> with(plots)

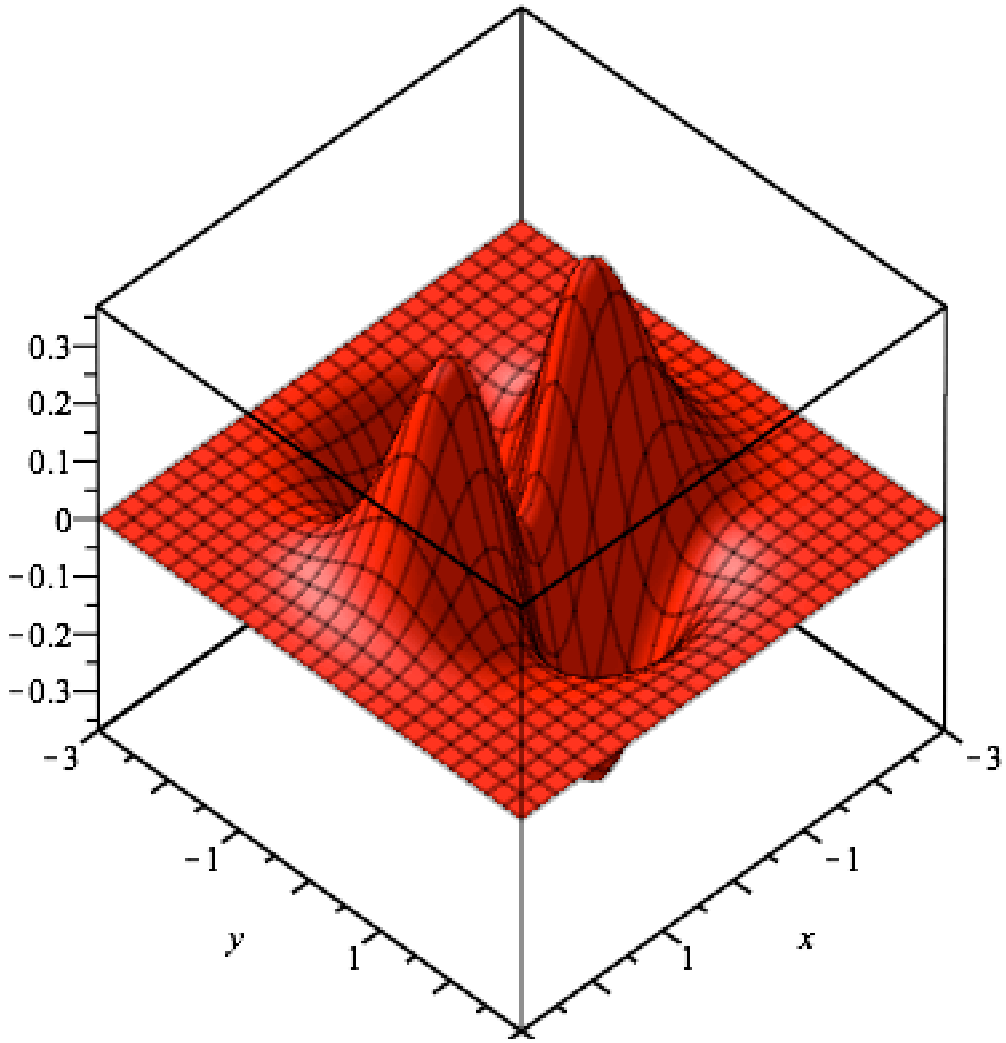
[*animate*, *animate3d*, *animatecurve*, *arrow*, *changecoords*, *complexplot*, *complexplot3d*, *conformal*, *conformal3d*, *contourplot*, *contourplot3d*, *coordplot*, *coordplot3d*, *densityplot*, *display*, *dualaxisplot*, *fieldplot*, *fieldplot3d*, *gradplot*, *gradplot3d*, *implicitplot*, *implicitplot3d*, *inequal*, *interactive*, *interactiveparams*, *intersectplot*, *listcontplot*, *listcontplot3d*, *listdensityplot*, *listplot*, *listplot3d*, *loglogplot*, *logplot*, *matrixplot*, *multiple*, *odeplot*, *pareto*, *plotcompare*, *pointplot*, *pointplot3d*, *polarplot*, *polygonplot*, *polygonplot3d*, *polyhedra_supported*, *polyhedraplot*, *rootlocus*, *semilogplot*, *setcolors*, *setoptions*, *setoptions3d*, *spacecurve*, *sparsematrixplot*, *surfdata*, *textplot*, *textplot3d*, *tubeplot*] **(1**

