-cy;
              fx:=t->x1+bx*t+cx*t^2+dx*t^3;
              fy:=t->y1+bvy*t+cy*t^2+dy*t^3;
              plot([fx(t), fy(t), t=0..1]);
            end proc:
> data1 := [[1, 1], [0, 0], [-2, 0], [-2, 1]];
                        data1 := [[1, 1], [0, 0], [−2, 0], [−2, 1]]                    (1)
> plot1 := bezier(data1) : display(plot1);
```



##

2. Do exercise 5 using Maple

5. Describe the character drawn by the following two-piece Bezier curve:
(0,2) (1,2) (1,1) (0,1)
(0,1) (1,1) (1,0) (0,0)

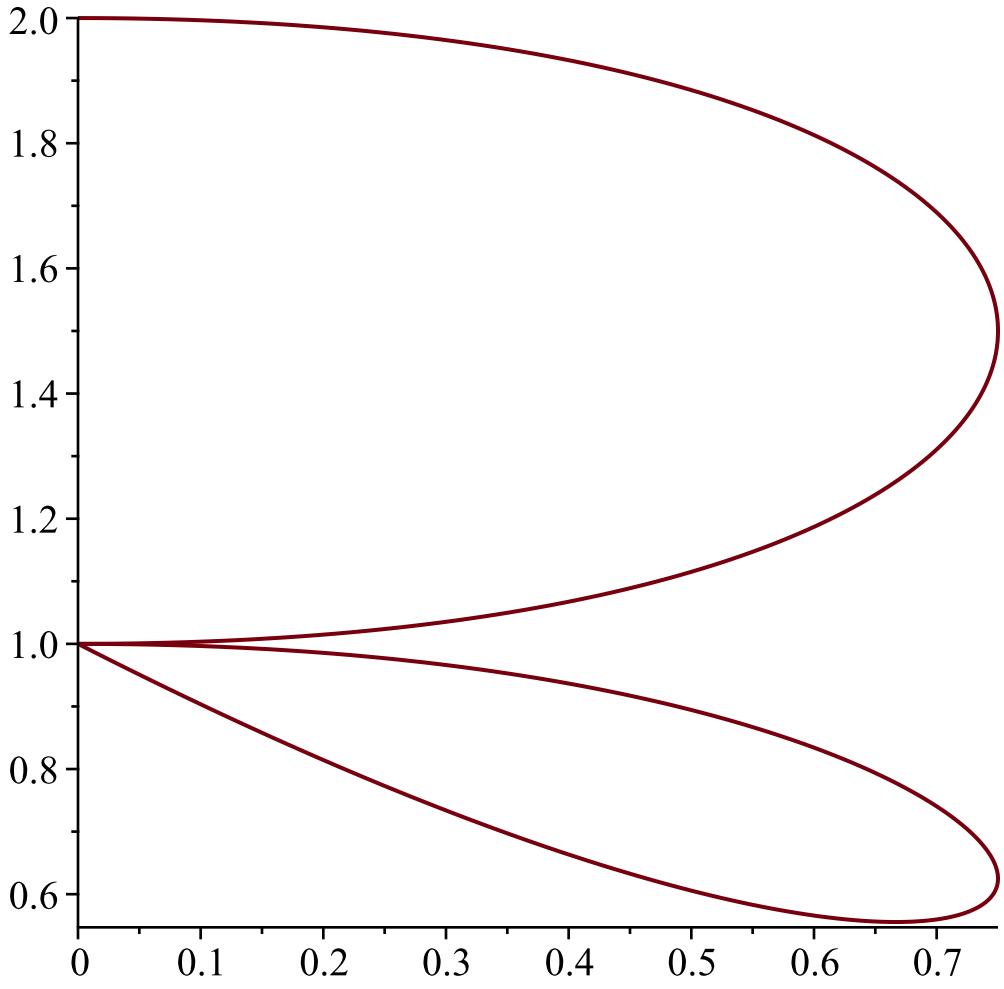
```
> data1 := [[0, 2], [1, 2], [1, 1], [0, 1]];
```

$$data1 := [[0, 2], [1, 2], [1, 1], [0, 1]] \quad (2)$$

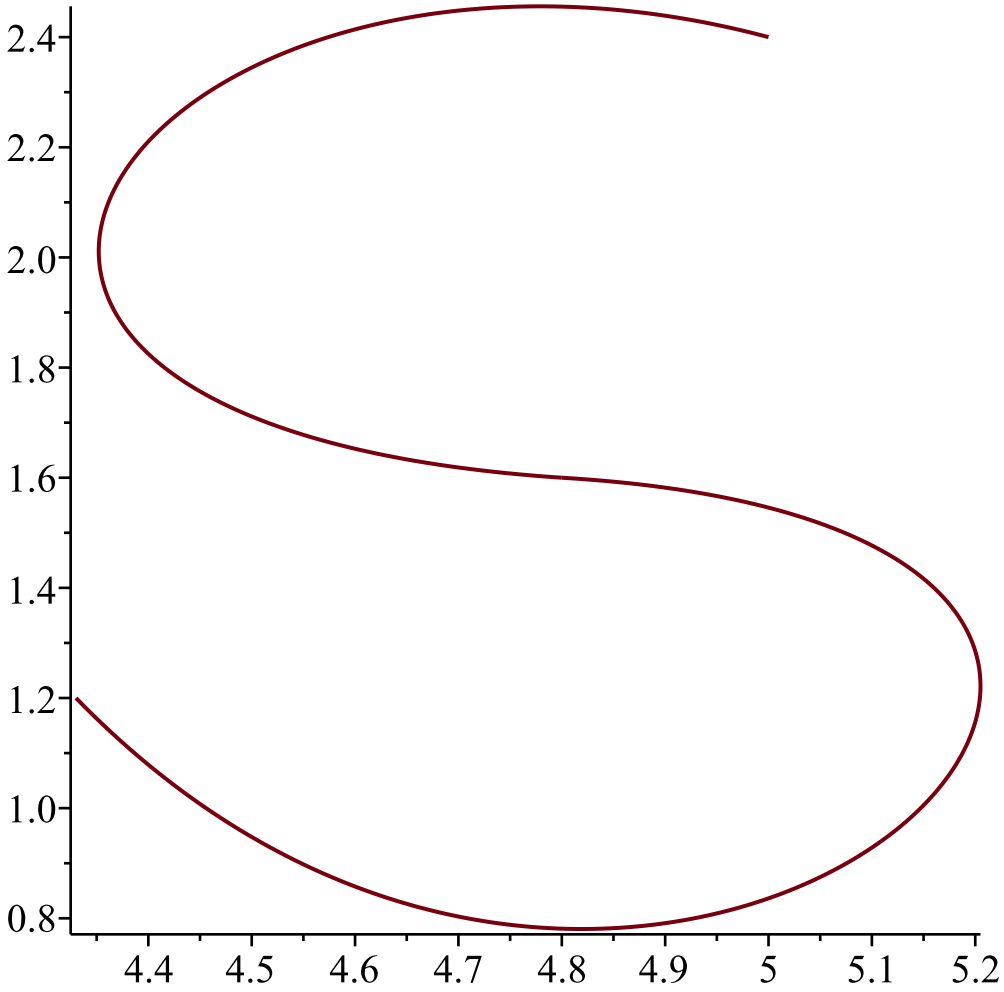
```
> data2 := [[0, 1], [1, 1], [1, 0], [0, 1]];
```

$$data2 := [[0, 1], [1, 1], [1, 0], [0, 1]] \quad (3)$$

```
>
> display(bezier(data1), bezier(data2))
```




```
