All hw should be uploaded to canvas as a *pdf*. Make sure that if you scan your handwritten notes that they are legible and appropriately oriented. If you use an online resource to solve any problem, please appropriately cite that source.

Solve these following problems from the VMLS book (linked here):

Problem 1. (VMLS 2.8, Integral and derivative of polynomial.)

Problem 2. (VMLS 3.6, Taylor approximation of norm.)

Problem 3. (VMLS 3.9, Difference of squared distances.)

Problem 4. (VMLS 3.24, Distance versus angle nearest neighbor.)

Problem 5. (VMLS 4.3, Linear separation in 2-way partitioning.)

Problem 6. (VMLS 5.5, Orthogonalizing vectors.)

And solve these additional problems:

Problem 7. (Linear functions.) Let the T-vector x be a time series, with x_t its value in period t, for $t = 1, \ldots, T$. Consider the function $f(x) = x_T - \mathbf{avg}(x)$, the difference of the last value and the average. Is f linear? If f is not linear, give a specific example of T-vectors x, y, and constants α and β, for which $f(\alpha x + \beta y) \neq \alpha f(x) + \beta f(y)$. If f is linear, give a specific vector a for which $f(x) = a^\top x$ holds for any T-vector x.

Problem 8. (True or false.) Determine whether each of the following statements is true or false, and provide justification for your answer.

(a) If n-vectors x and y make an acute angle, then $\|x + y\| \geq \max\{\|x\|, \|y\|\}$.

(b) For any vector a, $\mathbf{avg}(a) \leq \mathbf{rms}(a)$.