1.7.1 – Matgeo Assignment

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Question

Show that the points $(0, 0)$, $(2m, -4)$, and $(3, 6)$ are collinear, and hence find m, using the rank method.

Step 1: Form vectors

$$A = (0, 0), \quad B = (2m, -4), \quad C = (3, 6)$$

$$AB = \begin{bmatrix} 2m \\ -4 \end{bmatrix}, \quad AC = \begin{bmatrix} 3 \\ 6 \end{bmatrix}$$

Step 2: Matrix form

Form the matrix with AB and AC as columns:

$$M = \begin{bmatrix} 2m & 3 \\ -4 & 6 \end{bmatrix}$$

For collinearity, $\text{rank}(M) = 1$, i.e. $\det(M) = 0$.

Step 3: Determinant

$$\det(M) = (2m)(6) - (-4)(3)$$

$$\det(M) = 12m + 12$$

For collinearity:

$$12m + 12 = 0 \quad \Rightarrow \quad m = -1$$

Final Answer

The points $(0, 0)$, $(2m, -4)$, and $(3, 6)$ are collinear when

$$\boxed{m = -1}$$