1-1.6-25

ai24btech11030 - Shiven Bajpai

Question: Three points $P(h,k)$, $Q(x_1,y_1)$ and $R(x_2,y_2)$ lie on a line. Show that

$$\frac{h-x_1}{y_2-y_1}=\frac{k-y_1}{x_2-x_1}$$

Solution: Since the points P, Q, R are collinear, The matrix $\begin{pmatrix}P-Q & R-Q\end{pmatrix}$ must have rank 1.

$$\begin{pmatrix}P-Q & R-Q\end{pmatrix}^T=\begin{pmatrix}h-x_1 & x_2-x_1\\ y-y_1 & y_2-y_1\end{pmatrix}$$

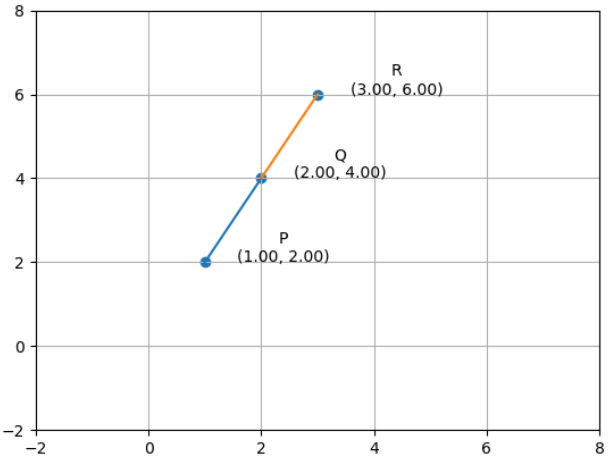
$$\text{Using } R_2 \leftarrow R_2-\frac{k-y_1}{h-x_1}R_1$$

$$=\begin{pmatrix}h-x_1 & x_2-x_1\\ 0 & y_2-y_1-\frac{(k-y_1)(x_2-x_1)}{h-x_1}\end{pmatrix}$$

Since matrix has rank 1, we can say

$$y_2-y_1-\frac{(k-y_1)(x_2-x_1)}{h-x_1}=0$$

$$\frac{h-x_1}{y_2-y_1}=\frac{k-y_1}{x_2-x_1}$$




```
:!python3 main.py
Taking point P to be: [[1.]
 [2.]]
Taking point Q to be: [[2.]
 [4.]]
Taking point R to be: [[3.]
 [6.]]
Calculated LHS to be: 2.0
Calculated RHS to be: 2.0
```

Code for this plot can be found at:

Codes/main.py Codes/main.c