P9

PRACTICE 9: GRAPHICAL REPRESENTATION OF SURFACES

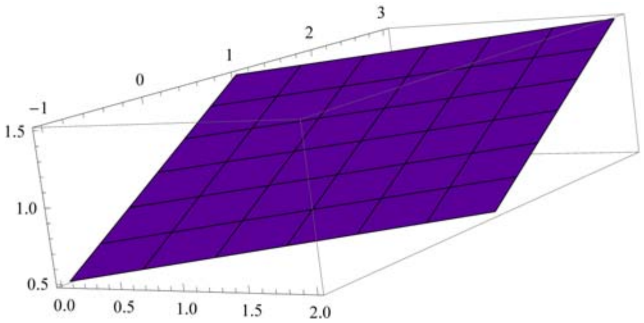
▼ Proposed Exercise P- 9.1

Plot the plane that contains the points P1(1,1,0), P2(0,0,-1) and P3(1,2,1/2) using its parametric equations.

▼ Resolution P- 9.1

★ Plane

```
Clear["Global`*"]
{w1, w2} = {{1, 1, 0}, {0, 1, 1 / 2}};
ParametricPlot3D[{1, 1, 1} + u w1 + v w2, {u, -1, 1},
 {v, -1, 1}, Mesh → 5, BoundaryStyle → Black, PlotStyle → Purple]
```



▼ Proposed Exercise P- 9.2

Given the cone $x^2 + y^2 = z^2$ and the sphere $x^2 + y^2 + z^2 = 1$, make the graphical representation of their intersection.

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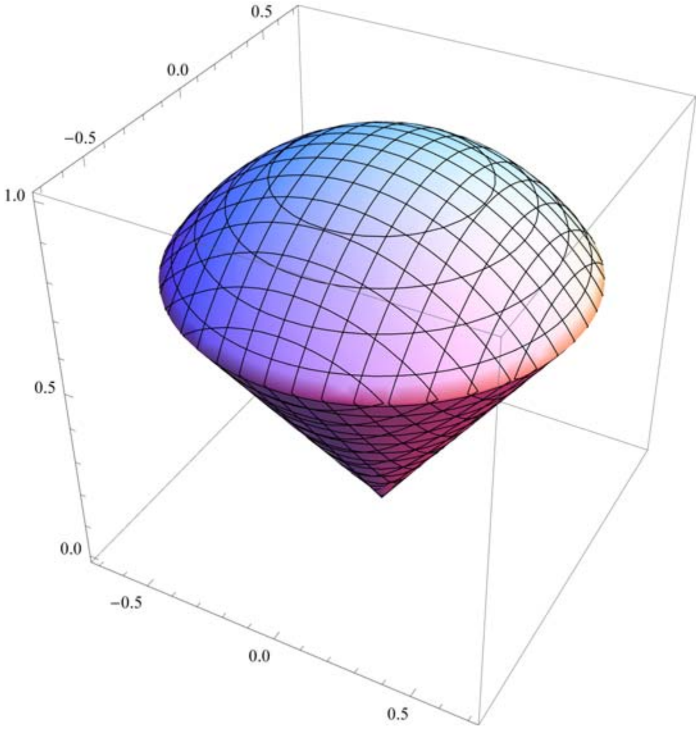
▼ Resolution P- 9.2

```
RegionPlot3D[x^2 + y^2 + z^2 < 1 && x^2 + y^2 < z^2,
 {x, -1, 1}, {y, -1, 1}, {z, 0, 1}, PlotPoints → 35, PlotRange → All]
```



▼ Proposed Exercise P- 9.3

Make the graphical representation of the interior part of the following paraboloids: $z=x^2+y^2$ and $z=10-x^2-2y^2$