Oppgave 10.1.14

a)

(i)

> $plot3d\left(\left(x^2 - y^2\right) \cdot \exp\left(-x^2 - y^2\right), x = -3\,..3, y = -3\,..3, axes = boxed, color = \mathrm{red}, \mathrm{labels} = [\mathrm{x}, \mathrm{y}, \mathrm{z}]\right)$



(ii)

Av figuren ser det lurt ut å velge nivåkurver der $f(x, y) = 0, \pm 0.1, \pm 0.2, \pm 0.3$.
For å slippe å skrive opp uttrykket for funksjonen 7 ganger, definerer vi først funksjonen $f(x, y)$:

> $f := (x, y) \rightarrow \left(x^2 - y^2\right) \cdot \exp\left(-x^2 - y^2\right)$

$$f := (x, y) \rightarrow \left(x^2 - y^2\right) e^{-x^2 - y^2} \tag{2}$$

> $P1 := implicitplot(f(x, y) = 0.3, x = -3 ..3, y = -3 ..3, color = \mathrm{red}, numpoints = 10000)$

$$P1 := PLOT(\ldots) \tag{3}$$

> $P2 := implicitplot(f(x, y) = 0.2, x = -3 ..3, y = -3 ..3, color = orange, numpoints = 10000)$

$$P2 := PLOT(\ldots) \tag{4}$$

> $P3 := implicitplot(f(x, y) = 0.1, x = -3 ..3, y = -3 ..3, color = \mathrm{yellow}, numpoints = 10000)$

$$P3 := PLOT(\ldots) \tag{5}$$

> $P4 := implicitplot(f(x, y) = 0, x = -3 ..3, y = -3 ..3, color = green, numpoints = 10000)$

$$P4 := PLOT(\ldots) \tag{6}$$

> $P5 := implicitplot(f(x, y) = -0.1, x = -3 ..3, y = -3 ..3, color = blue, numpoints = 10000)$

