# Linear Data Chapter 10

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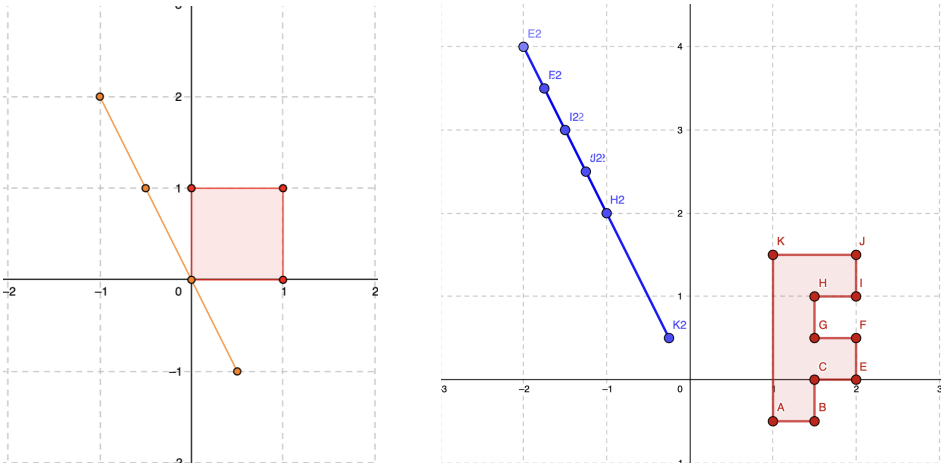
1. (a) Give an example of an element of the null space / kernel of the matrix $\mathbf{A}$ from the coding demonstration for Section 10.1.

   (b) [5 points] Give an example of an element of the image / column space of the matrix $\mathbf{A}$ from thhe coding demonstration for Section 10.1.

2. Consider the Geogebra screenshots below showing the effects of multiplication by a certain $2 \times 2$ matrix $\mathbf{B}$.




   (a) What must the rank of $\mathbf{B}$ be? Explain your answer.

   (b) Give at least one element of the image / column space of $\mathbf{C}$ which is not the zero vector. Explain your answer.

   (c) Describe what elements of the cokernel of $\mathbf{C}$ look like.

3. Using Python/Jupyter or Matlab/Matlab Live Script, perform the following.

   (a) Set

$$\mathbf{M} = \begin{pmatrix} -2 & 2 & -2 \\ 0 & -2 & 0 \\ 3 & 2 & 3 \end{pmatrix}, \quad \vec{b} = \begin{pmatrix} 1 \\ 5 \\ 5 \end{pmatrix}, \quad \vec{z} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

   (b) Determine if $\mathbf{M}\vec{x} = \vec{b}$ has a solution $\vec{x}$. If it does have a solution, give the solution.

(c) Set $\vec{c} = \mathbf{M}\vec{z}$.

(d) Generate another solution to $\mathbf{M}\vec{x} = \vec{c}$ than $\vec{x} = \vec{z}$.

(e) Explain how the answer to part (d) is related to the coimage of $\mathbf{M}$.