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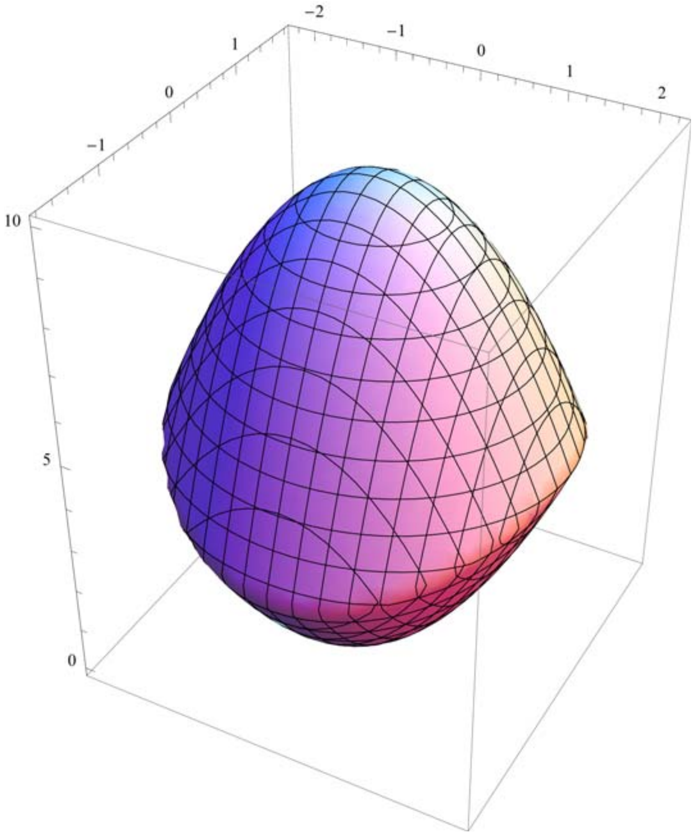
▼ Resolution P- 9.3

```
RegionPlot3D[x^2 + y^2 < z && 10 - x^2 - 2 y^2 > z, {x, -3, 3}, {y, -2, 2},
 {z, 0, 10}, PlotPoints → 35, BoxRatios → {2, 2, 2.5}, PlotRange → All]
```



▼ Proposed Exercise P- 9.4

Make the graphical representation of the domain that is exterior to the cylinder $y=x^2+y^2$, interior to the sphere $x^2+y^2+z^2=1$ and delimited by the plane z=0 in the second quadrant.

▼ Resolution P- 9.4

```
cil[x_, y_, z_] = -y + x^2 + y^2
```

$x^2 - y + y^2$

```
sf[x_, y_, z_] = x^2 + y^2 + z^2 - 1
```

$-1 + x^2 + y^2 + z^2$

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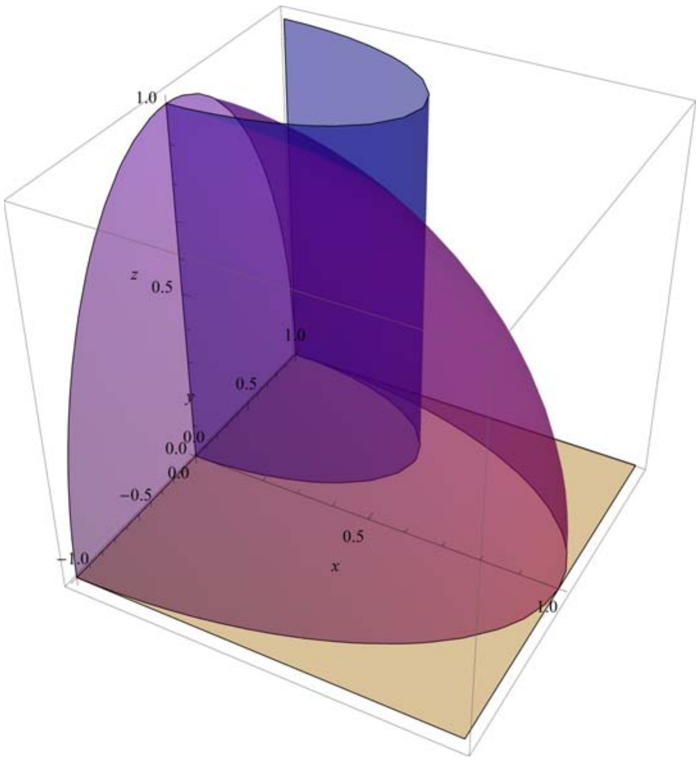
```
ContourPlot3D[{z == 0, -y + x^2 + y^2, x^2 + y^2 + z^2 - 1}, {x, 0, 1}, {y, -1, 1},
 {z, 0, 1}, BoxRatios → {2, 2, 2}, Mesh → False, AxesLabel → {x, y, z},
 AxesOrigin → {0, 0, 0}, ContourStyle → {Directive[Orange, Opacity[0.4]],
   Directive[Blue, Opacity[0.5]], Directive[Purple, Opacity[0.5]]}]
```



▼ Proposed Exercise P- 9.5

Using parametric coordinates, make the graphical representation of the domain that is interior to the cylinder $1/2=x^2+y^2$ and which is delimited by the sphere $x^2+y^2+z^2=1$.

