

# Parametrisering og plots af Tycho Brahe Planetarium

## Fakta

### Fakta om Planetarium:

<http://www.planetariet.dk/bes%C3%B8g-os/om-planetariet/historien-om-planetariet/byggefasen>

Højde: 38 m

Diameter: 26 m

Taghældning: 30°

NB: Højeste punkt på Tycho Brahe Planetarium placeres i (0, 0, 38).

> restart

> with(plots) :

## Randen i bunden (cirkel)

Parametrisering med 1 parameter i 3D, hvor  $u \in [0; 2 \cdot \pi]$  :

>  $r1(u) := \langle a \cdot \cos(u) + a, a \cdot \sin(u), 0 \rangle$  :

'r1(u)' = r1(u)

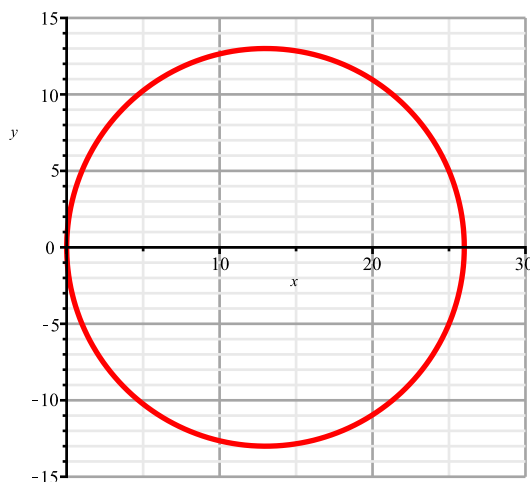
$$r1(u) = \begin{bmatrix} a \cos(u) + a \\ a \sin(u) \\ 0 \end{bmatrix} \quad (2.1)$$

For at plotte vælges en værdi for a (radius i cirklen):

> a := 13 :

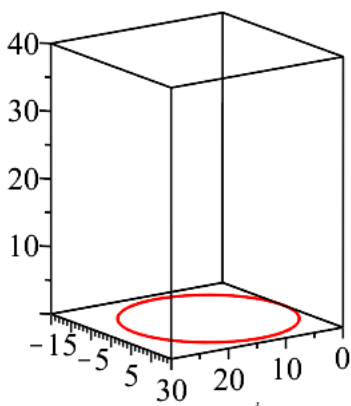
### Plot i 2D:

> plot([r1(u)[1], r1(u)[2], u = 0 .. 2·π], labels = [x, y], view = [0 .. 30, -15 .. 15], thickness = 2, color = red, gridlines, scaling = constrained);



### Plot i 3D:

> spacecurve(r1(u), u = 0 .. 2·π, axes = box, labels = [x, y, z], view = [0 .. 30, -15 .. 15, 0 .. 40], color = red, thickness = 2, scaling = constrained)



## Bunden (cirkelskive)

```
> unassign('a')
```

Parametrisering med 2 parametre i 3D, hvor  $u \in [0; 2 \cdot \pi]$  og  $v \in [0; 1]$  :

```
> r2(u, v) := <v·a·cos(u) + a, v·a·sin(u), 0> :
'r2(u, v)' = r2(u, v)
```

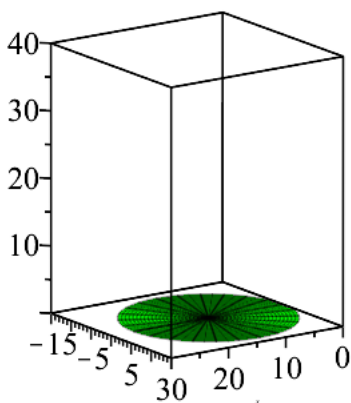
$$r2(u, v) = \begin{bmatrix} v a \cos(u) + a \\ v a \sin(u) \\ 0 \end{bmatrix} \quad (3.1)$$