##############################################################################
  3. Construct a Bezier curve that models the shape of letter S
##############################################################################
>
> data1 := [[5, 2.4], [4.4, 2.7], [4, 1.7], [4.8, 1.6]];
                    data1 := [[5, 2.4], [4.4, 2.7], [4, 1.7], [4.8, 1.6]]   (4)
> data2 := [[4.8, 1.6], [5.7, 1.5], [4.9, 0.1], [4.33, 1.2]]
                    data2 := [[4.8, 1.6], [5.7, 1.5], [4.9, 0.1], [4.33, 1.2]]   (5)
> display(bezier(data1), bezier(data2))
```



curve1:

>

bx=3*(x2-x1) = 3*(4.4-5)= -1.8
cx=3*(x3-x2) = 3*(4-4.4)= -1.2
dx = x4-x1-bx-cx= 4.8-5+1.8+1.2=2.8

by=3*(y2-y1)=3*(2.7-2.4)= 0.9
cy=3*(y3-y2)=3*(1.7-2.7)= -3
dy= 1.6 - 2.4 -0.9 +3 = 1.3

X1(t) = 5 - 1.8* t - 1.2*t^2 + 2.8*t^3
Y1(t) = 2.4 + 0.9* t - 3.0*t^2 -+1.3*t^3

curve2:
bx=3*(x2-x1) = 3*(5.7-4.8)= 2.7
cx=3*(x3-x2) = 3*(4.9-5.7)= -2.4
