

# MatOhj 2013, harj. 2 teht. 14

## MattieT/.../mplV018R

25.3.2013

### Leikkaavien lieriöiden tangenti

```
> restart
> with(plots) :
  setoptions3d(axes = boxed, orientation = [ -30, 50 ]) :
```

```
> x1 :=  $\sqrt{2} \cdot \cos(t)$ ;
  y1 :=  $\sqrt{2} \cdot \sin(t)$ 
```

$$x1 := \sqrt{2} \cos(t)$$

$$y1 := \sqrt{2} \sin(t)$$

(1.1)

```
> L1 := plot3d([x1, y1, z], t=0 ..2·Pi, z=-2 ..2)
  L1 := PLOT3D(...)
```

(1.2)

```
> y2 :=  $\sqrt{2} \cdot \cos(t)$ ;
  z2 :=  $\sqrt{2} \cdot \sin(t)$ ;
```

$$y2 := \sqrt{2} \cos(t)$$

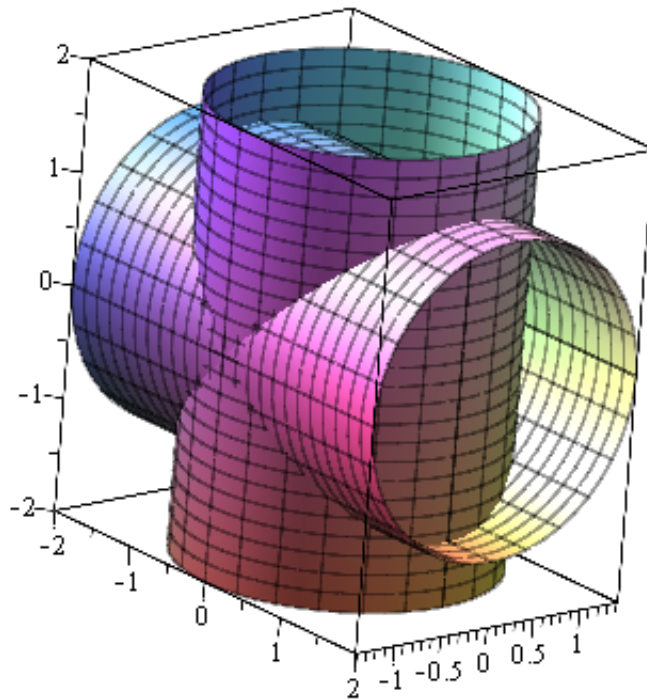
$$z2 := \sqrt{2} \sin(t)$$

(1.3)

```
> L2 := plot3d([x, y2, z2], x=-2 ..2, t=0 ..2·Pi)
  L2 := PLOT3D(...)
```

(1.4)

```
> display(L1, L2, scaling = constrained)
```



> ?Gradient

> with(VectorCalculus); with(LinearAlgebra) :

[&x, `\*`, `+`, `-', `:`, `:`, <, >, <|>, About, AddCoordinates, ArcLength, BasisFormat, Binormal, Compatibility, ConvertVector, CrossProduct, Curl, Curvature, D, Del, DirectionalDiff, Divergence, DotProduct, Flux, GetCoordinateParameters, GetCoordinates, GetNames, GetPVDDescription, GetRootPoint, GetSpace, Gradient, Hessian, IsPositionVector, IsRootedVector, IsVectorField, Jacobian, Laplacian, LineInt, MapToBasis, Nabla, Norm, Normalize, PathInt, PlotPositionVector, PlotVector, PositionVector, PrincipalNormal, RadiusOfCurvature, RootedVector, ScalarPotential, SetCoordinateParameters, SetCoordinates, SpaceCurve, SurfaceInt, TNBFrame, Tangent, TangentLine, TangentPlane, TangentVector, Torsion, Vector, VectorField, VectorPotential, VectorSpace, Wronskian, diff, eval, evalVF, int, limit, series]

(1.5)

> Lxy :=  $x^2 + y^2 - 2$ ; Lyz :=  $y^2 + z^2 - 2$ ;

$$Lxy := x^2 + y^2 - 2$$

$$Lyz := y^2 + z^2 - 2$$

(1.6)

> nxy := Gradient(Lxy, [x, y, z]); nxy := subs(x=1, y=-1, nxy)

$$nxy := 2x\bar{e}_x + 2y\bar{e}_y$$

$$nxy := 2\bar{e}_x - 2\bar{e}_y \quad (1.7)$$

>  $nzy := \text{Gradient}(Lyz, [x, y, z]); nzy := \text{subs}(z=1, y=-1, nzy)$   
 $nzy := 2y\bar{e}_y + 2z\bar{e}_z$

$$nzy := -2\bar{e}_y + 2\bar{e}_z \quad (1.8)$$

>  $\text{tangentiv} := \text{CrossProduct}(nxy, nzy)$

$$\text{tangentiv} := \begin{bmatrix} -4 \\ -4 \\ -4 \end{bmatrix} \quad (1.9)$$

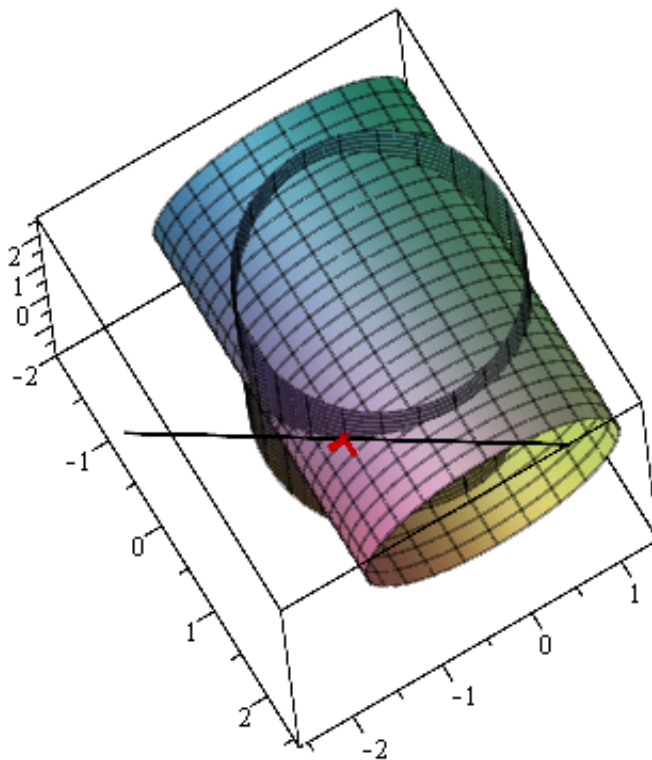
>  $Tsuora := \langle 1, -1, 1 \rangle + t \cdot \text{tangentiv}$

$$Tsuora := (1 - 4t)\bar{e}_x + (-1 - 4t)\bar{e}_y + (1 - 4t)\bar{e}_z \quad (1.10)$$

>  $\text{tangkuva} := \text{spacecurve}(Tsuora, t=-.4..4, \text{thickness}=2, \text{color}=\text{black})$

$$\text{tangkuva} := \text{PLOT3D}(\dots) \quad (1.11)$$

>  $\text{display}(L1, L2, \text{tangkuva}, \text{spacecurve}([1, -1, 1], x=-1..1, y=-1..1, \text{style}=\text{point}, \text{symbol}=\text{cross}, \text{symbolsize}=40, \text{color}=\text{red}, \text{thickness}=3))$



Piirrettiin lopuksi vielä sivuamispiste spacecurvella, yritettiin erilaisilla optioilla saada näkyviin, no jotenkuten, kun pyörittelee.

