水滴

构造曲线

我们先来画一个圆
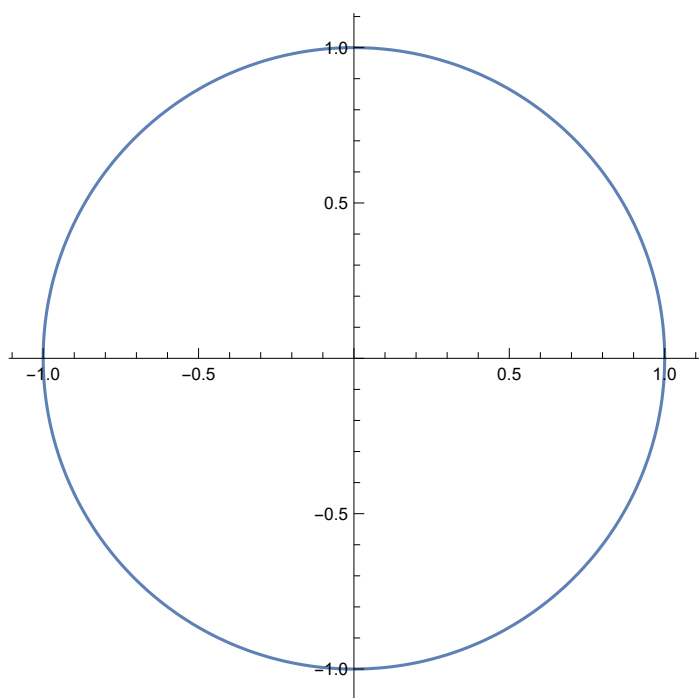
```
ParametricPlot[{Cos[v], Sin[v]}, {v, 0, 2π}]
  绘制参数图        余弦      正弦
```

然后对y轴进行变形，加上变量v，使其向上偏移

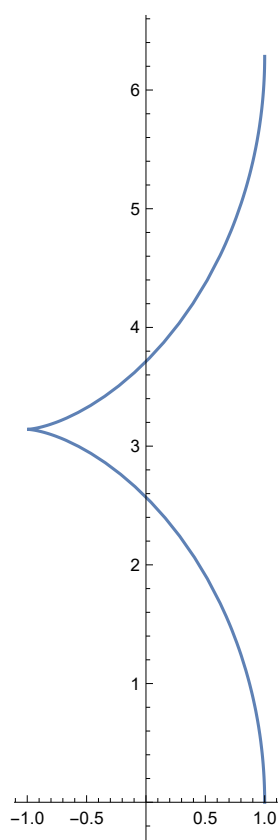*In[◦]:=* `ParametricPlot[{Cos[v], Sin[v] + v}, {v, 0, 2 π}]`
绘制参数图　　余弦　　正弦

Out[◦]=

我们试试减小上一步对y轴的改变

In[◦]:=

`ParametricPlot[{Cos[v], Sin[v] + `$\frac{v}{2\,\pi}$`}, {v, 0, 2 π}]`
绘制参数图　　余弦　　正弦

Out[◦]=
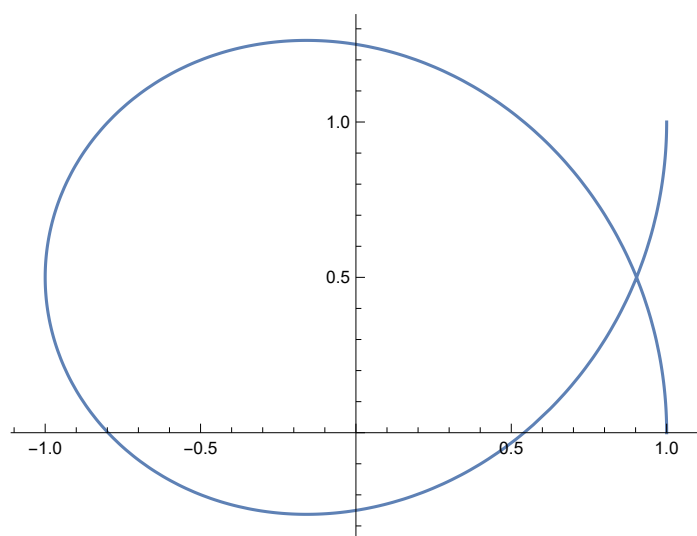
这下有水滴的样子了，将其向下平移0.5，对齐到原点

In[ ]:= `ParametricPlot[{Cos[v], Sin[v] + `$\frac{v}{2\pi}$` - 0.5}, {v, 0, 2π}]`
绘制参数图　　余弦　　正弦