dx = x4-x1-bx-cx= 4.33-4.8-2.7+2.4=-0.77

by=3*(y2-y1)=3*(1.5-1.6)= -0.3
cy=3*(y3-y2)=3*(0.1-1.5)= -4.2
dy= y4-y1-by-cy=1.2 - 1.6 + 0.3 + 4.2 = 4.1

X2(t) = 4.8 - 2.7* t - 2.4*t^2 - 0.77*t^3

Y2(t) = 1.6 - 0.3* t - 4.2*t^2 + 4.1*t^3

Answer:
2 curves were used to create letter S:
X1(t) = 5 - 1.8* t - 1.2*t^2 + 2.8*t^3
Y1(t) = 2.4 + 0.9* t - 3.0*t^2 +1.3*t^3

X2(t) = 4.8 - 2.7* t - 2.4*t^2 - 0.77*t^3
Y2(t) = 1.6 - 0.3* t - 4.2*t^2 + 4.1*t^3

##########

4. Design a geeky heart shape using two symmetric Bezier curves.

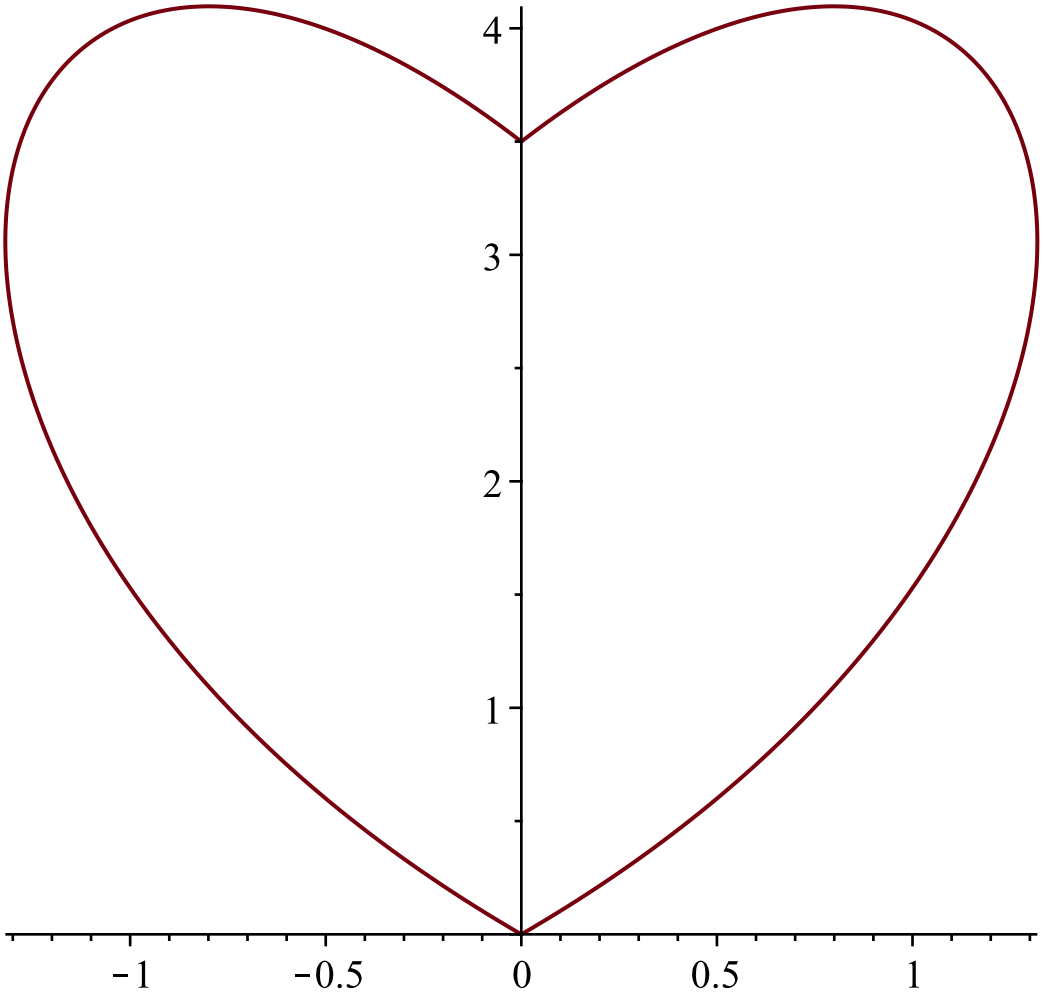
```
> data1 := [[0, 3.5], [1.5, 5.5], [2, 2], [0, 0]];
```

$$data1 := [[0, 3.5], [1.5, 5.5], [2, 2], [0, 0]] \quad (6)$$

```
> data2 := [[0, 3.5], [-1.5, 5.5], [-2, 2], [0, 0]]
```

$$data2 := [[0, 3.5], [-1.5, 5.5], [-2, 2], [0, 0]] \quad (7)$$

```
> display(bezier(data1), bezier(data2))
```



```
