Exercise 4.2.20

```
A = randn(8,4);
A(:,5:6)=A(:,1:2) + A(:,3:4);
[Q,R]=qr(randn(6));
A = A * Q;
A
```

```
A = 8×6
   1.2880e+00  -2.6749e+00  -7.1700e-01   1.2865e+00  -2.5589e+00   1.8635e+00
  -1.2273e+00   7.2965e-01  -3.7717e-02  -7.3116e-01   1.7739e+00  -2.4644e-01
   9.4414e-01   2.1948e+00   6.9207e-01  -1.2440e+00   3.1253e+00  -1.0307e+00
   2.1050e-02   1.9076e-01  -1.4278e-01  -1.7191e-01   2.6570e+00   6.0782e-01
   1.7269e+00  -1.3422e+00  -4.5538e-01   1.3914e-01   4.4244e-01   1.5767e+00
   2.4711e-01  -1.8232e+00  -9.4248e-01  -1.5740e+00  -1.4220e+00   1.4838e+00
  -6.4776e-01  -1.6829e+00  -4.1297e-01   1.9949e+00  -1.8353e+00   8.8628e-01
  -1.3360e+00   9.1636e-01   7.4043e-02  -3.0774e-01   2.1059e+00  -3.7049e-01
```

There's no good way to determine the numerical rank of this matrix by inspection of it's elements.

```
S = svd(A);
format short e;
S'
```

```
ans = 1×6
   8.0426e+00   3.6182e+00   2.5673e+00   2.4537e+00   4.3969e-16   2.9516e-16
```

We see there are two very small signular vaules - near machine precision in value. This indicates the numerical rank is 4.

```
tol =eps;

r=rank(A,tol)
```

```
r = 
     6
```

Sometimes we get 5 using eps for tol. If we set tol=eps^2 we always get 6.