Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Let $\vec{u} = \begin{bmatrix} -4 \\ -1 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} -7 \\ -9 \end{bmatrix}$. Find $\vec{u} + \vec{v}$. 1) _____

A) $\begin{bmatrix} -3 \\ -8 \end{bmatrix}$ B) $\begin{bmatrix} -13 \\ -8 \end{bmatrix}$ C) $\begin{bmatrix} -5 \\ -16 \end{bmatrix}$ D) $\begin{bmatrix} -11 \\ -10 \end{bmatrix}$

2) Let $u = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$, $v = \begin{bmatrix} 2 \\ 9 \end{bmatrix}$. Find u - v. 2) _____

A) $\begin{bmatrix} -7 \\ -2 \end{bmatrix}$ B) $\begin{bmatrix} 0 \\ -5 \end{bmatrix}$ C) $\begin{bmatrix} 4 \\ 13 \end{bmatrix}$ D) $\begin{bmatrix} -2 \\ -7 \end{bmatrix}$

3) Let $u = \begin{bmatrix} 8 \\ 8 \end{bmatrix}$, $v = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$. Find v - u. 3) _____

A) $\begin{bmatrix} 0 \\ -5 \end{bmatrix}$ B) $\begin{bmatrix} 12 \\ 7 \end{bmatrix}$ C) $\begin{bmatrix} -9 \\ -4 \end{bmatrix}$ D) $\begin{bmatrix} -4 \\ -9 \end{bmatrix}$

4) Let $u = \begin{bmatrix} -5 \\ -2 \end{bmatrix}$. Find 6u. 4) _____

A) $\begin{bmatrix} 30 \\ -12 \end{bmatrix}$ B) $\begin{bmatrix} -30 \\ 12 \end{bmatrix}$ C) $\begin{bmatrix} 30 \\ 12 \end{bmatrix}$ D) $\begin{bmatrix} -30 \\ -12 \end{bmatrix}$

5) Let $u = \begin{bmatrix} -3 \\ 2 \end{bmatrix}$. Find 7u. 5) _____

A) $\begin{bmatrix} -21 \\ 14 \end{bmatrix}$ B) $\begin{bmatrix} -21 \\ -14 \end{bmatrix}$ C) $\begin{bmatrix} 21 \\ -14 \end{bmatrix}$ D) $\begin{bmatrix} -21 \\ -14 \end{bmatrix}$

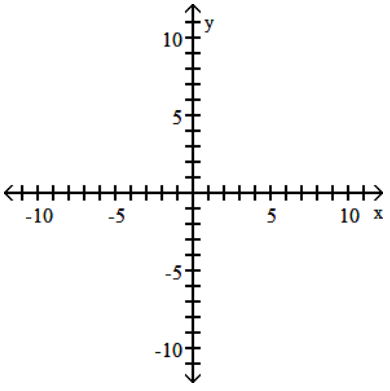
6) Let $u = \begin{bmatrix} -2 \\ -3 \end{bmatrix}$. Find -9u. 6) _____

A) $\begin{bmatrix} 18 \\ -27 \end{bmatrix}$ B) $\begin{bmatrix} 18 \\ 27 \end{bmatrix}$ C) $\begin{bmatrix} -18 \\ 27 \end{bmatrix}$ D) $\begin{bmatrix} -18 \\ -27 \end{bmatrix}$

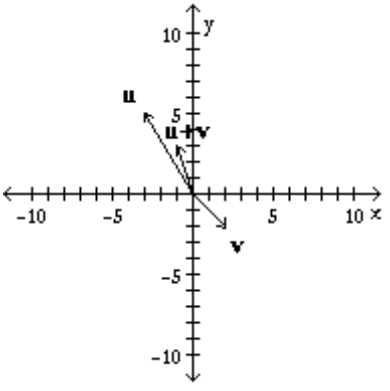
7) Let $u = \begin{bmatrix} 5 \\ -6 \end{bmatrix}$, $v = \begin{bmatrix} -2 \\ -3 \end{bmatrix}$. Find 2u + v. 7) _____

A) $\begin{bmatrix} 6 \\ -15 \end{bmatrix}$ B) $\begin{bmatrix} 6 \\ -9 \end{bmatrix}$ C) $\begin{bmatrix} -2 \\ -5 \end{bmatrix}$ D) $\begin{bmatrix} 8 \\ -15 \end{bmatrix}$

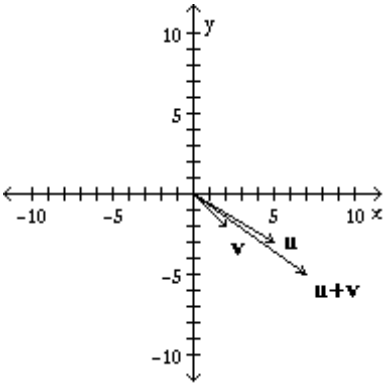
8) Let $u = \begin{bmatrix} -3 \\ 5 \end{bmatrix}$ and $v = \begin{bmatrix} -2 \\ 2 \end{bmatrix}$. Display the vectors u, v, and u + v on the same axes. 8) _____



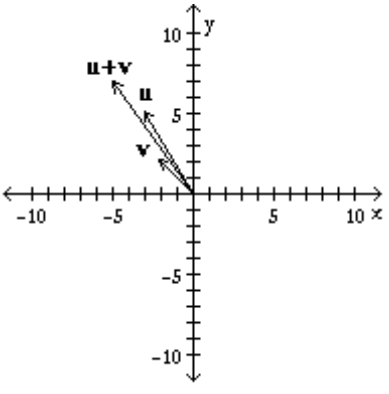
A)



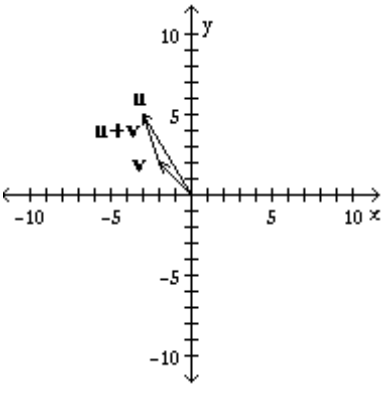
B)



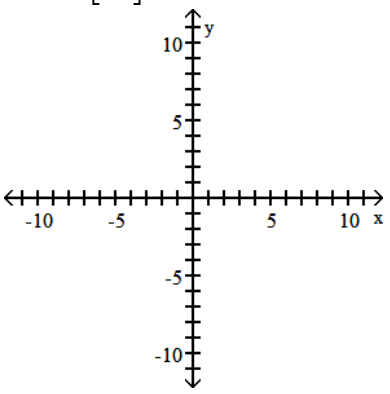
C)



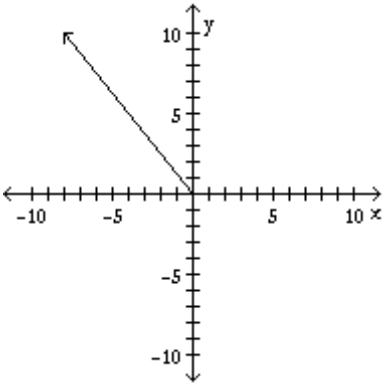
D)



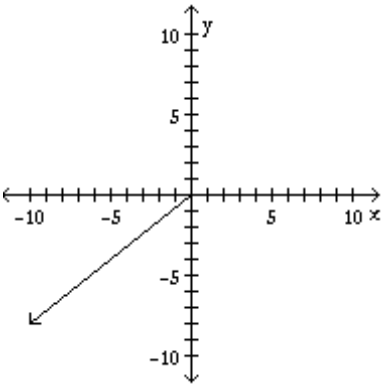
9) Let $u = \begin{bmatrix} 5 \\ -4 \end{bmatrix}$. Display the vector 2u using the given axes. 9) _____



