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 CS539
 HW7

1.

1.

1. given $x = [1,1]$ scaled by sigmas = $[2,2]$ and $[0.5,0.5]$

sum = $[4,4]$

2. given $x = [1,-1]$ scaled by sigmas = $[2,-2]$ and $[1,-1]$

sum = $[3,-3]$

3. $M =$

$\begin{bmatrix} 3,1 \\ 3,1 \end{bmatrix}$

$Mx = [4,4]$

$Mx = [3,-3]$

2. IF $N = UDV^T$ then

$$N^T N = (VD^T U^T) U D V^T$$

$$= V(D^T D) V^T$$

$$\text{AS } D = D^T$$

$$V(D^T D) V^T = V(D^2) V^T$$

2. If all world points are co-planer the A cannot have a rank greater than 9. Such that A's rank is 12. This is because given RREF(B), where $B = A$ with a Rank > 9 , then the number of free pivots == N, and is a non homogenous system. As such $Bx \neq 0$ and thereby does not exist a set of linearly independent solutions.

3.

1. For all world points X^W its image point

$$X^I = |f|^2 * X^c / f_x X^c$$

$$X_{foe}^I = |f|^2 * V^c / f_x V^c$$

If the camera is moving with a velocity of V^c with no rotation, then the projection of the world onto the image is the $P(RX^W + T)$

As $R = 0$ then the world points are moving over time T

given T then any point in X^I will be shown with a displacement of $X^I - X_{foe}^I$

In relation to time k then the velocity of the image point will be given as $(k)(X^I - X_{foe}^I)$

2. As Velocity = distance/time

$$VI = K(\text{Displacement})$$

then K must equal 1/time