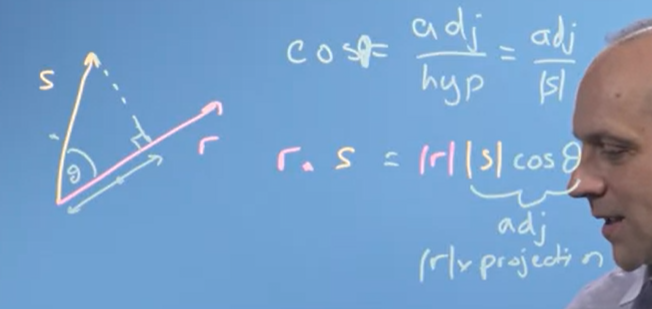
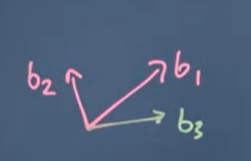
**Mathematics-for-Machine-Learning**

1. Getting handle on vectors:
   1. Definition:
      1. Vectors are usually viewed by computers as an ordered list of numbers which they can perform "operations" on - some operations are very natural and, as we will see, very useful!
      2. A vector in space-time can be described using 3 dimensions of space and 1 dimension of time according to some co-ordinate system.
      3. Vectors can be thought of in a variety of different ways - some geometrically, some algebraically, some numerically. In this way, there are a lot of techniques one can use to deal with vectors.
   2. Vector is just something that are based on two rules. Firstly, addition, and secondly, multiplication by a scalar number.
      1. Addition:
      2. Multiplication:
2. Finding the size of vectors, its size and projection
   1. Size of vectors = =
   2. Dot product of vectors:
   3. Cosine rule =
   4. Projection = dot product gives us, is it gives us the projection here of S on to R times the size of R. And one thing to notice here is that if S was perpendicular to R, if S was pointing this way, it would have no shadow. 
      1. Vector projection =
      2. Scalar projection =
3. Changing basis:
   1. Any vector space has multiple bases, so the question naturally arises: what are the relationships between bases of a vector space? In the first place, there must be the same number of elements in any basis of a vector space. Then, given two bases of a vector space, there is a way to translate vectors in terms of one basis into terms of the other; this is known as change of basis.

Change of basis is a technique applied to finite-dimensional vector spaces in order to rewrite vectors in terms of a different set of basis elements. It is useful for many types of matrix computations in linear algebra and can be viewed as a type of linear transformation.

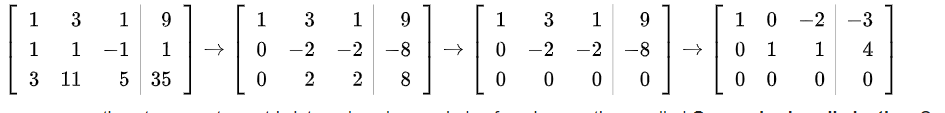
* 1. 1)
  2. 2)

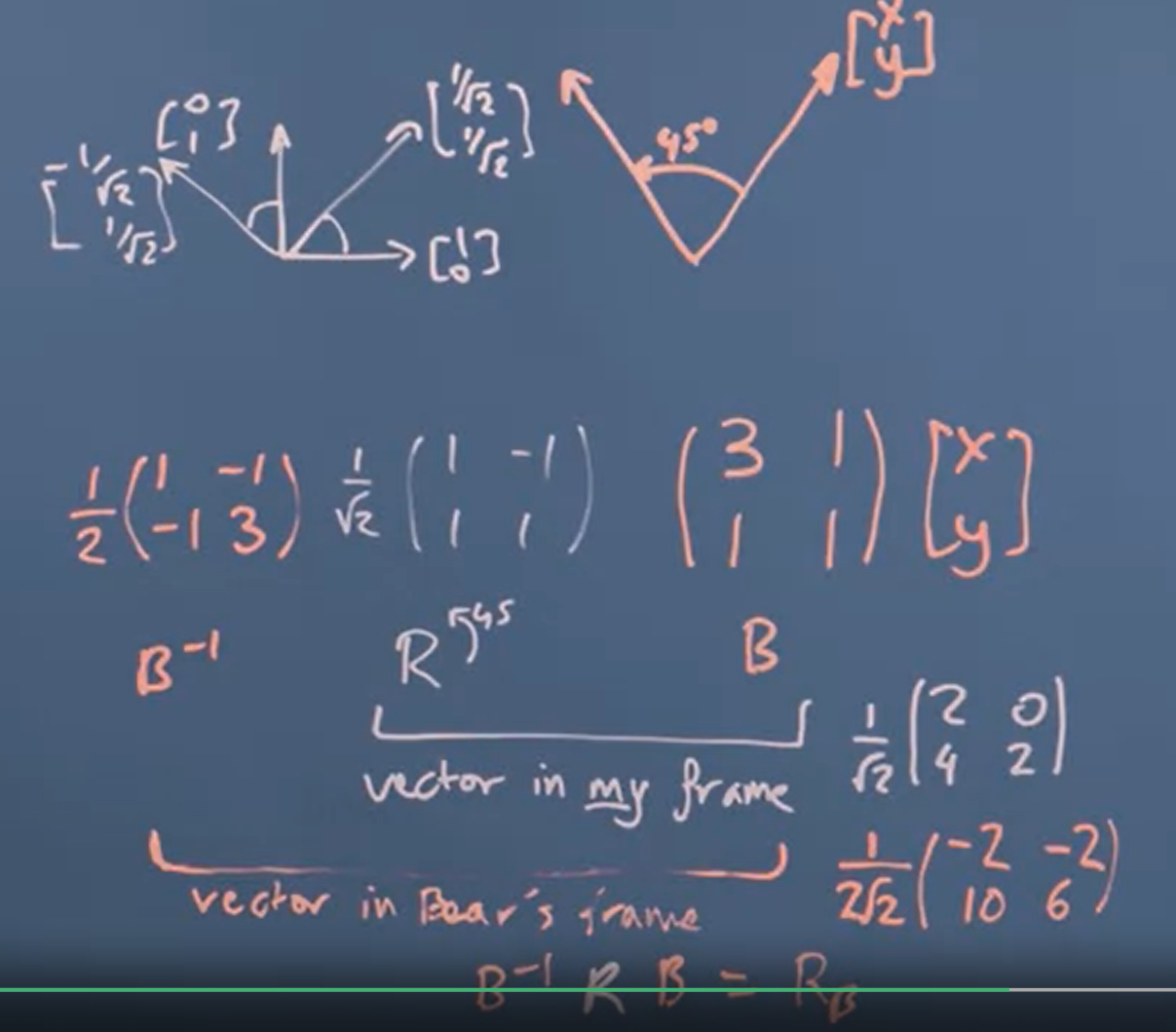
1. Basis, vector space and linear independence
   1. Basis is a set pf n vectors that:
      1. Are not linear combination of each other(Linear independent)
      2. Span the space
      3. The space is n-dimensional
   2. Linear independence:

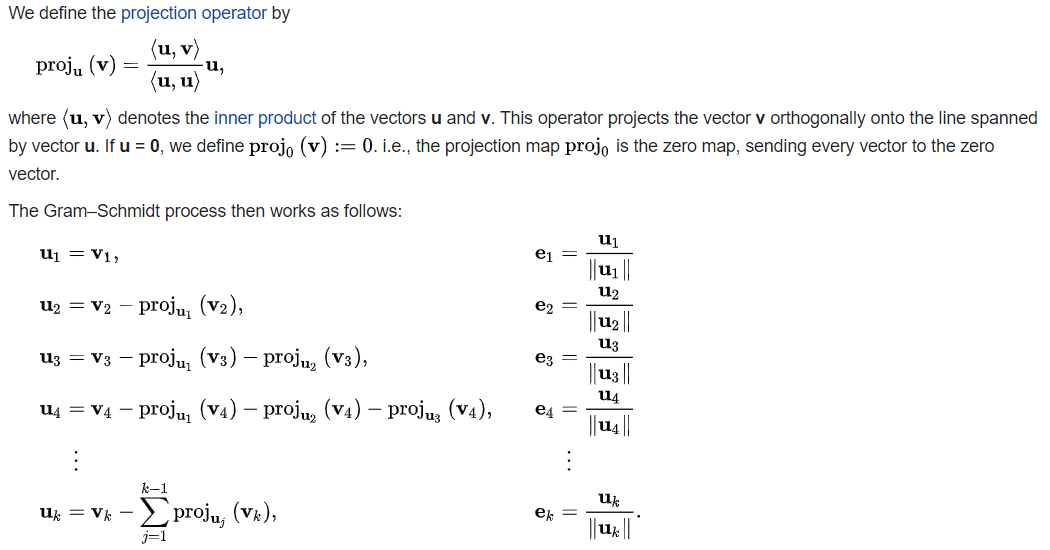


* + 1. if detM≠0, the given vectors are linearly independent

1. Gaussian elimination
   1. Gaussian elimination, also known as row reduction, is an algorithm in linear algebra for solving a system of linear equations. It is usually understood as a sequence of operations performed on the corresponding matrix of coefficients.



1. Transformation in a changed basis and changing basis: 
2. Orthogonal matrices
   1. ,
   2. Orthogonal matrixes –
   3. A set of unit length basis vectors that are all perpendicular to each other are called an orthonormal basis set, and the matrix composed of them is called an orthogonal matrix.
3. The Gram–Schmidt process



* 1. Gram–Schmidt process is a method for orthonormalizing a set of vectors in an inner product space, most commonly the Euclidean space

1. Transformation matrix for reflecting vectors in an arbitrarily angled mirror, construct an orthonormal basis that spans a set of input vectors ,
2. Eigenvalues and Eigenvectors:
   1. In linear algebra, an **eigenvector** or **characteristic vector** of a linear transformation is a nonzero vector that changes by a scalar factor when that linear transformation is applied to it. The corresponding eigenvalue, often denoted by is the factor by which the eigenvector is scaled.
   2. How to find eigenvectors and eigenvalues
   3. To find we use diagonalization for ex:
      1. The find eigenvectors: