**Name:**

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## Mutliple Choice

**1.** Which of the following is *not* a field?

(a) The numbers $\{0, 1\}$ with $+$ and $\times$ defined modulo 2

(b) The natural numbers $\mathbb{N}$

(c) The real numbers $\mathbb{R}$

(d) The complex numbers $\mathbb{C}$

**2.** The multiplicative inverse of $1 + i$ is

(a) $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$

(b) $1 - i$

(c) $\frac{i}{2}$

(d) $\sqrt{2} - \sqrt{2}i$

(e) $\frac{1}{2} - \frac{1}{2}i$

**3.** Which number satisfies $z^8 = 1$?

(a) $z = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$

(b) $z = 1 - i$

(c) $z = \frac{i}{2}$

(d) $z = \sqrt{2} - \sqrt{2}i$

(e) $z = \frac{1}{2} - \frac{1}{2}i$

**4.** Consider the vector space $\mathbb{R}^4$. Which one of the following subsets is a subspace?

(a) $\{(a, b, c, d) \in \mathbb{R}^4 : a = 1\}$

(b) $\{(a, b, c, d) \in \mathbb{R}^4 : a + b + c + d = 1\}$

(c) $\{(a, b, c, d) \in \mathbb{R}^4 : a + 2b = 3c + 4d\}$

(d) $\{(a, b, c, d) \in \mathbb{R}^4 : a + b + c \geq d\}$

(e) $\{(a, b, c, d) \in \mathbb{R}^4 : ab = cd\}$

(f) $\{a, b, c, d, ) \in \mathbb{R}^4 : a^2 + b^2 + c^2 + d^2 = 1\}$

## True or False

**5.** The set $\left\{ f : [0,1] \to \mathbb{R} : f \text{ is integrable and } \displaystyle\int_0^1 f = 0 \right\}$ is a subspace of $\mathbb{R}^{[0,1]}$.

**6.** The set $\left\{ f : (-1,1) \to \mathbb{R} : f \text{ is twice differentiable and } f''(0) = 2 \right\}$ is a subspace of $\mathbb{R}^{(-1,1)}$.

**7.** The set $\left\{ f : \mathbb{R} \to \mathbb{R} : f'(-1) = f(1) \right\}$ is a subspace of $\mathbb{R}^{\mathbb{R}}$.

**8.** The set of all sequences of real numbers with limit 0 is a subspace of $\mathbb{R}^\infty$.

**9.** If $X = \{(a, 2a, 3a) \in \mathbb{R}^3 : a \in \mathbb{R}\}$ and $Y = \{(a, a, a) \in \mathbb{R}^3 : a \in \mathbb{R}\}$ then $(1, 3, 5) \in X + Y$.

**10.** If $X = \{(0, 0, a) \in \mathbb{R}^3 : a \in \mathbb{R}\}$, $Y = \{(a, a, a) \in \mathbb{R}^3 : a \in \mathbb{R}\}$ and $Z = \{(a, a, b) \in \mathbb{R}^3 : a, b \in \mathbb{R}\}$, then $X \oplus Y = Z$.