# Mathematics C1 Cayley: Educational Targets

<table>
<thead>
<tr>
<th>Module</th>
<th>block 2A, year 2013-2014</th>
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</thead>
<tbody>
<tr>
<td>Version</td>
<td>25-03-2013</td>
</tr>
</tbody>
</table>

The student is able to:

1. **work with systems of linear equations, vectors, matrices, linear transformations and explain the connections between these concepts**
   - determine an echelon form and the reduced echelon form of a matrix
   - write a linear system in the form \( Ax = b \)
   - determine if a linear system is (in)consistent
   - determine the solution set of a linear system
   - perform operations with vectors and matrices
     - (addition, scalar multiplication, multiplication, transpose, linear combinations
   - apply properties of operations with vectors and matrices
   - interrelate the solution sets of \( Ax = b \) and \( Ax = 0 \)
   - examine the linear (in)dependency of a set of vectors
   - explain the concept of linear transformation (domain, codomain, images)
   - calculate the standard matrix of a linear transformation
   - examine properties of linear transformations (one-to-one, onto)
   - define the concept of inverse of a matrix
   - apply properties of an invertible matrix
   - calculate the inverse of a regular matrix
   - characterize an invertible matrix in terms of its echelon form, its columns (rows), linear systems

2. **work with subspaces of \( \mathbb{R}^n \) and determinants and connect them with the previous concepts**
   - explain the concepts of subspace and basis
   - determine (a basis for) a subspace (e.g., column space, null space of a matrix)
   - compute coordinate vectors w.r.t. a basis
   - determine the dimension of a subspace
   - determine the rank of a matrix
   - apply the Rank Theorem
   - explain the concept of determinant of a matrix
   - compute the determinant of a matrix using cofactor expansion
   - apply properties of determinants
     - (w.r.t. row- and column operations and multiplication)
   - characterize an invertible matrix in terms of its determinant
   - calculate the area of a parallelogram or volume of a parallelepiped using determinants
   - explain the effect of a linear transformation on areas and volumes