▼ Resolution P- 9.5

★ Graphical representation of the surfaces that delimite each figure

```
Clear["Global`*"]
```

```
cir[x_, y_, z_] = x^2 + y^2 - 1 / 2
```

$$-\frac{1}{2}+x^2+y^2$$

```
sph[x_, y_, z_] = x^2 + y^2 + z^2 - 1
```

$$-1+x^2+y^2+z^2$$

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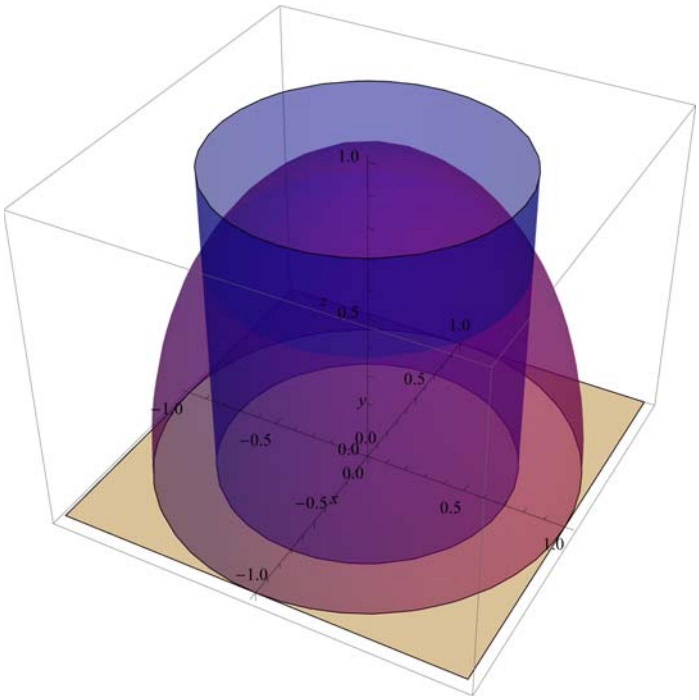
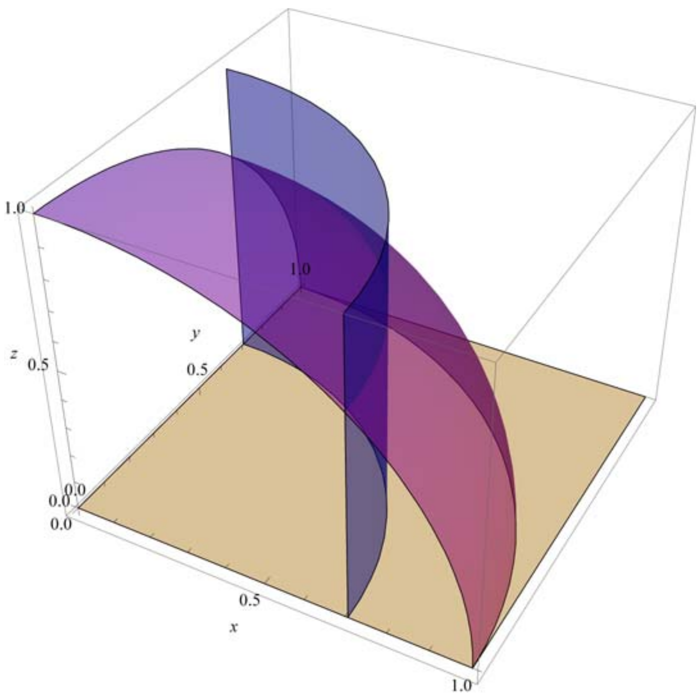
```
ContourPlot3D[{z == 0, x^2 + y^2 - 1 / 2 == 0, x^2 + y^2 + z^2 - 1 == 0}, {x, -1, 1}, {y, -1, 1},
 {z, 0, 1}, BoxRatios → {1, 1, 0.8}, Mesh → False, AxesLabel → {x, y, z},
 AxesOrigin → {0, 0, 0}, ContourStyle → {Directive[Orange, Opacity[0.4]],
   Directive[Blue, Opacity[0.5]], Directive[Purple, Opacity[0.5]]}]
```




```
ContourPlot3D[{z == 0, x^2 + y^2 - 1 / 2 == 0, x^2 + y^2 + z^2 - 1 == 0}, {x, 0, 1}, {y, 0, 1},
 {z, 0, 1}, BoxRatios → {1, 1, 0.8}, Mesh → False, AxesLabel → {x, y, z},
 AxesOrigin → {0, 0, 0}, ContourStyle → {Directive[Orange, Opacity[0.4]],
   Directive[Blue, Opacity[0.5]], Directive[Purple, Opacity[0.5]]}]
```