$$P5 := PLOT(\ldots) \tag{7}$$

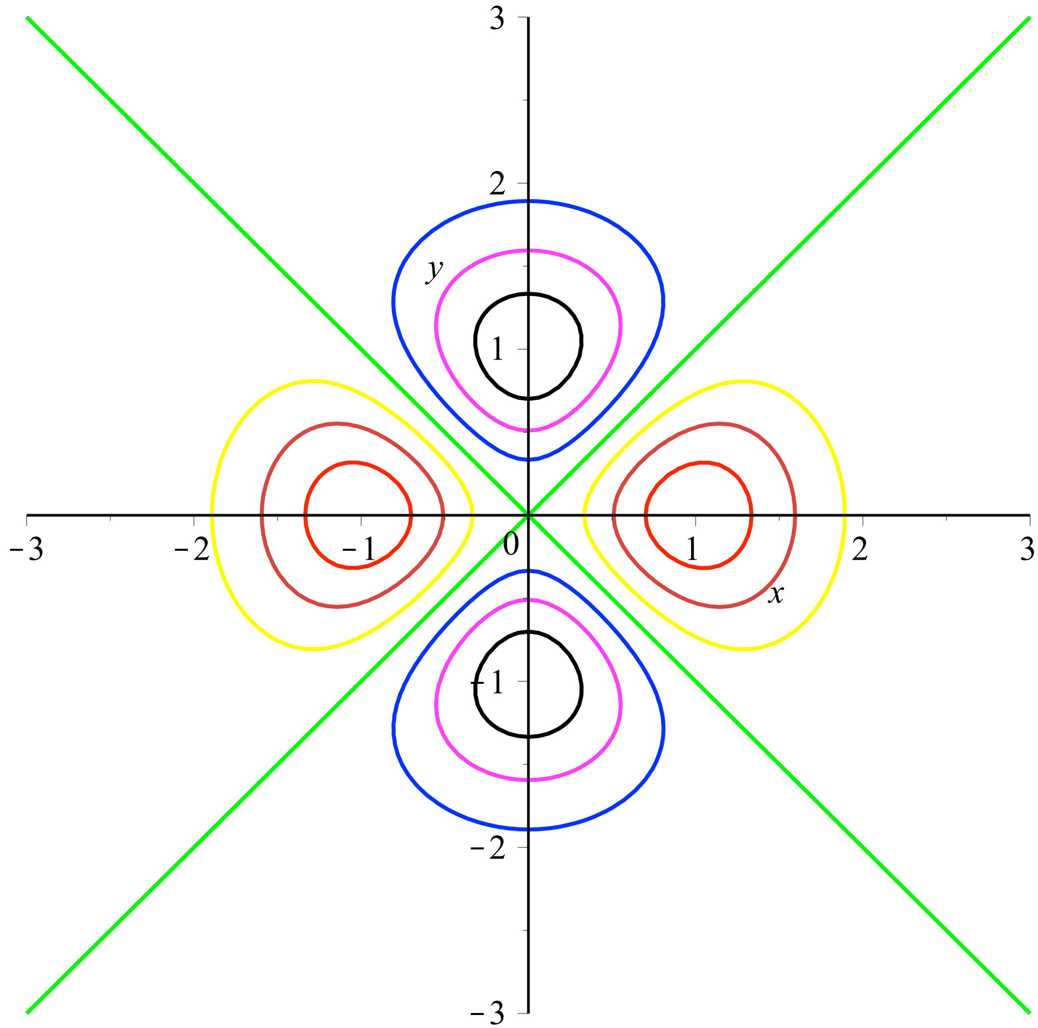
> $P6 := implicitplot(f(x, y) = -0.2, x = -3 ..3, y = -3 ..3, color = magenta, numpoints = 10000)$

$$P6 := PLOT(\ldots) \tag{8}$$

> $P7 := implicitplot(f(x, y) = -0.3, x = -3 ..3, y = -3 ..3, color = black, numpoints = 10000)$

