centroid

EE1030 : Matrix Theory
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1-2-18. If the origin is the centroid of the triangle PQR with vertices $\mathbf{P}(2a, 4.6)$, $\mathbf{Q}(-4, 3b, 10)$ and $\mathbf{R}(8, 14, 2c)$, then find the values of a,b and c.
sol:

$$\mathbf{P}\,(x_1, y_1, z_1) = (2a, 4, 6)$$
$$\mathbf{Q}\,(x_2, y_2, z_2) = (-4, 3b, 10)$$
$$\mathbf{R}\,(x_3, y_3, z_3) = (8, 14, 2c)$$

Given that, the centroid of the triangle **PQR** is origin$(0, 0, 0)$.
Centroid(G).

$$let\ the\ matrix\ S = \begin{bmatrix} 2a & 4 & 6 \\ -4 & 3b & 10 \\ 8 & 14 & 2c \end{bmatrix}$$

$$The\ matrix\ G = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \end{bmatrix} S$$

after the matrix multiplication

$$G = \frac{1}{3}\begin{bmatrix} 2a - 4 + 8 & 4 + 3b + 14 & 6 + 10 + 2c \end{bmatrix}$$

and given that

$$G = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$$

on comparing we get that

- $2a - 4 + 8 = 0$
- $4 + 3b + 14 = 0$
- $6 + 10 + 2c = 0$
- $a = -2$
- $b = -6$
- $c = -8$

$\therefore$ the values of a,b,c are -2,-6,-8 respectively.