Dynamat

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Links

- Harpa
- http://www.geogebra.lt
- http://notendur.hi.is/hla1/
- http://notendur.hi.is/kre7/alpha2/index.html

Calculus material

- Derivatives: Associating the slope of a tangent to the derivative.

- Integration: daemi 7.6.30 (exercise 7.6.30)

Geometry - algebra

- exercises
- $f(x) = x^3 + ax^2 + bx + c$
- Find a, b and c such that : point of inflection at (-1,12), minimum at x = 1.
- GeoGebra numer_3.ggb
- Find formula.... parabolas
- Optimization..... GeoGebra - rectangle

mixed

- Ball – variable speed
- Euclidean egg

Linear algebra

Describe the geometric effect of multiplication by

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

in terms of shears, compressions, expansions, and reflections.

Solution Since $\det(A) \neq 0$, the matrix A is invertible and hence can be reduced to I by a sequence of elementary row operations; for example,

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 2 \\ 0 & -2 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Add -3 times the first row to the second.

Multiply the second row by $-\frac{1}{2}$.

Add -2 times the second row to the first.

The three successive row operations can be performed using multiplications by the elementary matrices

$$E_1 = \begin{bmatrix} 1 & 0 \\ -3 & 1 \end{bmatrix}, \quad E_2 = \begin{bmatrix} 1 & 0 \\ 0 & -\frac{1}{2} \end{bmatrix}, \quad E_3 = \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$$

Inverting these matrices and applying Formula (2) of Section 3.3 yields the factorization

$$A = E_1^{-1}E_2^{-1}E_3^{-1} = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$

Thus, reading right to left, the geometric effect of A is to successively shear by a factor of 2 in the x-direction, expand by a factor of 2 in the y-direction, reflect about the x-axis, and shear by a factor of 3 in the y-direction. ∎

Ideas

- “Myndræn stærðfræði KB” - book
- New version of GeoGebra
- Statistics