$$P7 := PLOT(\ldots) \tag{9}$$

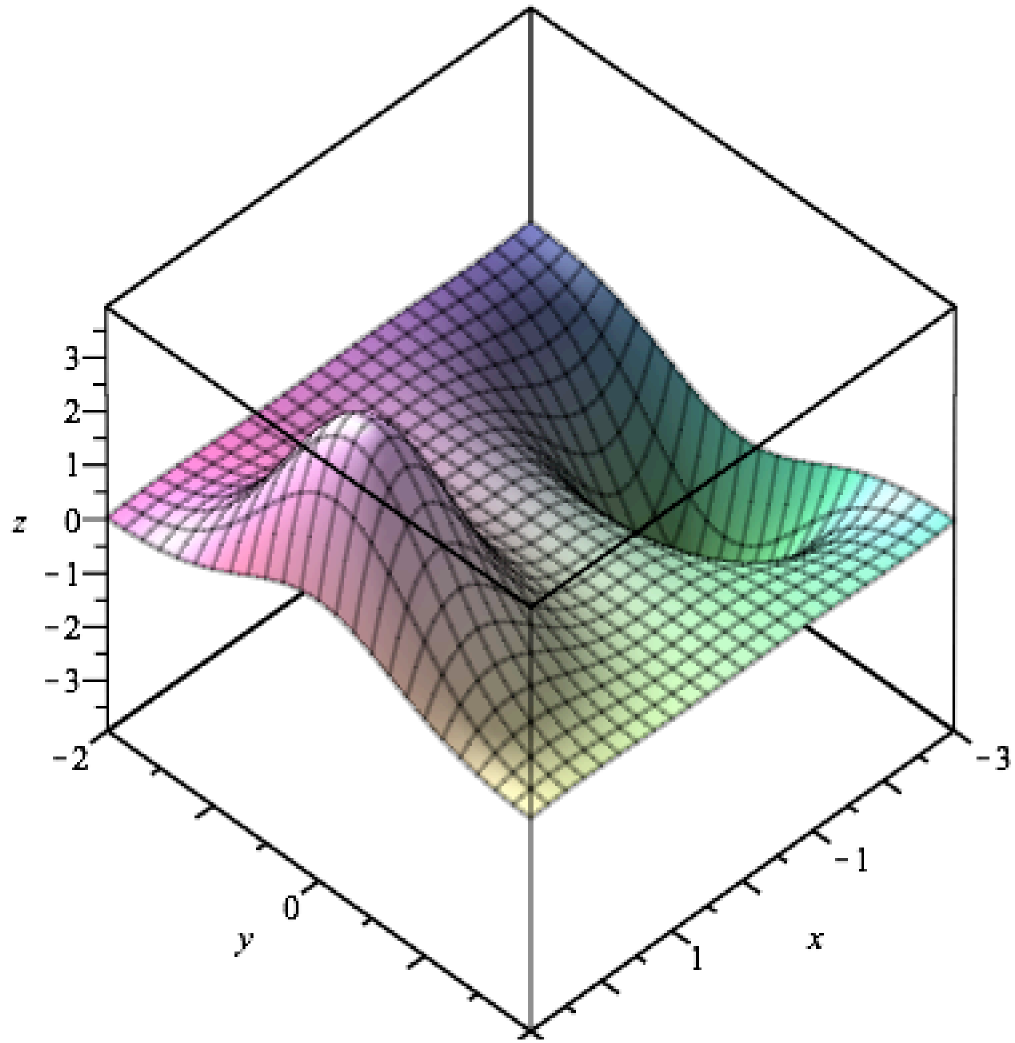
> $display(P1, P2, P3, P4, P5, P6, P7)$



d)

(i)

> $plot3d\left(\mathrm{x}^2 \cdot \exp\left(-y^2\right) \cdot \sin(x), x=-3..3, y=-2..2, axes = boxed, labels = [x, y, z]\right)$



(ii)

> $P1 := implicitplot\left(x^2 \cdot \exp\left(-y^2\right) \cdot \sin(x) = 3, x = -5..5, y = -2..2, gridrefine = 2, color = red\right)$

$$P1 := PLOT(\ldots) \tag{10}$$

> $P2 := implicitplot\left(\mathrm{x}^2 \cdot \exp\left(-y^2\right) \cdot \sin(x) = 2, x = -5..5, y = -2..2, gridrefine = 2, color = orange\right)$

$$P2 := PLOT(\ldots) \quad (11$$

> $P3 := implicitplot\left(\mathrm{x}^2 \cdot \exp\left(-y^2\right) \cdot \sin(x) = 1, x = -5..5, y = -2..2, gridrefine = 2, color = yellow\right)$

$$P3 := PLOT(\ldots) \quad (12$$

> $P4 := implicitplot\left(\mathrm{x}^2 \cdot \exp\left(-y^2\right) \cdot \sin(x) = 0, x = -5..5, y = -2..2, gridrefine = 2, color = green\right)$

$$P4 := PLOT(\ldots) \quad (13$$

> $P5 := implicitplot\left(\mathrm{x}^2 \cdot \exp\left(-y^2\right) \cdot \sin(x) = -1, x = -5..5, y = -2..2, gridrefine = 2, color = blue\right)$