###############################################################################
>
```

bx=3*(x2-x1) = 3*(1.5-0)= 4.5
cx=3*(x3-x2) = 3*(2-1.5)= 1.5
dx = x4-x1-bx-cx= 0-0-4.5-1.5= -6

by=3*(y2-y1)=3*(5.5-3.5)= 6
cy=3*(y3-y2)=3*(2.0-5.5)= -10.5
dy= y4-y1-by-cy = 0 - 0 - 6 + 10.5 = 4.5

X1(t) = 0 + 4.5* t - 1.5*t^2 - 6.0*t^3
Y1(t) = 3.5 + 6.0* t - 10.5*t^2 +4.5*t^3

curve2:
bx=3*(x2-x1) = 3*(-1.5-0)= -4.5
cx=3*(x3-x2) = 3*(-2.0+1.5)= -1.5
dx = x4-x1-bx-cx= 0-0+4.5+1.5= 6.0

by=3*(y2-y1)=3*(5.5-3.5)= 6.0
cy=3*(y3-y2)=3*(2.0-5.5)= -7.5
dy= y4-y1-by-cy= 0 - 0 - 6.0 +7.5 = 1.5

X2(t) = 0 - 4.5* t - 1.5*t^2 + 6.0*t^3
Y2(t) = 3.5 + 6.0* t - 7.5*t^2 + 1.5*t^3

Answer:
2 curves were used to create letter S:

X1(t) = 0 + 4.5* t - 1.5*t^2 - 6.0*t^3
Y1(t) = 3.5 + 6.0* t - 10.5*t^2 +4.5*t^3

X2(t) = 0 - 4.5 * t - 1.5*t^2 + 6.0*t^3
Y2(t) = 3.5 + 6.0* t - 7.5*t^2 + 1.5*t^3

```
>
```