Out[ ]=
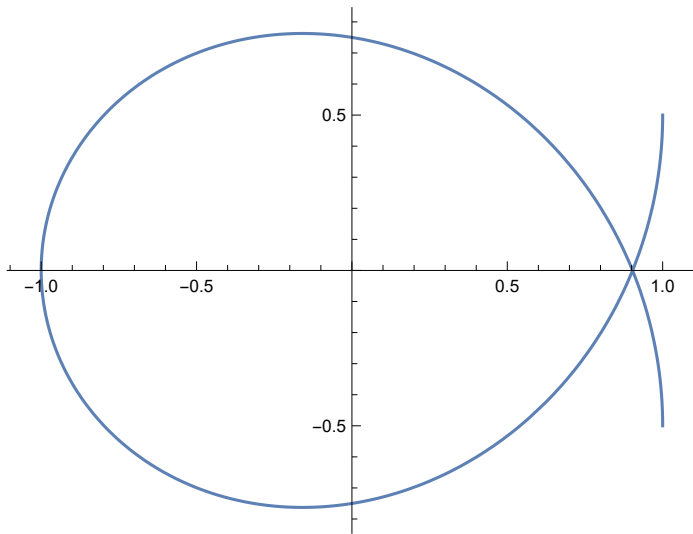
再修剪一下，
先计算上图的交点对应的v值，需要注意条件0<v<2π是必要的，否则Mathematica无法求解

In[ ]:=

`Solve[{Sin[v] + `$\frac{v}{2\pi}$` == `$\frac{1}{2}$`, 0 < v < 2π}]`
解方程　　正弦

Out[ ]=

$\left\{ \{v \to \pi\}, \left\{ v \to \text{⟳} 0.444... \right\}, \left\{ v \to \text{⟳} 5.84... \right\} \right\}$

修改变量v的开始和结束

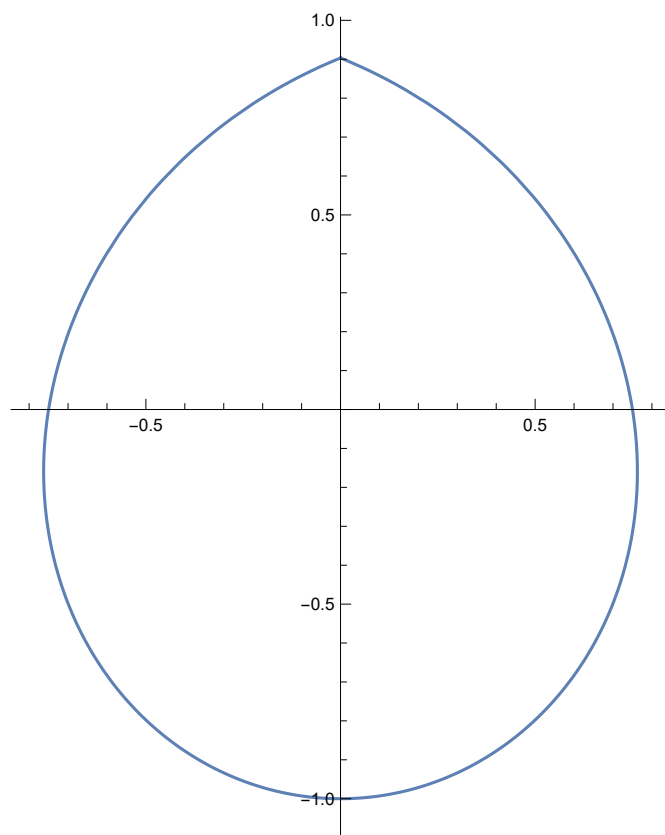*In[ ]:=* `ParametricPlot[{Cos[v], Sin[v] + `$\frac{v}{2\pi}$` - 0.5}, {v, 0.444, 5.84}]`
绘制参数图　　余弦　　正弦