For at plotte vælges en værdi for a (radius i cirklen):

```
> a := 13 :
```

Plot i 3D:

```
> plot3d(r2(u, v), u=0..2·π, v=0..1, labels=[x, y, z], axes=box, view=[0..30, -15..15, 0..40], scaling
=constrained, color=green)
```



## Kanten langs toppen (løftet cirkel)

```
> unassign('a')
```

Hældningskoefficienten for tagfladen, når vinklen med vandret er  $30^\circ$  :

```
> α := tan(-30/180·π)
```

$$\alpha := -\frac{\sqrt{3}}{3} \quad (4.1)$$

Ligning for plan, som indeholder tagfladen:

$$z = \alpha \cdot x + h = -\frac{\sqrt{3}}{3} \cdot x + 38$$

**Parametrisering med 1 parameter i 3D**, hvor  $u \in [0; 2 \cdot \pi]$  :

>  $r3(u) := \langle a \cdot \cos(u) + a, a \cdot \sin(u), \alpha \cdot (a \cdot \cos(u) + a) + h \rangle$  :  
 $'r3(u)' = r3(u)$

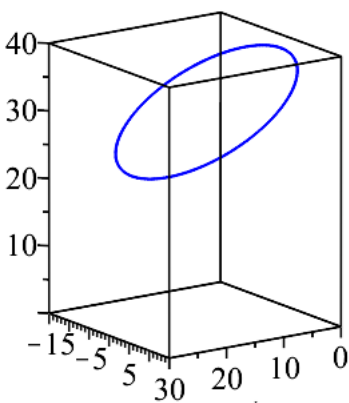
$$r3(u) = \begin{bmatrix} a \cos(u) + a \\ a \sin(u) \\ -\frac{\sqrt{3}}{3} (a \cos(u) + a) + h \end{bmatrix} \quad (4.2)$$

For at plote vælges en værdi for a (radius i cirklen på jorden) og h (højden):

>  $a := 13 : h := 38$  :

**Plot i 3D:**

> `spacecurve(r3(u), u = 0 .. 2 * pi, axes = box, labels = [x, y, z], view = [0 .. 30, -15 .. 15, 0 .. 40], color = blue, thickness = 2, scaling = constrained)`



## ▼ Skrå tagflade (løftet cirkelskive)

> `unassign('a') : unassign('h')`

**Parametrisering med 2 parametre i 3D**, hvor  $u \in [0; 2 \cdot \pi]$  og  $v \in [0; 1]$  :

>  $r4(u, v) := \langle v \cdot a \cdot \cos(u) + a, v \cdot a \cdot \sin(u), \alpha \cdot (v \cdot a \cdot \cos(u) + a) + h \rangle$  :  
 $'r4(u, v)' = r4(u, v)$

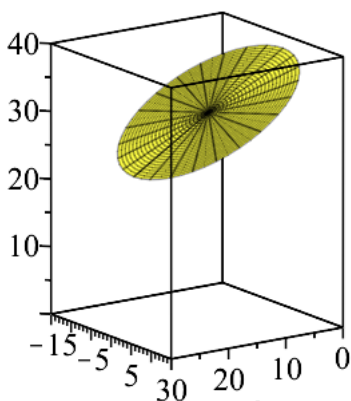
$$r4(u, v) = \begin{bmatrix} v a \cos(u) + a \\ v a \sin(u) \\ -\frac{\sqrt{3}}{3} (v a \cos(u) + a) + h \end{bmatrix} \quad (5.1)$$

For at plote vælges en værdi for a (radius i cirklen på jorden) og h (højden):

>  $a := 13 : h := 38$  :

**Plot i 3D:**

> `plot3d(r4(u, v), u = 0 .. 2 * pi, v = 0 .. 1, labels = [x, y, z], axes = box, view = [0 .. 30, -15 .. 15, 0 .. 40], scaling = constrained, color = yellow)`



