Finding Eigenvalues

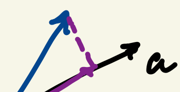
$Ax = \lambda x \Rightarrow (A - \lambda I)x = 0$

$C = (A - \lambda I)$, The shift of A along the diagonal such that it is singular.

1. $\det(A - \lambda I) = 0$
   see the study guide for 2x2 examples. Not so good for matrices larger than 2x2.

2. How MATLAB does it.
   - more in the Lin Algebra Appendix.

   a) $A \rightarrow Q$ Q has orthogonal columns.



$A = QR$

[Q,R]=qr(A);
A=R*Q;

Gram schmidt algoritm via projections of columns of A.

   b) $A = QR \Rightarrow R = Q^T A$

   c) $A = RQ$

A and RQ are similar matrices, meaning that they have the same eigenvalues.

d) repeat steps a - c until:

i) Q is an identity matrix.

ii) $A = RQ$ is upper triangular.

iii) A will not change with additional iterations.

e) Eigenvalues are on the diagonal of new A.

$$\det(C) = \begin{vmatrix} a_{11}-\lambda_1 & a_{12} & a_{13} \\ & a_{22}-\lambda_2 & a_{23} \\ 0 & & a_{33}-\lambda_3 \end{vmatrix} = (a_{11}-\lambda_1)(a_{22}-\lambda_2)(a_{33}-\lambda_3) = 0$$

Roots of the polynomial are the diagonal values:

$a_{11}, a_{22}, a_{33}, \ldots$