Instructions:

- Solve the following questions on a sheet of paper (do not need to type).
- Write your Last name, First name, and Student ID on the top of the first page.
- Take photos or scan each page by a phone or scanner.
- Turn your photos into a single PDF file using free softwares for merging PDF files such as: `https://pdfresizer.com/`
- Upload your answers in a single PDF file in the Assignment section of the course website. Make sure your file is in PDF and is readable before you submit it.
- Deadline of the submission: Sunday, Jan. 19, 11:59 pm. Total marks: 20.

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1. Let $u = \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}$, $v = \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}$ and $w = \begin{bmatrix} 4 \\ 0 \\ 3 \end{bmatrix}$,
   (a) Calculate the dot products $u.w$ and $u.(v + w)$.
   (b) Compute the lengths $\|u\|$, $\|v\|$ and $\|w\|$.
   (c) Find the unit vector parallel to u.
   (d) Find a vector with the same length as u, in the same direction as v.
   (e) Verify triangular inequality and Schwartz inequality for the vectors v and w.

2. Let $u = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, $v = \begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix}$,
   (a) Find the angle between the vectors u and v.
   (b) Is the vector u orthogonal to v? Why?

3. Let $u = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$, $v = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$ and $w = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$,
   (a) Show that w is not a linear combination of u.
   (b) Show that u and v are linearly independent.
   (c) Show that w is a linear combination of u and v.