Out[ ]=
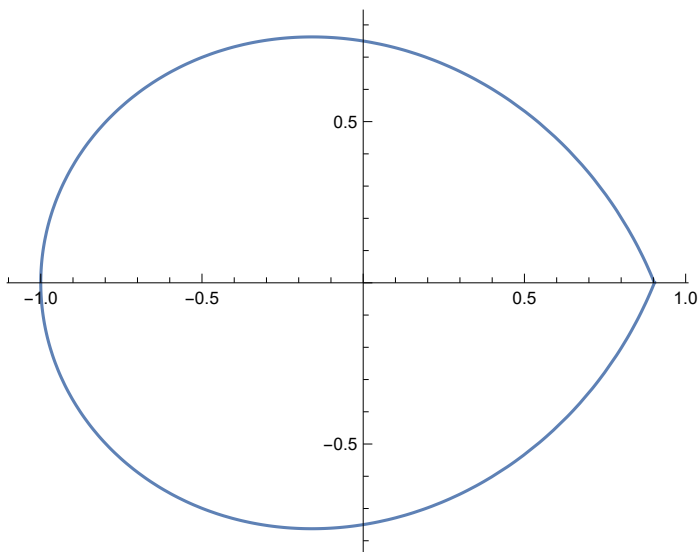
交换x和y轴，让它立起来，就能得到水滴曲线

In[ ]:= `ParametricPlot[{Sin[v] +` $\frac{v}{2\pi}$ `- 0.5, Cos[v]}, {v, 0.444, 5.84}]`
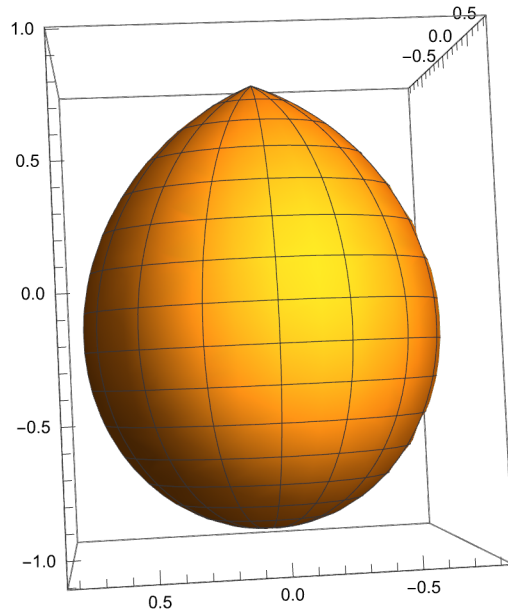绘制参数图 正弦 余弦

Out[ ]=

好啦，基本准备就绪

绘制3D图形

接下来只需将曲线绕y轴旋转一下就能得到一个3D的水滴，
略微注意下v的取值范围

$In[\circ]:=$ **RevolutionPlot3D$\left[\left\{Sin[v] + \dfrac{v}{2\pi} - 0.5, Cos[v]\right\}, \{v, 0.444, \pi\}, RotationAction \rightarrow "Clip"\right]$**
绘制三维旋转图　　正弦　　　　　余弦　　　　　旋转操作　　剪切

$Out[\circ]=$
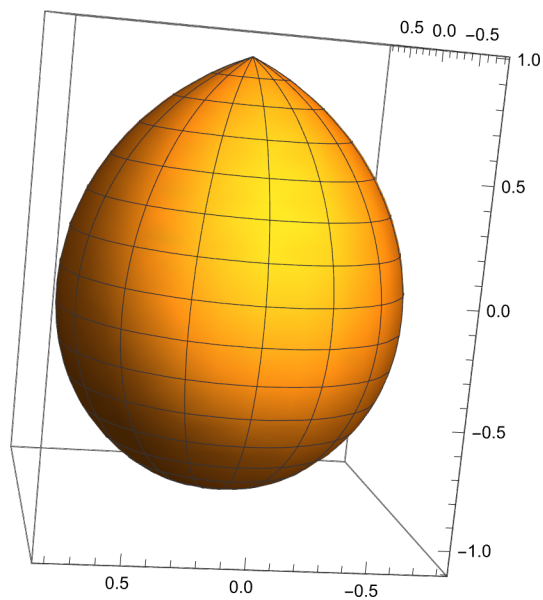
当然使用ParametricPlot3D也是可以的

In[ ]:= `ParametricPlot3D`[{`Cos`[u] (`Sin`[v] + $\frac{v}{2\pi}$ - 0.5), `Sin`[u] (`Sin`[v] + $\frac{v}{2\pi}$ - 0.5), `Cos`[v]},