## Vægfladen (afskåret cylinder)

```
> unassign('a') : unassign('h')
```

Parametrisering med 2 parametre i 3D, hvor  $u \in [0; 2 \cdot \pi]$  og  $v \in [0; 1]$  :

```
> r5(u) := <a*cos(u) + a, a*sin(u), v*(a*cos(u) + a) + h> :
'r5(u, v)' = r5(u, v)
```

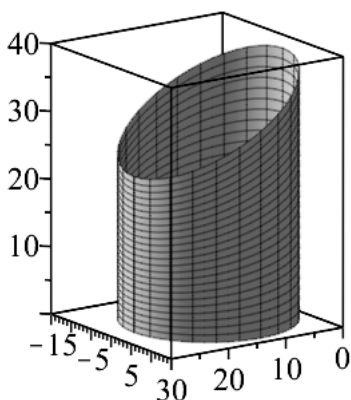
$$r5(u, v) = \begin{bmatrix} a \cos(u) + a \\ a \sin(u) \\ v \left( -\frac{\sqrt{3}}{3} (a \cos(u) + a) + h \right) \end{bmatrix} \quad (6.1)$$

For at plotte vælges en værdi for a (radius i cirklen på jorden) og h (højden):

```
> a := 13 : h := 38 :
```

Plot i 3D:

```
> plot3d(r5(u, v), u = 0 .. 2 * pi, v = 0 .. 1, labels = [x, y, z], axes = box, view = [0 .. 30, -15 .. 15, 0 .. 40], scaling = constrained, color = gray)
```



## Planetarium (3 stk. 2D-flader)

Bruger ovenstående parametriseringer med 2 parametre i 3D.

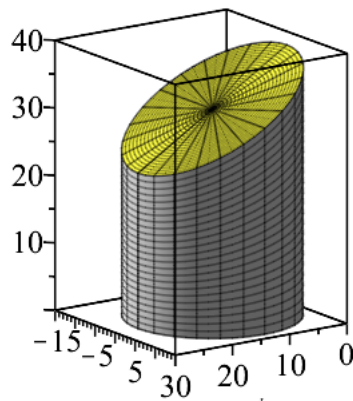
Plot i 3D:

```
> bund := plot3d(r2(u, v), u = 0 .. 2 * pi, v = 0 .. 1, labels = [x, y, z], axes = box, view = [0 .. 30, -15 .. 15, 0 .. 40], scaling = constrained, color = green) :
tag := plot3d(r4(u, v), u = 0 .. 2 * pi, v = 0 .. 1, labels = [x, y, z], axes = box, view = [0 .. 30, -15 .. 15, 0 .. 40],
```

```

scaling = constrained, color = yellow) :
sideflade := plot3d(r5(u, v), u = 0 .. 2 * pi, v = 0 .. 1, labels = [x, y, z], axes = box, view = [0 .. 30, -15 .. 15, 0
.. 40], scaling = constrained, color = gray) :
display(bund, tag, sideflade)

```



## Planetarium (3D-rum)

```
> unassign('a') : unassign('h')
```

**Parametrisering med 3 parametre i 3D**, hvor  $u \in [0; 2 \cdot \pi]$  og  $v \in [0; 1]$  og  $w \in [0; 1]$ :

```
> r6(u, v, w) := (w * a * cos(u) + a, w * a * sin(u), v * (alpha * (w * a * cos(u) + a) + h)) :
'r6(u, v, w)' = r6(u, v, w)
```

$$r6(u, v, w) = \begin{pmatrix} w a \cos(u) + a \\ w a \sin(u) \\ v \left( -\frac{\sqrt{3}}{3} (w a \cos(u) + a) + h \right) \end{pmatrix} \quad (8.1)$$

For at plotte vælges en værdi for a (radius i cirklen på jorden) og h (højden):

```
> a := 13 : h := 38 :
```

**Plot i 3D:**

```
> B := [0, 2 * pi, 0, 1, 0, 1] :
net := [10, 10, 10] :
bygning := Integrator8[sideFlader](r6, B, net) :
display(bygning, axes = box, labels = [x, y, z])
```

