

Mat-C.1 harj2

21.3. 2012

Jonot ja listat

Tässä on tiivistettyinä jonoihin ja listoihin liittyviä operaatioita, jotka voi käydä itsenäisesti läpi.

> $jono := seq(\ln(n), n = 1..10)$
 $jono := 0, \ln(2), \ln(3), 2 \ln(2), \ln(5), \ln(6), \ln(7), 3 \ln(2), 2 \ln(3), \ln(10)$ (3.1)

> $jono[5]$
 $\ln(5)$ (3.2)

> $jono[2..4]$
 $\ln(2), \ln(3), 2 \ln(2)$ (3.3)

> $exp(jono)$ # ei toimi näin
Error, (in exp) expecting 1 argument, got 10

> $lista := [jono]$
 $lista := [0, \ln(2), \ln(3), 2 \ln(2), \ln(5), \ln(6), \ln(7), 3 \ln(2), 2 \ln(3), \ln(10)]$ (3.4)

> $map(exp, lista)$ # kuvataan funktio exp listan alkioihin
 $[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]$ (3.5)

> $kulmat := \left[x, seq\left(\frac{n \cdot \pi}{6}, n = 0..6\right) \right]$
 $kulmat := \left[x, 0, \frac{1}{6} \pi, \frac{1}{3} \pi, \frac{1}{2} \pi, \frac{2}{3} \pi, \frac{5}{6} \pi, \pi \right]$ (3.6)

> $sini := map(\sin, kulmat)$
 $sini := \left[\sin(x), 0, \frac{1}{2}, \frac{1}{2} \sqrt{3}, 1, \frac{1}{2} \sqrt{3}, \frac{1}{2}, 0 \right]$ (3.7)

> $\sin\sim(kulmat);$
 $\left[\sin(x), 0, \frac{1}{2}, \frac{1}{2} \sqrt{3}, 1, \frac{1}{2} \sqrt{3}, \frac{1}{2}, 0 \right]$ (3.8)

> $kosini := map(\cos, kulmat)$
 $kosini := \left[\cos(x), 1, \frac{1}{2} \sqrt{3}, \frac{1}{2}, 0, -\frac{1}{2}, -\frac{1}{2} \sqrt{3}, -1 \right]$ (3.9)

$$\begin{aligned} > f := x \rightarrow \sin(2 \cdot x) \\ & \qquad \qquad \qquad f := x \rightarrow \sin(2x) \end{aligned} \tag{3.10}$$

$$\begin{aligned} > sini2 := \text{map}(f, kulmat) \\ sini2 := \left[\sin(2x), 0, \frac{1}{2} \sqrt{3}, \frac{1}{2} \sqrt{3}, 0, -\frac{1}{2} \sqrt{3}, -\frac{1}{2} \sqrt{3}, 0 \right] \end{aligned} \tag{3.11}$$

$$\begin{aligned} > \text{matrix}([kulmat, sini, kosini, sini2]) \\ \begin{bmatrix} x & 0 & \frac{1}{6} \pi & \frac{1}{3} \pi & \frac{1}{2} \pi & \frac{2}{3} \pi & \frac{5}{6} \pi & \pi \\ \sin(x) & 0 & \frac{1}{2} & \frac{1}{2} \sqrt{3} & 1 & \frac{1}{2} \sqrt{3} & \frac{1}{2} & 0 \\ \cos(x) & 1 & \frac{1}{2} \sqrt{3} & \frac{1}{2} & 0 & -\frac{1}{2} & -\frac{1}{2} \sqrt{3} & -1 \\ \sin(2x) & 0 & \frac{1}{2} \sqrt{3} & \frac{1}{2} \sqrt{3} & 0 & -\frac{1}{2} \sqrt{3} & -\frac{1}{2} \sqrt{3} & 0 \end{bmatrix} \end{aligned} \tag{3.12}$$

> with(LinearAlgebra) :

> with(linalg) :