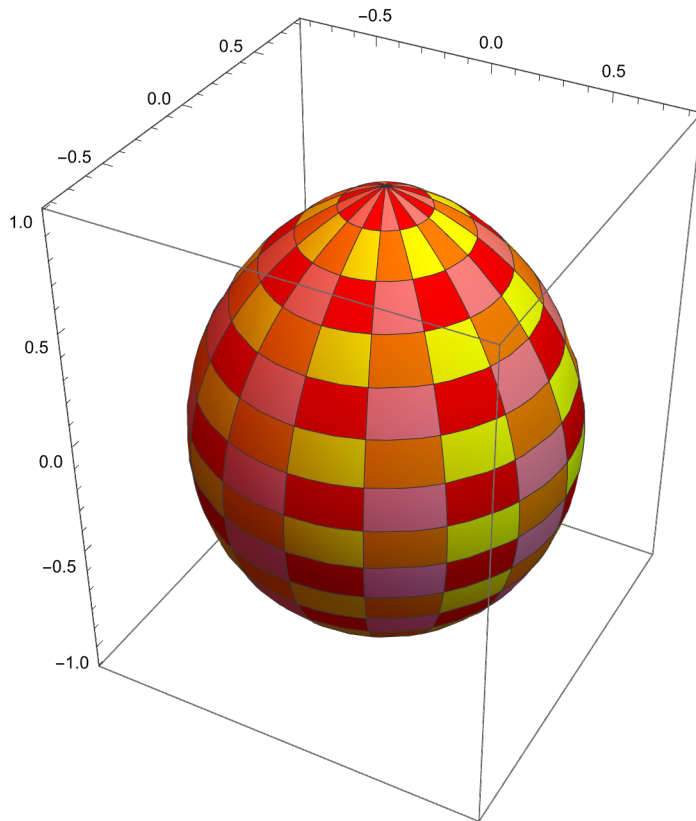{u, 0, 2 π}, {v, 0.444, π}, `RotationAction` → "Clip"]

Out[ ]=

给水滴上色

In[ ]:= `RevolutionPlot3D[{Sin[v] +` $\frac{v}{2\pi}$ `- 0.5, Cos[v]}, {v, 0.444, π},`
　　　　绘制三维旋转图　　　　正弦　　　　余弦

　　　`RotationAction → "Clip", MeshShading → {{Red, Yellow}, {Pink, Orange}}]`
　　　　旋转操作　　　　剪切　　　网格着色　　　红色　黄色　　　粉色　橙色
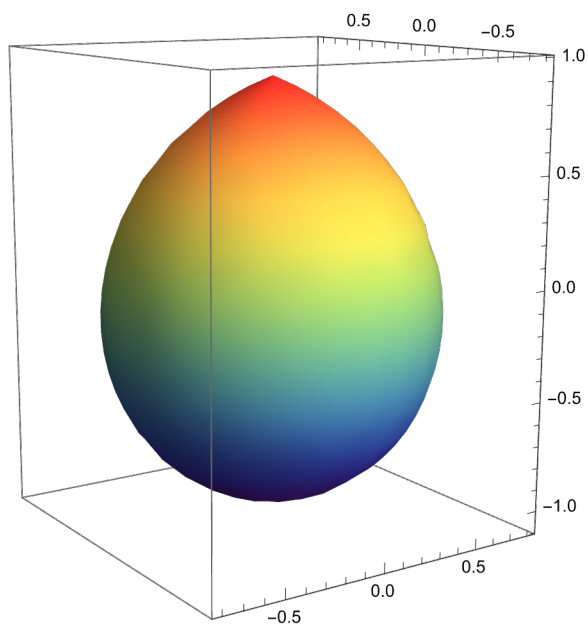
Out[ ]=

