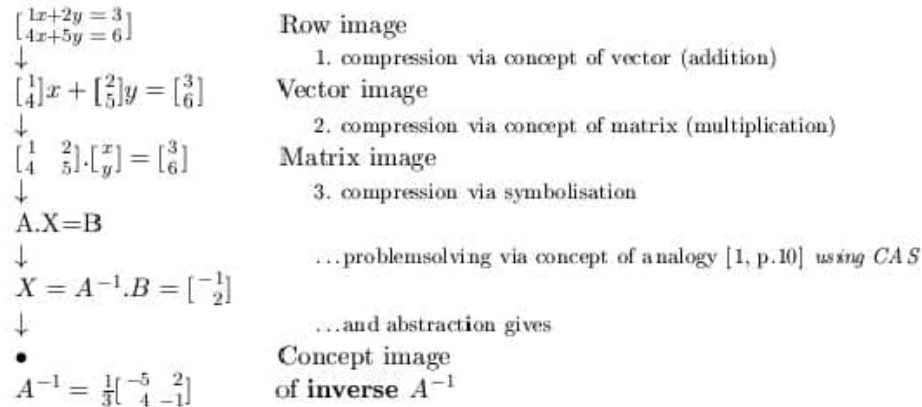


2B Concept formation according to APOS theory

Try to identify the individual **A-P-O-S** phases in the following sequence of steps to *form the concept of the inverse matrix* to an invertible matrix A :



Exercise:

- a) First test and explain the following interactive EIGENMATH mini learning environment (LE) to support the coining of the concept of the inverse matrix as shown above:

```
# EIGENMATH
A = ((1,2),(4,5))
X = (x,y)
B = (3,6)           -- dot(.,.) = .*
dot(A,X)             -- LHS of linear system A*X=B
X = dot(inv(A),B)    -- X = 1/A*B = A^(-1)*B
dot(A,X) == B        -- verify solution X = A^-1*B
```

Note: EIGENMATH use *dot* for the scalar/matrix product and *inv(A)* for the inverse matrix A^{-1} .

Invoke Eigenmath: <https://georgeweigt.github.io/eigenmath-demo.html>

Now enter the 6 statements in Eigenmath's window line by line.

Press **[↵] RETURN** after every code line. Press the **[Run]** button. Watch the output.

- b) In your opinion, what exploration opportunities are offered to the student in the above CAS-LE? Which *phenomena* could be specifically observed? In what respect is this LE *interactive*? What additional didactical and methodological options are there compared to a CAS-free access to the formation of the concept 'inverse matrix'?
- c) Design a small A.C.E cycle based on the above CAS-LE to form the concept of the inverse matrix.
- d) Construct an A.C.E cycle within a suitable CAS-LE to create a concept for a self-chosen concept from linear algebra/analytic geometry or analysis.