> transpose((3.12));

$$\begin{bmatrix} x & \sin(x) & \cos(x) & \sin(2x) \\ 0 & 0 & 1 & 0 \\ \frac{1}{6} \pi & \frac{1}{2} & \frac{1}{2} \sqrt{3} & \frac{1}{2} \sqrt{3} \\ \frac{1}{3} \pi & \frac{1}{2} \sqrt{3} & \frac{1}{2} & \frac{1}{2} \sqrt{3} \\ \frac{1}{2} \pi & 1 & 0 & 0 \\ \frac{2}{3} \pi & \frac{1}{2} \sqrt{3} & -\frac{1}{2} & -\frac{1}{2} \sqrt{3} \\ \frac{5}{6} \pi & \frac{1}{2} & -\frac{1}{2} \sqrt{3} & -\frac{1}{2} \sqrt{3} \\ \pi & 0 & -1 & 0 \end{bmatrix} \tag{3.13}$$

> Transpose(Matrix((3.12)));

$$\begin{array}{cccc}
 x & \sin(x) & \cos(x) & \sin(2x) \\
 0 & 0 & 1 & 0 \\
 \frac{1}{6}\pi & \frac{1}{2} & \frac{1}{2}\sqrt{3} & \frac{1}{2}\sqrt{3} \\
 \frac{1}{3}\pi & \frac{1}{2}\sqrt{3} & \frac{1}{2} & \frac{1}{2}\sqrt{3} \\
 \frac{1}{2}\pi & 1 & 0 & 0 \\
 \frac{2}{3}\pi & \frac{1}{2}\sqrt{3} & -\frac{1}{2} & -\frac{1}{2}\sqrt{3} \\
 \frac{5}{6}\pi & \frac{1}{2} & -\frac{1}{2}\sqrt{3} & -\frac{1}{2}\sqrt{3} \\
 \pi & 0 & -1 & 0
 \end{array} \tag{3.14}$$

HT

Ellipsin $9 \cdot x^2 + 16 \cdot y^2 = 144$ sisään piirrettävä suorakulmio, jonka ala = max.

> restart :

> ellipsi := $9 \cdot x^2 + 16 \cdot y^2 = 144$

$$ellipsi := 9x^2 + 16y^2 = 144 \tag{4.1}$$

> A := $4 \cdot x \cdot y$

$$A := 4xy \tag{4.2}$$

> Y := solve(ellipsi, y);

$$Y := \frac{3}{4}\sqrt{-x^2 + 16}, -\frac{3}{4}\sqrt{-x^2 + 16} \tag{4.3}$$

> y := Y[1]

$$y := \frac{3}{4}\sqrt{-x^2 + 16} \tag{4.4}$$

> A;

$$3x\sqrt{-x^2 + 16} \tag{4.5}$$

> dA := diff(A, x);

$$dA := 3\sqrt{-x^2 + 16} - \frac{3x^2}{\sqrt{-x^2 + 16}} \tag{4.6}$$

> simplify(%);

$$-\frac{6(x^2 - 8)}{\sqrt{-x^2 + 16}} \tag{4.7}$$

> solve(% = 0, x);

$$\tag{4.8}$$

$$-2\sqrt{2}, 2\sqrt{2} \quad (4.8)$$

> `x0 := max(%);`

$$x0 := 2\sqrt{2} \quad (4.9)$$

> `subs(x = x0, A);`

$$6\sqrt{2}\sqrt{8} \quad (4.10)$$

> `simplify(%);`

$$24 \quad (4.11)$$

> `x, y := 'y';`

$$\begin{aligned} x \\ y := y \end{aligned} \quad (4.12)$$

> `with(plots) :`

> `ellipsi`

$$9x^2 + 16y^2 = 144 \quad (4.13)$$

> `ellkuva := implicitplot(ellipsi, x=-5..5, y=-5..5);`

$$ellkuva := PLOT(...) \quad (4.14)$$

> `y0 := subs(x = x0, Y[1]);`

$$y0 := \frac{3}{4}\sqrt{8} \quad (4.15)$$

> `suorak := [[x0, y0], [-x0, y0], [-x0, -y0], [x0, -y0], [x0, y0]];`

$$suorak := \left[\left[2\sqrt{2}, \frac{3}{4}\sqrt{8} \right], \left[-2\sqrt{2}, \frac{3}{4}\sqrt{8} \right], \left[-2\sqrt{2}, -\frac{3}{4}\sqrt{8} \right], \left[2\sqrt{2}, -\frac{3}{4}\sqrt{8} \right], \left[2\sqrt{2}, \frac{3}{4}\sqrt{8} \right] \right] \quad (4.16)$$

> `skKuva := plot(suorak) :`

> `display(ellkuva, skKuva);`

