CSE 252A HW#3 Zhisheng Huang A53240987

P1/ (a) Since $(x, y) = (0,0) \rightarrow (-20, 0, 1)$

$(u, v) = (0,0) \rightarrow (20, 0, 1)$,

$(x, y) = (12, 12) \rightarrow (-8, 12, 1)$

$(u, v) = (1, 12) \rightarrow (21, 12, 1)$

For points in each camera are relative to the camera center, we can get the expressions for two lines which go through these two points:

$L_1 = (-20, 0, 0) + a((-8, 12, 1) - (-20, 0, 0))$

$L_2 = (20, 0, 0) + b((21, 12, 1) - (20, 0, 0))$

let $L_1 = L_2$

We get

$$\begin{pmatrix} -20 + 12a \\ 12a \\ a \end{pmatrix} = \begin{pmatrix} 20 + b \\ 12b \\ b \end{pmatrix}$$

$$\text{So, } \begin{cases} a = b \\ -20 + 12a = 20 + b \end{cases} \Rightarrow a = b = \frac{40}{11}$$

Thus, the 3D location of the point is $\begin{bmatrix} \frac{260}{11} \\ \frac{480}{11} \\ \frac{40}{11} \end{bmatrix}$

(b) Let's assume P's on this line, with coordinates as $\begin{bmatrix} x \\ 0 \\ z \end{bmatrix}$, where $x + z = 0$.

P' is the corresponding point with coordinate $\begin{bmatrix} x+40 \\ 0 \\ z \end{bmatrix}$.

Two points on 2 images are P_1 & P_2. G is the corresponding point for P_1 on image II, which remains the same distance to the center of image II.

The illustration graph is shown below