## ECE 5554: CV: HW-4

1.a) Essential Matrix

E = [t] x R

xx: Skew Synnetric natrice R: Rotation Natrice, which is I - Italy sto our case

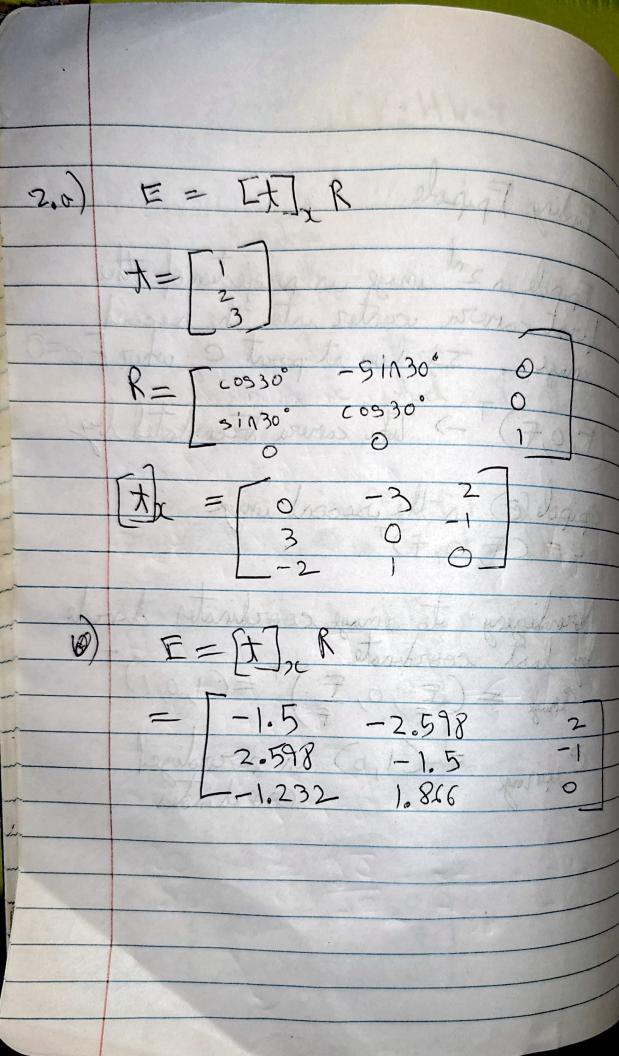
to translation is (F, O, F)' as comore branslates by Fin 2' and 3' durentions in y' R = I is the Le identity matrix

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 & -f & 0 \\ f & 0 & -f \\ 0 & f & 0 \end{bmatrix}$$

下= [大]

 $E = \begin{bmatrix} 0 & -f & 0 \\ f & 0 & -F \\ 0 & F & 0 \end{bmatrix}$ 

1) Finding Tripole Epipole in 2nd image is projection of the first corners conter into the second image. It lies at point 2, where Eo=0 (F, O, F) -> The corners translated by Exipole (2) in the second image  $e = (F, O, F)^T$ Normalizing to image coordinates duride by last coordinate  $(E, 0, F)^T = (1, 0, 1)^T$ Exprage = (1,0) in normalized Coordinates



b) Rock of E: Using (5VD) Singular Value Decomposition Z = [3.7417,0] Rank of = is 2 as there ste two sinjerificant non-zero values. natorita & sunal 910 THE SELECTION OF SELECTION partital regists while Neilige gary glass 18 

```
[1] import numpy as np
    # Define the translation vector t
    t = np.array([1, 2, 3])
    # Define the rotation matrix R
    theta = np.radians(30) # Convert angle to radians
    R = np.array([
        [np.cos(theta), -np.sin(theta), 0],
        [np.sin(theta), np.cos(theta), 0],
        [0, 0, 1]
    1)
    # Compute the skew-symmetric matrix [t]_x
    t_cross = np.array([
        [0, -t[2], t[1]],
        [t[2], 0, -t[0]],
        [-t[1], t[0], 0]
    1)
    # Compute the essential matrix E = [t]_x * R
    E = np.dot(t_cross, R)
    # Perform Singular Value Decomposition (SVD) to compute the rank of E
    U, S, Vt = np.linalg.svd(E)
    rank_E = np.sum(S > 1e-10) # Count non-zero singular values
    E, S, rank_E
\rightarrow (array([[-1.5 , -2.59807621, 2.
                                                   1,
            [ 2.59807621, -1.5
            [-1.23205081, 1.8660254,
                                        0.
     array([3.74165739e+00, 3.74165739e+00, 1.98024198e-17]),
     2)
```