**Applied Computational Science**

# Homework: Linear Algebra.

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**Q.1 a)**

To show *ATA* symmetric,

Since transpose of the term ATA is gives the original matrix as result.

For Positive Semi-definite,

We need to show *≥ 0*,

Since square of any real number is always positive.

To demonstrate that *ATA* is positive definite,

Assume *A* is invertible,

*xT*(*ATA*)*x*=(*Ax*)*T*(*Ax*)=∥*Ax*∥2

And, we know, for . Therefore, which means is positive definite.

Also, let us assume that is positive definite, then for a non-zero vector ,

If A was invertible, then the value of should be , which is not possible since x is a non-zero vector, A must be invertible.