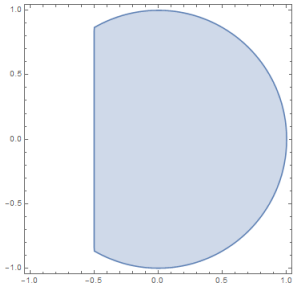
More examples of plotting by Mathematica

Below are some examples of plotting in Mathematica. To learn more options to each function, one can press F1 and type the function's name.

1. Regions: **RegionPlot** (2D region), **ParametricPlot** (2D region), **RegionPlot3D** (3D region).

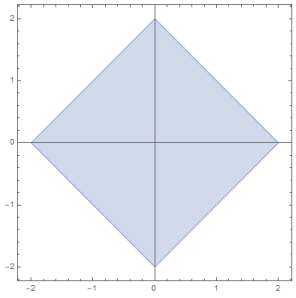
   - Shade the 2D region of points (x, y) inside the circle $x^2 + y^2 = 1$ and on the right of the line $x = -1/2$.

     ```
     RegionPlot[x^2+y^2<=1 && x>-1/2,{x,-1,1},{y,-1,1}]
     ```

   - Shade the 2D region parametrized by $x = u + v$, $y = u - v$ for $-1 \leq u, v \leq 1$.

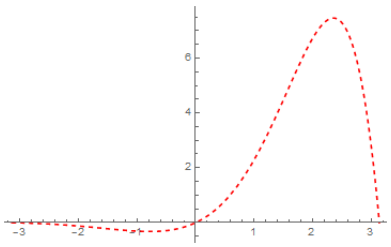
     ```
     ParametricPlot[{u+v,u-v},{u,-1,1},{v,-1,1}]
     ```

2. Curves: **Plot** (plotting graph of function $f(x)$), **ContourPlot** (plotting level set $f(x) = C$), **ParametricPlot** (plotting a curve given by parametric equations).

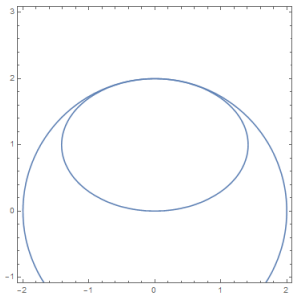
   - Plot the graph of function $f(x) = e^x \sin x$.

     ```
     Plot[E^x*Sin[x], {x, -Pi, Pi}, PlotStyle -> {Dashed, Red}]]
     ```

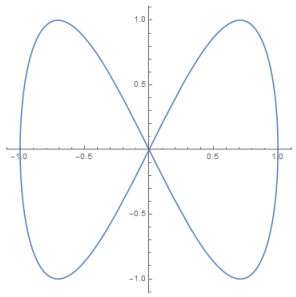
- Plot the ellipse $x^2 + 2(y-1)^2 = 2$ and the circle $x^2 + y^2 = 4$ on the same graph.

```
p1 = ContourPlot[x^2 + 2*(y - 1)^2 == 2, {x, -2, 2}, {y, -1, 3},
AspectRatio -> 1]
p2 = ContourPlot[x^2 + y^2 == 4, {x, -2, 2}, {y, -2, 2}],
Show[p1,p2]
```



- Plot the curve $x = \sin\theta$, $y = \sin(2\theta)$.

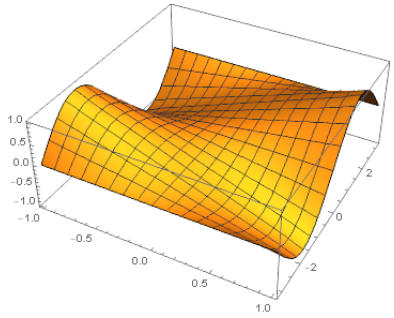
```
ParametricPlot[{Sin[theta], Sin[2 theta]}, {theta, 0, 2 Pi}]
```



3. Surfaces: **Plot3D** (plotting graph of a function $f(x,y)$), **ContourPlot3D** (plotting level set $f(x,y) = C$), **ParametricPlot3D** (plotting surface given by parametric equations). Note: on each 3D pictures in Mathematica, one can rotate it by placing the mouse on the picture and drag.

- Plot the graph of function $f(x,y) = x\sin y$.

```
Plot3D[x*Sin[y], {x, -1, 1}, {y, -Pi, Pi}]
```



- Plot the surface $x = (2+\cos\phi)\cos\theta$, $y = (2+\cos\phi)\sin\theta$, $z = \sin\phi$.

```
ParametricPlot3D[{(2 + Cos[phi])*Cos[theta], (2 + Cos[phi])*
   Sin[theta], Sin[phi]}, {phi, 0, 2*Pi}, {theta, 0, Pi/2}]
```