$$P5 := PLOT(\ldots) \quad (14$$

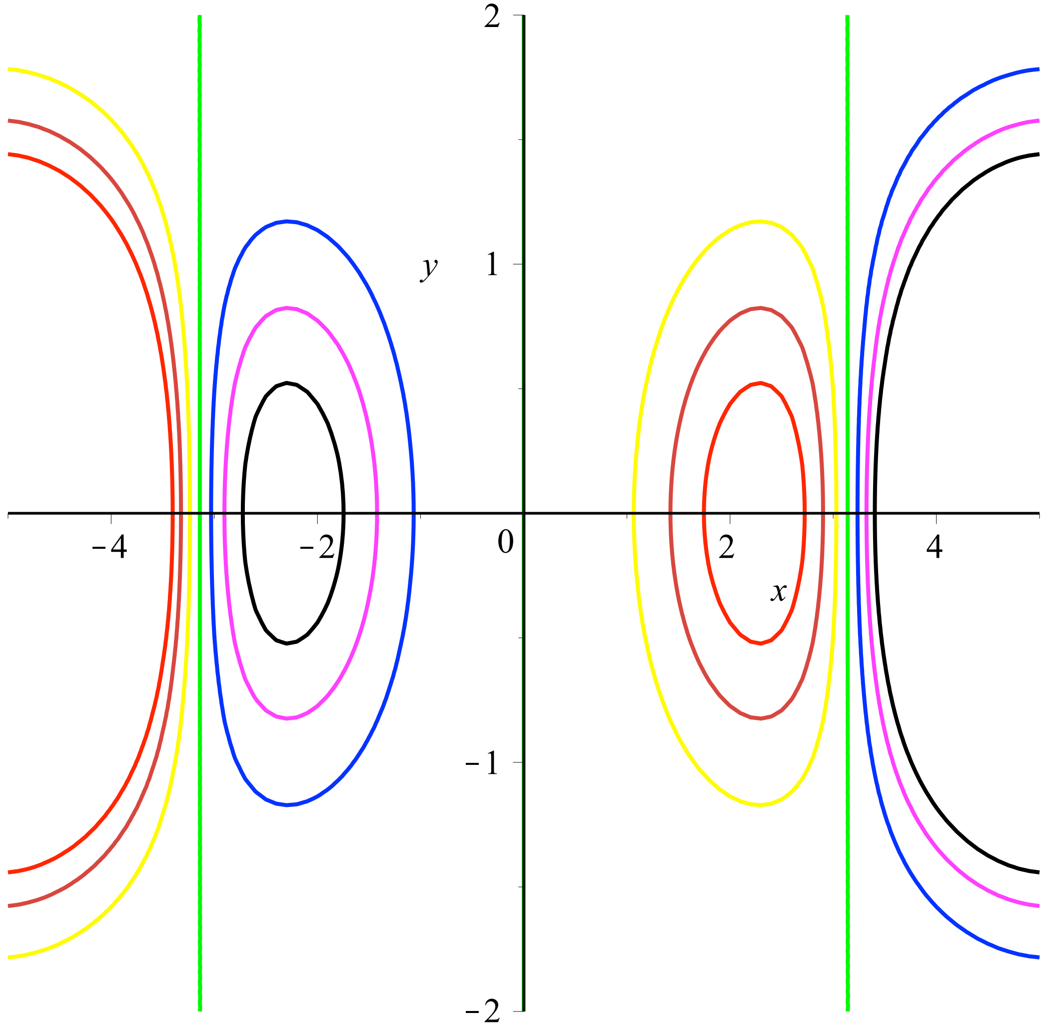
> $P6 := implicitplot\left(\mathrm{x}^2 \cdot \exp\left(-y^2\right) \cdot \sin(x) = -2, x = -5..5, y = -2..2, gridrefine = 2, color = magenta\right)$

$$P6 := PLOT(\ldots) \quad (15$$

> $P7 := implicitplot\left(\mathrm{x}^2 \cdot \exp\left(-y^2\right) \cdot \sin(x) = -3, x = -5..5, y = -2..2, gridrefine = 2, color = black\right)$

$$P7 := PLOT(\ldots) \quad (16$$

> $display(P1, P2, P3, P4, P5, P6, P7)$



Oppgave 10.1.15

a)