★ Change to cylindrical coordinates

Domain

```
x = r * Cos[t];
y = r * Sin[t];
```

Limits of the radius “r”: r1=0 eta r2=1/$\sqrt{2}$

Rango

```
ec = sph[x, y, z] == 0 // Simplify
```

$r^2 + z^2 == 1$

```
Solve[ec, z] // Simplify
```

$\{\{z \to -\sqrt{1 - r^2}\}, \{z \to \sqrt{1 - r^2}\}\}$

★ The domain in cylindrical coordinates

{t,0,2 Pi},{r,0,1/$\sqrt{2}$ },{z,0,$\sqrt{1-r^2}$ }

```
d = {x, y, 0}
```

{r Cos[t], r Sin[t], 0}

```
reg1 = {x, y, Sqrt[1 - r^2]}
```

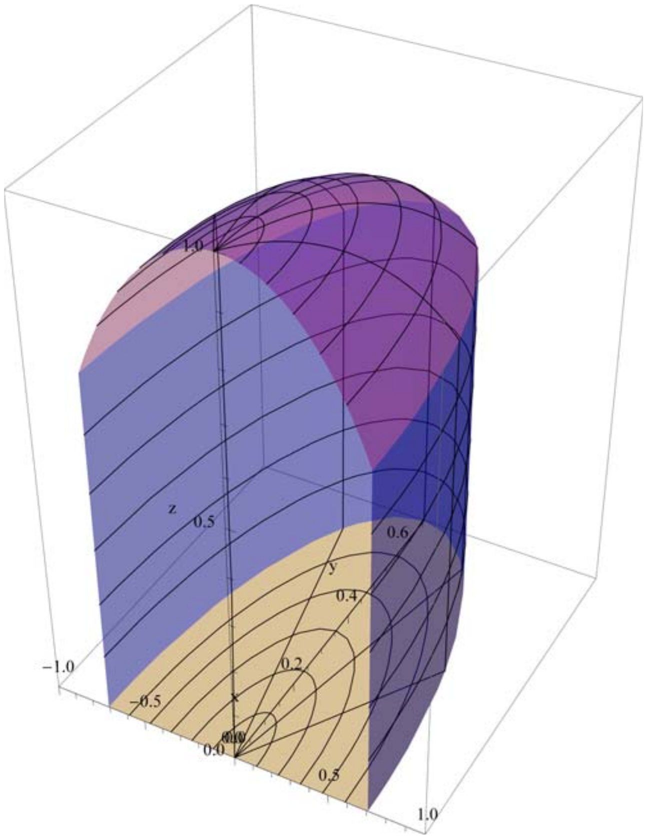
{r Cos[t], r Sin[t], $\sqrt{1 - r^2}$}

```
R1 = ParametricPlot3D[{reg1, d}, {t, 0, Pi}, {r, 0, 1/Sqrt[2]},
   Mesh → 5, BoxRatios → {1, 1, 1.4}, PlotRange → {{-1, 1}, {0, 1}, {0, 1}},
   PlotStyle → {Directive[Purple, Opacity[0.4]],
     Directive[Orange, Opacity[0.4]], Directive[Blue, Opacity[0.5]]}];
```

```
reg2 = {1/Sqrt[2] Cos[t], 1/Sqrt[2] Sin[t], r};
```

```
R2 = ParametricPlot3D[{reg2}, {t, 0, Pi}, {r, 0 , 1/Sqrt[2]},
   Mesh → 5, BoxRatios → {1, 1, 1.2}, PlotRange → {{-1, 1}, {0, 1}, {0, 1}},
   PlotStyle → {Directive[Blue, Opacity[0.4]],
     Directive[Green, Opacity[0.4]], Directive[Blue, Opacity[0.5]]}];
```

```
Show[{R1, R2}, AxesLabel → {"x", "y", "z"},
 AxesOrigin → {0, 0, 0}, PlotRange → {{-1, 1}, {0, 1/√2}, {0, 1}}]
```



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