1. True or False?

The set

$$\left\{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \in \mathbb{R}^3 : x + 2y - z = 0 \right\}$$

is a subspace of $\mathbb{R}^3$.

2. True or False?

The set

$$\left\{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \in \mathbb{R}^3 : x + y + z = 1 \right\}$$

is a subspace of $\mathbb{R}^3$.

3. True or False?

The set

$$\left\{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \in \mathbb{R}^3 : x^2 + y^2 = 0 \right\}$$

is a subspace of $\mathbb{R}^3$.

A real number is *rational* if it can be written as a fraction a/b where both a and b are integers. Equivalently, a real number is irrational if and only if there is no pattern in the decimal representation of the real number. For example, $1/3 = 0.333\cdots$ is rational, but $\pi = 3.14159\cdots$ is irrational.

4. True or False?

The set

$$\left\{ \begin{pmatrix} x \\ y \end{pmatrix} \in \mathbb{R}^2 : x \text{ and } y \text{ are both rational} \right\}$$

is a subspace of $\mathbb{R}^2$.

5. True or False?

The set

$$\{p(x) \in \mathcal{P}_3 : p(3) = 0\}$$

is a subspace of $\mathcal{P}_3$.

Recall that the set $\mathcal{P}_2$ of polynomials of degree *at most* 2 is a subspace of the vector space $\mathcal{P}$ of all polynomials.

6. True or False?

The set of all polynomials of degree at least 2, together with the zero polynomial, is a subspace of $\mathcal{P}$.

7. True or False?

The set

$$\left\{ \begin{pmatrix} a & a+b \\ 0 & b \end{pmatrix} : a, b \in \mathbb{R} \right\}$$

is a subspace of $\mathcal{M}_{2\times 2}$.