1. True or False?

The following two matrices have the same determinant.

$$\begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} \quad \begin{pmatrix} 1 & 2 \\ 0 & -1 \end{pmatrix}$$

2. True or False?

For how many values of x is the following matrix singular?

$$\begin{pmatrix} 2-x & 4 \\ 8 & 8-x \end{pmatrix}$$

(A) 0

(B) 1

(C) 2

(D) Infinitely many

3. Let A_θ be the matrix representing the linear map $h_\theta : \mathbb{R}^2 \to \mathbb{R}^2$ that rotates vectors counterclockwise by an angle θ. For how many values of θ is A_θ singular?

(A) 0

(B) 1

(C) 2

(D) Infinitely many

4. What is the area of the box formed by the following vectors?

$$\left\langle \begin{pmatrix} 1 \\ 3 \end{pmatrix}, \begin{pmatrix} -1 \\ 4 \end{pmatrix} \right\rangle$$

(A) 1

(B) 3

(C) 4

(D) 7

5. By what factor does the following transformation change the size of boxes?

$$\begin{pmatrix} x \\ y \end{pmatrix} \mapsto \begin{pmatrix} 3x - y \\ -2x + y \end{pmatrix}$$

(A) $1/2$

(B) 1

(C) 2

(D) 4

6. True or False?

Suppose $B = \langle v_1, v_2, v_3 \rangle$ is a list of vectors in $\mathbb{R}^3$ such that none of the vectors is a scalar multiple of one of the others. Then B is a basis for $\mathbb{R}^3$.

7. True or False?

Every list of 5 vectors in $\mathcal{P}_3$ is linearly dependent.

8. True or False?

There exists a single vector $\vec{v}$ that spans the vector space

$$V = \left\{ \begin{pmatrix} x+y \\ x+y \\ x+z \end{pmatrix} : x, y, z \in \mathbb{R} \right\}.$$