MATH 2000 **Quiz 4** APR 8, 2019
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1. Consider the following $\mathbf{3 \times 4}$ matrix:

$$A = \begin{bmatrix} 1 & 4 & 0 & -1 \\ 3 & 12 & 1 & -1 \\ 2 & 8 & 1 & 0 \end{bmatrix}$$

Let $T : \mathbb{R}^4 \to \mathbb{R}^3$ be a linear transformation defined as $T(\vec{x}) = A\vec{x}$.

(a) What is the image of T? Write it as span of some linearly independent vectors. What kind of geometric object is it? [5]

(b) Find a basis of the kernel of T i.e. null space of A. [3]

(c) Is T one-to-one? Is T onto? [2]

2. Suppose $\vec{v}_1 = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$ and $\vec{v}_2 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ form a basis $\mathscr{B}$ of a vector space V. Suppose you are given that $\vec{u} = \begin{bmatrix} 4 \\ -2 \\ 1 \end{bmatrix} \in V$. Find the coordinates of $\vec{u}$ with respect to $\mathscr{B}$ i.e. $[\vec{u}]_{\mathscr{B}}$. [5]