彩虹水滴

In[ ]:= `RevolutionPlot3D[{Sin[v] + `$\frac{v}{2\pi}$` - 0.5, Cos[v]}, {v, 0.444, π},`
绘制三维旋转图　正弦　余弦

`RotationAction → "Clip", ColorFunction → "Rainbow", Mesh → None]`
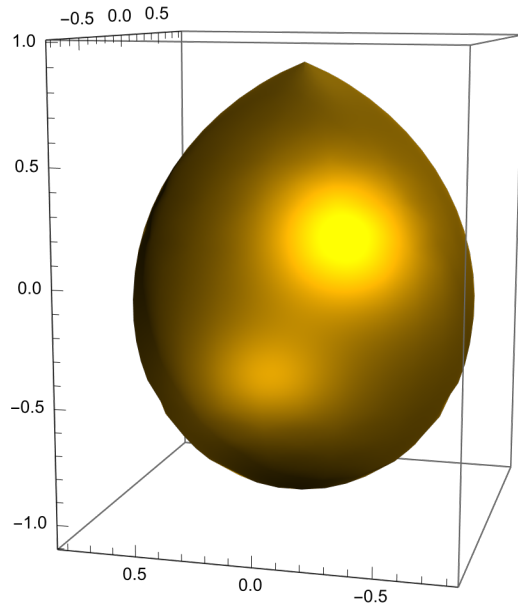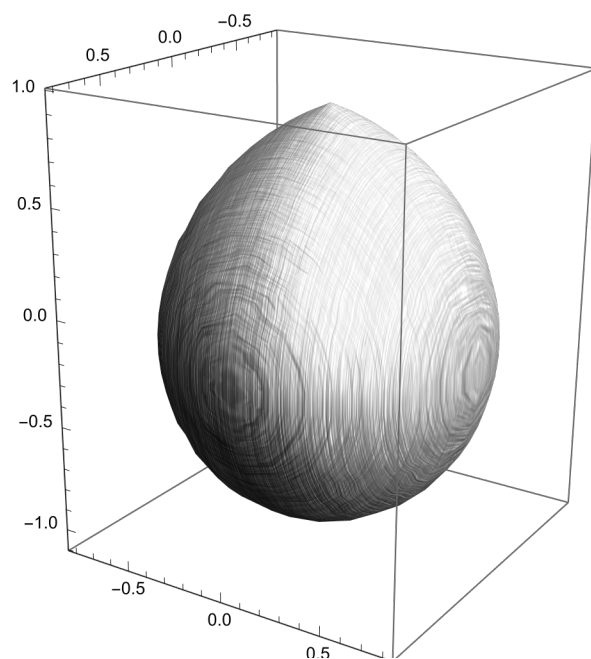旋转操作　剪切　颜色函数　网格　无

Out[ ]=

金色水滴

$In[\circ]:=$ RevolutionPlot3D$\left[\left\{\text{Sin}[v] + \frac{v}{2\pi} - 0.5, \text{Cos}[v]\right\}, \{v, 0.444, \pi\}, \text{RotationAction} \rightarrow \text{"Clip"},\right.$
绘制三维旋转图　　正弦　　　余弦　　　　　　　　　旋转操作　　　剪切

Mesh $\rightarrow$ None, PlotStyle $\rightarrow$ MaterialShading$[\text{"Gold"}]$, Lighting $\rightarrow \text{"ThreePoint"}\Big]$
网格　无　绘图样式　材质效果图　　　　　光照

$Out[\circ]=$

素描风格

In[ ]:= `RevolutionPlot3D[` $\left\{ \text{Sin[v]} + \dfrac{v}{2\pi} - 0.5, \text{Cos[v]} \right\}$ `, {v, 0.444, π}, RotationAction → "Clip",`

　　　　`Mesh → None, PlotStyle → Directive[` ▨ `, HatchShading[]], Lighting → "Neutral"]`

Out[ ]=

In[•]:= `RevolutionPlot3D` 绘制三维旋转图 $\left[\left\{\text{Sin}[v] + \dfrac{v}{2\pi} - 0.5, \text{Cos}[v]\right\},\right.$
正弦　　　　　　　　　余弦

{v, 0.444, π}, RotationAction → "Clip", Mesh → None, PlotPoints → 40,
旋转操作　　　　　剪切　网格　无　绘图点

PlotStyle → Directive[▢, ToonShading[]], Lighting → "Neutral"]
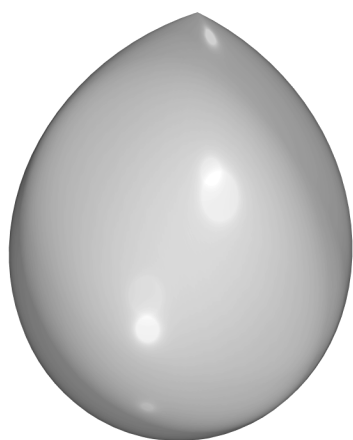绘图样式　　　指令　　　　卡通着色　　　　　光照

Out[•]=
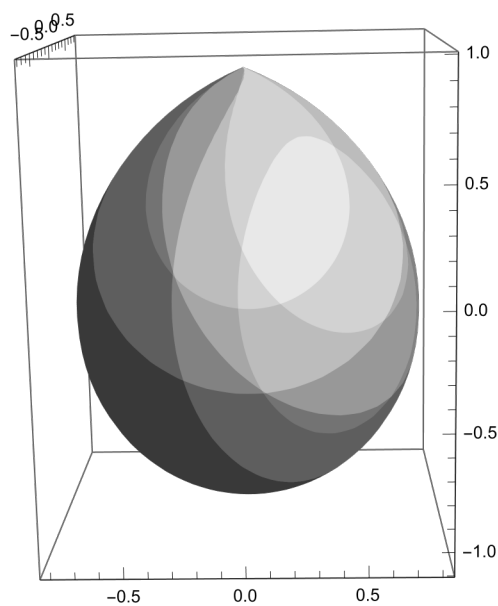
水滴本滴

```
In[ ]:= RevolutionPlot3D[{Sin[v] + v/(2 π) - 0.5, Cos[v]}, {v, 0.444, π},
         RotationAction → "Clip", Mesh → None, PlotPoints → 40, PlotStyle →
          Directive[MaterialShading[<|"BaseColor" → ▓, "RoughnessCoefficient" → 0.25,
             "SheenColor" → ▓, "SheenRoughnessCoefficient" → 0.2|>]],
         Lighting → "ThreePoint", Axes → False, Boxed → False]
```

Out[ ]=

```
In[ ]:= RevolutionPlot3D[{Sin[v] + v/(2 π) - 0.5, Cos[v]}, {v, 0.444, π},

       RotationAction → "Clip", Mesh → None, PlotStyle → Directive[White,

         MaterialShading[<|"BaseColor" → ▣, "SurfaceNormals" → Texture[▨],

           "SheenColor" → ▣, "RoughnessCoefficient" → 0.5, "SpecularColor" → ▣|>]],

       Lighting → "ThreePoint"]
```
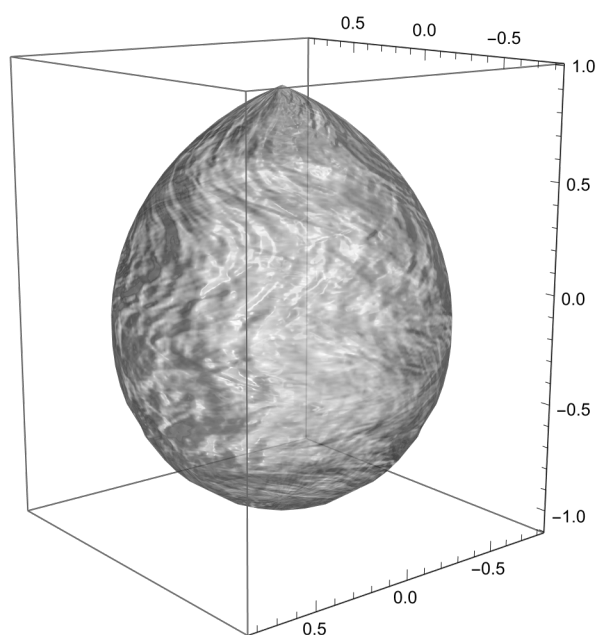

Over!