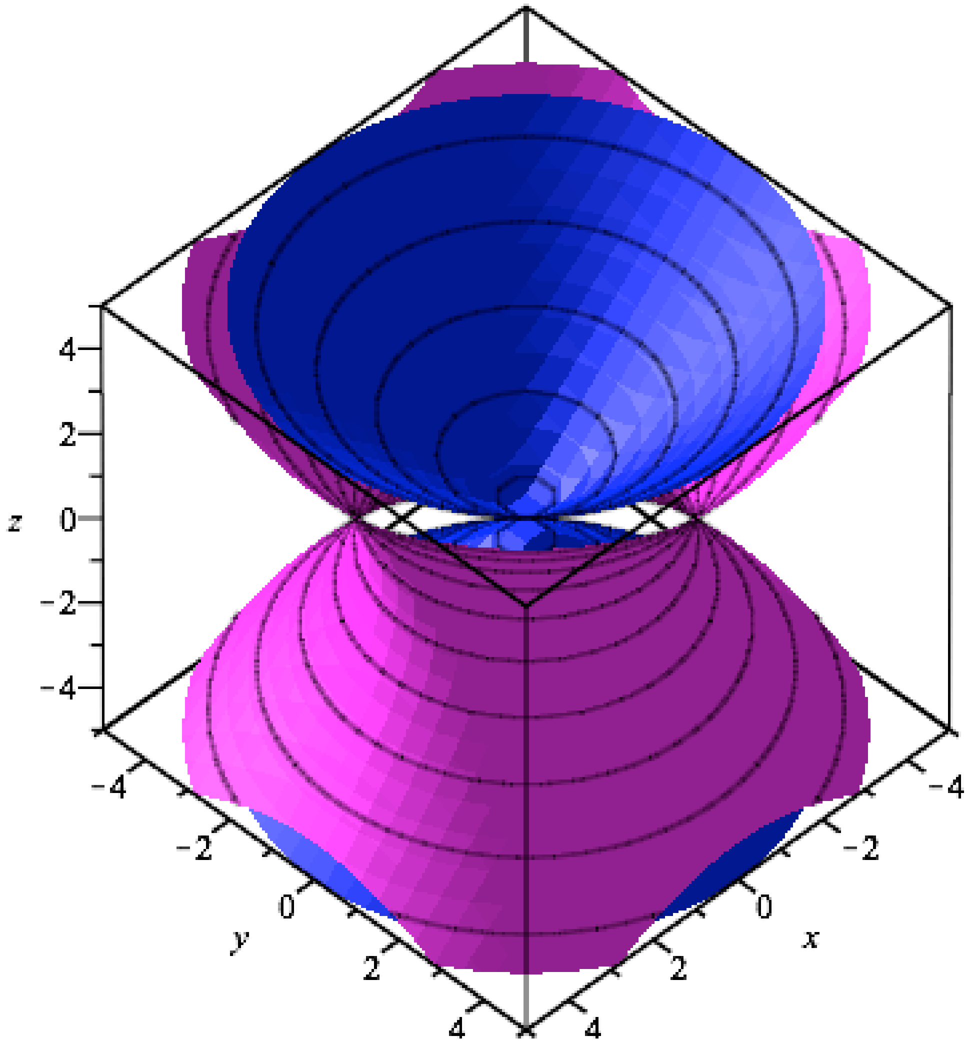
> $P1 := implicitplot3d\left(x^2 + y^2 - z^2 = 0, x = -5..5, y = -5..5, z = -5..5, color = blue, numpoints = 10000, style = surfacecontour\right)$

$$P1 := PLOT3D(...) \quad (17$$

> $P2 := implicitplot3d\left(x^2 + y^2 - z^2 = 8, x = -5..5, y = -5..5, z = -5..5, color = magenta, numpoints = 10000, style = surfacecontour\right)$

