

Lab 5, April 13, 2016
Numerical Linear Algebra, Spring 2016

Experiment:

Find the reduced QR factorization of the Vandermonde matrix $A = [1, x, x^2, \dots, x^{n-1}]$ by using 256 equally spaced points in the interval $[-1, 1]$ and plot the first five Legendre polynomials (in the same plot). To start, use the following code:

```
x = (-128:128)'/128; % set x to a discretization of [-1, 1]
A = [x.^0 x.^1 x.^2 x.^3]; % construct Vandermonde matrix for $n=4$
```

After you find $A = QR$, the columns of Q are the first four Legendre polynomials P_k . Since they should satisfy $P_k(1) = 1$. Fix it by scaling:

```
scale = Q(257,:); % select the last row of Q
Q = Q*diag(1./scale); % rescale columns
plot(Q) % plot columns of rescaled Q
```