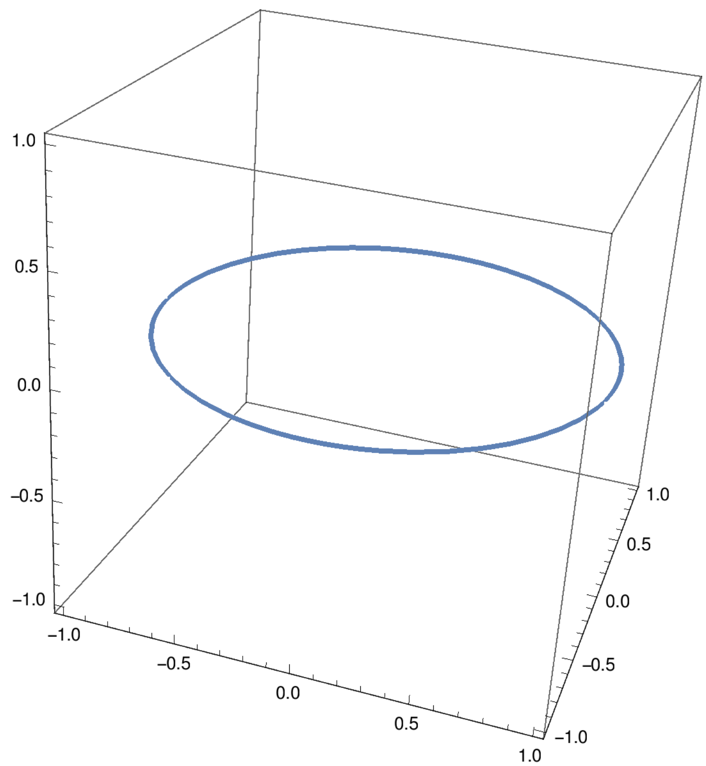
```
In[1096]:= ClearAll["Global`*"]

(* http://mini.pw.edu.pl/~porter/cc/psw/psw_cw1.pdf *)

(* Unit Circle with Spherical Coordinates *)
$density := 1;
$R := 1;

$xCircle[r_, u_, v_] := r * Sin[v] Cos[u];
$yCircle[r_, u_, v_] := r * Sin[v] Sin[u];
$zCircle[r_, u_, v_] := r * Cos[v];
$v = π / 2;

$Circle[r_, u_, v_] := {$xCircle[r, u, $v], $yCircle[r, u, $v], $zCircle[r, u, $v]};
ParametricPlot3D[$Circle[$R, u, $v], {u, 0, 2 π}]

$JacobianMatrix[r_, u_, v_] := ( D[$xCircle[r, u, v], r]  D[$xCircle[r, u, v], u] );
                               ( D[$yCircle[r, u, v], r]  D[$yCircle[r, u, v], u] )

Print["Jacobian Matrix", MatrixForm[$JacobianMatrix[r, u, v]]]
$JacobianDet[r_, u_, v_] := Abs[Det[$JacobianMatrix[r, u, v]]];

$CircleIntegral[a_] := $density * ∫_0^(2 π) ∫_0^1 $JacobianDet[r, u, $v] a ⅆr ⅆu;

$CircleMass := $CircleIntegral[1];
$CircleCenterOfMass := {$CircleIntegral[$xCircle[1, u, $v]],
    $CircleIntegral[$yCircle[1, u, $v]], $CircleIntegral[0]} / $CircleMass;

$X := $xCircle[1, u, $v];
$Y := $yCircle[1, u, $v];
$Z := 0;
$ICircle = {
   {$CircleIntegral[$Y^2 + $Z^2],
    -$CircleIntegral[$X * $Y],
    -$CircleIntegral[$X * $Z]},
   {-$CircleIntegral[$X * $Y],
    $CircleIntegral[$X^2 + $Z^2],
    -$CircleIntegral[$Y * $Z]},
   {-$CircleIntegral[$X * $Z ],
    -$CircleIntegral[$Y * $Z],
    $CircleIntegral[$Y^2 + $X^2]}};

Print["Circle Mass: ", $CircleMass]
```

```
Print["Circle Center of Mass: ", MatrixForm[$CircleCenterOfMass]]
Print["Circle Tensor of Intertia: ", MatrixForm[$ICircle]]

$a = 1;
Show[ContourPlot3D[{{ix, iy, iz}.$ICircle.{ix, iy, iz} == 1},
  {ix, -$a, $a}, {iy, -$a, $a}, {iz, -$a, $a}]]
```

Out[1104]=



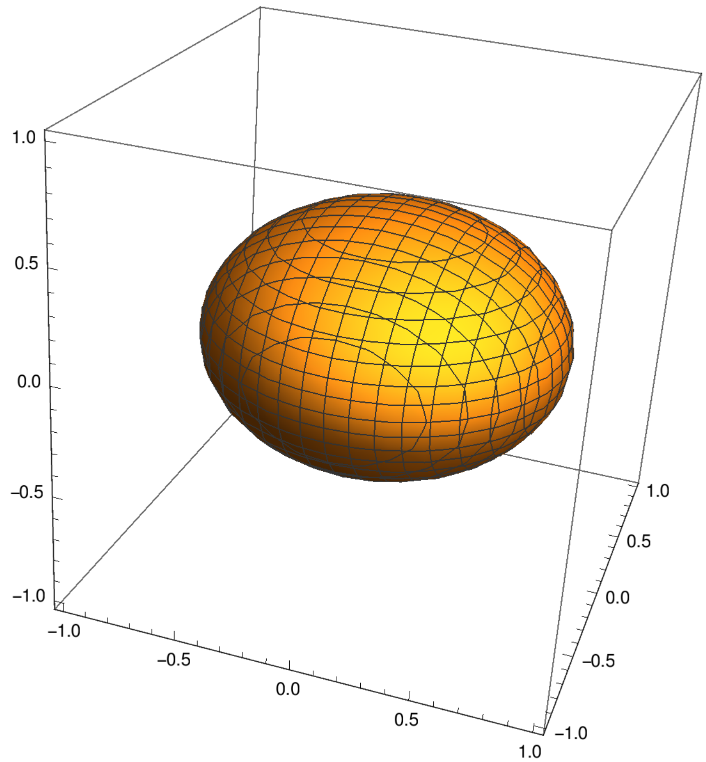
Jacobian Matrix $\begin{pmatrix} \text{Cos}[u]\,\text{Sin}[v] & -r\,\text{Sin}[u]\,\text{Sin}[v] \\ \text{Sin}[u]\,\text{Sin}[v] & r\,\text{Cos}[u]\,\text{Sin}[v] \end{pmatrix}$

Circle Mass: π

Circle Center of Mass: $\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$

Circle Tensor of Intertia: $\begin{pmatrix} \frac{\pi}{2} & 0 & 0 \\ 0 & \frac{\pi}{2} & 0 \\ 0 & 0 & \pi \end{pmatrix}$

Out[1119]=



In[1120]:=