$$P2 := PLOT3D(...) \quad (18$$

> $display(P1, P2)$

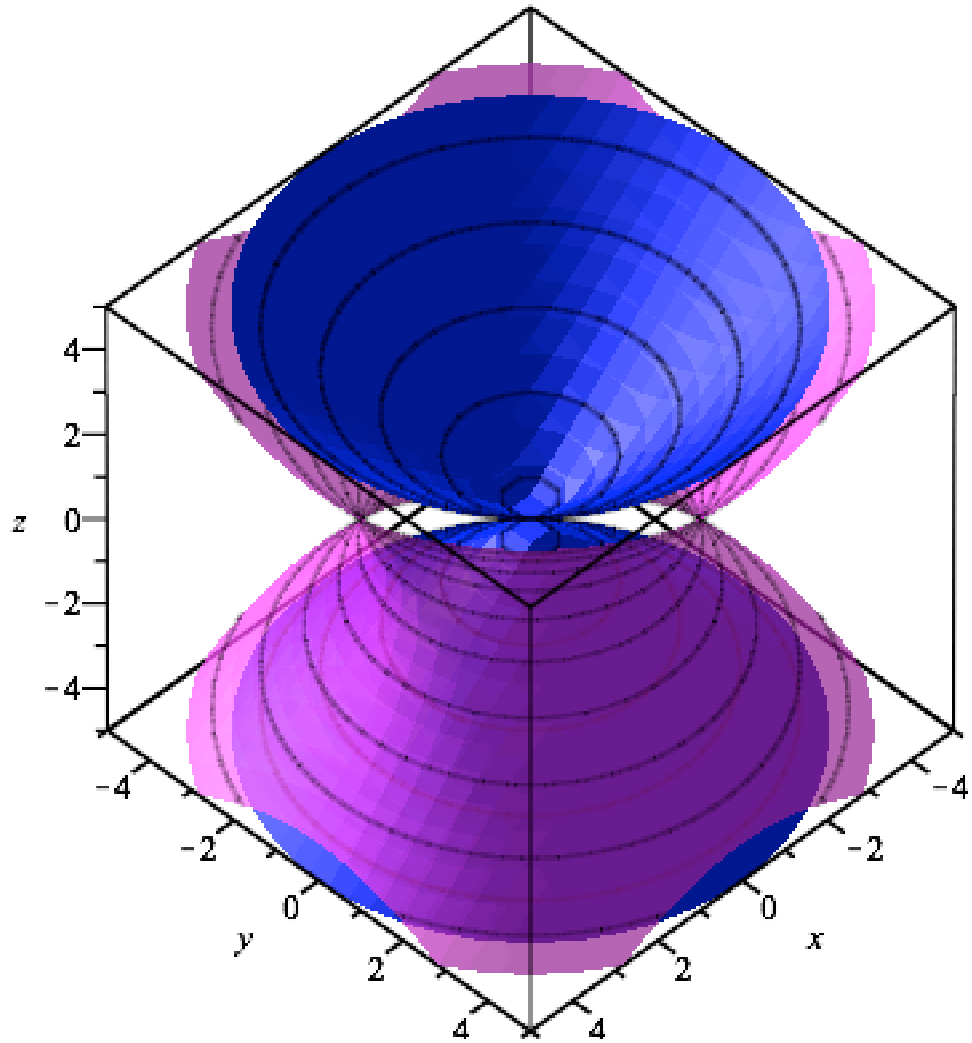


Vi ser figuren best ved å dreie litt på den. Gjør det!
P1 er egentlig en dobbel kjegle, men Maple mangler noen punkter nær origo der dobbelkjeglen er smalest. (Slikt kan skje, men det hjelper å be om flere punkter.)
P2 er en enkappet hyperboloide. Det dumme er at P2 skygger for P1.
Vi kan gjøre P2 litt gjennomsiktig:

