1. Carry out Gaussian Elimination with partial pivoting to find $P, L, U$ for

$$A = \begin{pmatrix} 2 & 1 & 3 \\ 1 & 1 & 2 \\ 4 & 1 & 2 \end{pmatrix}.$$ 

2. Let $A$ be $m \times n$, $m \geq n$. Show that $\|A^T A\|_2 = \|A\|_2^2$ and that $\kappa_2(A^T A) = \kappa_2(A)^2$.

3. Show that if a matrix is triangular and orthogonal, then it is diagonal.

4. Derive an approximation flop count for code.

```plaintext
s=0
for k=1:n
    for j=k:n
        s=s+k+j
    end
end
```

5. Prove that

$$\|x\|_{\infty} \leq \|x\|_2$$

for all vectors $x$ of length $n$. 