> $P2 := implicitplot3d\left(x^2 + y^2 - z^2 = 8, x = -5..5, y = -5..5, z = -5..5, color = magenta, numpoints = 10000, style = surfacecontour, transparency = 0.3\right)$

$$P2 := PLOT3D(\ldots) \qquad \textbf{(19}$$

> $display(P1, P2, axes = boxed, labels = [x, y, z])$

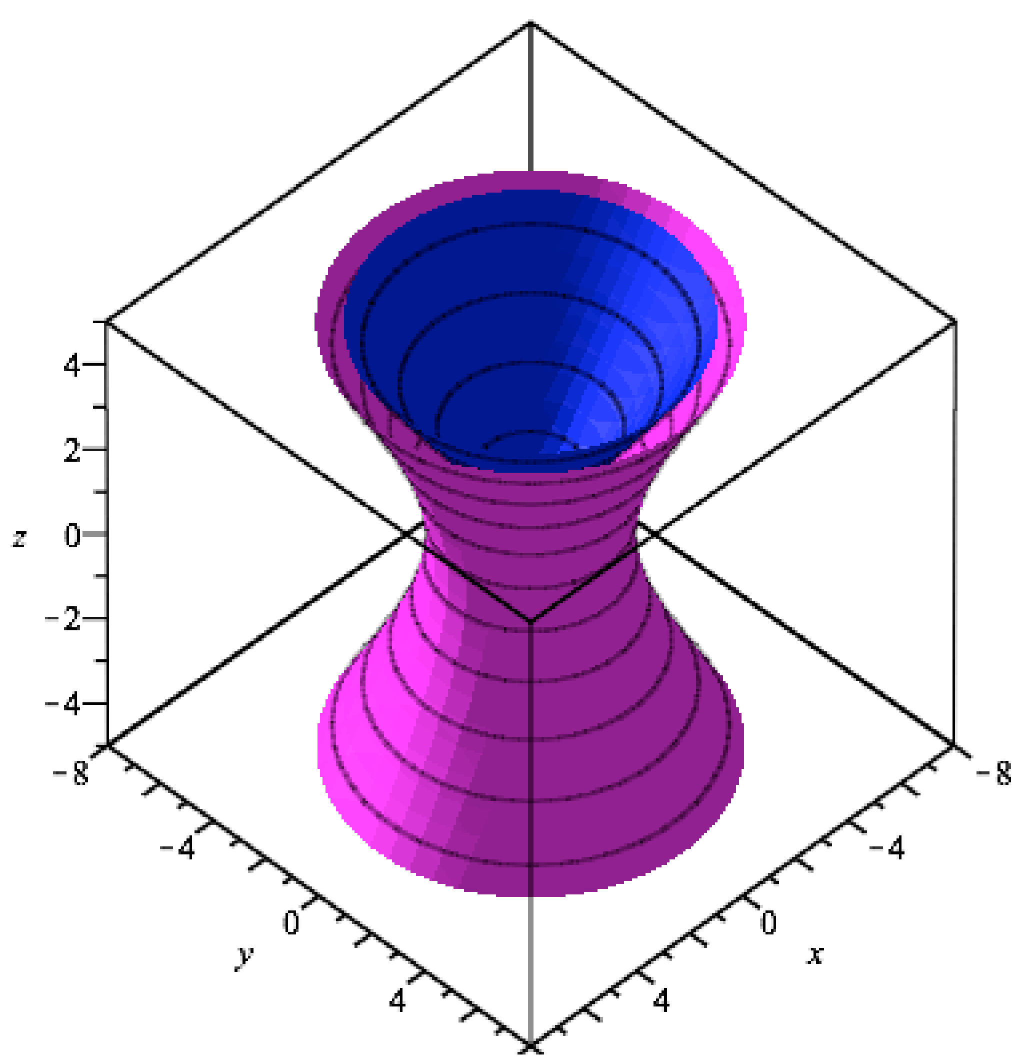


Det ble kanskje litt bedre.
Men den røde flaten burde vel også ha vært kuttet av i en sirkel og ikke med et kvadrat.

> $P2 := implicitplot3d\left(x^2 + y^2 - z^2 = 8, x = -8..8, y = -8..8, \ z = -5..5, color = magenta, numpoints = 10000, style = surfacecontour\right)$

$$P2 := PLOT3D(\ldots) \qquad \textbf{(20}$$

> $display(P1, P2)$



Ser du hvorfor denne forandringen i kommandoen fungerte?

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