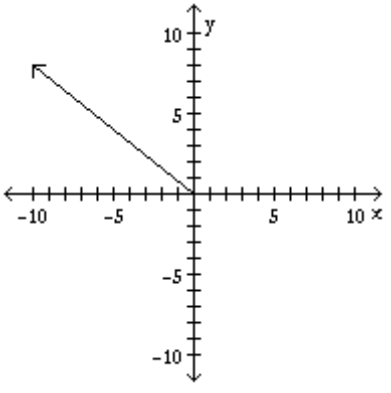
A)



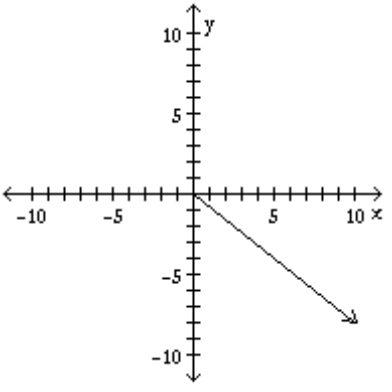
B)



C)



D)



10) Consider the points P(1,2,2), Q(-1, 0, 1), and R(3, 2, 1). Then 10) _____

A) $\overrightarrow{PQ} + \overrightarrow{RP} = \overrightarrow{QR}$

B) $\overrightarrow{PQ} + \overrightarrow{PR} = \overrightarrow{QR}$

C) $\overrightarrow{PQ} + \overrightarrow{PR} = \overrightarrow{PR}$

D) $\overrightarrow{QP} + \overrightarrow{PR} = \overrightarrow{QR}$

11) Find a vector equation of the line passing through the point P(1, -1, 3) and parallel to the line with an equation $\vec{X} = \begin{vmatrix} 2 \\ 1 \\ 2 \end{vmatrix} + t \begin{vmatrix} 4 \\ -2 \\ 2 \end{vmatrix}, t \in \mathcal{R}$ 11) _____

A) $\vec{X} = \begin{vmatrix} 2 \\ 1 \\ 2 \end{vmatrix} + t \begin{vmatrix} 4 \\ -2 \\ 2 \end{vmatrix}, t \in \mathcal{R}$

B) $\vec{X} = \begin{vmatrix} 2 \\ 1 \\ 2 \end{vmatrix} + t \begin{vmatrix} 1 \\ -1 \\ 3 \end{vmatrix}, t \in \mathcal{R}$

C) $\vec{X} = \begin{vmatrix} 1 \\ -1 \\ 3 \end{vmatrix} + t \begin{vmatrix} 2 \\ 1 \\ 2 \end{vmatrix}, t \in \mathcal{R}$

D) $\vec{X} = \begin{vmatrix} 1 \\ -1 \\ 3 \end{vmatrix} + t \begin{vmatrix} 2 \\ -1 \\ 1 \end{vmatrix}, t \in \mathcal{R}$

12) Find a vector equation of the line passing through the points P(-2, 1, 3) and Q(3, 0, -2). 12) _____

A) $\vec{X} = \begin{vmatrix} -2 \\ 1 \\ 3 \end{vmatrix} + t \begin{vmatrix} 1 \\ 1 \\ 1 \end{vmatrix}, t \in \mathcal{R}$

B) $\vec{X} = \begin{vmatrix} 2 \\ 1 \\ 3 \end{vmatrix} + t \begin{vmatrix} 1 \\ 1 \\ -5 \end{vmatrix}, t \in \mathcal{R}$

C) $\vec{X} = \begin{vmatrix} 3 \\ 0 \\ -2 \end{vmatrix} + t \begin{vmatrix} 1 \\ 1 \\ 1 \end{vmatrix}, t \in \mathcal{R}$

D) $\vec{X} = \begin{vmatrix} -2 \\ 1 \\ 3 \end{vmatrix} + t \begin{vmatrix} 5 \\ -1 \\ -5 \end{vmatrix}, t \in \mathcal{R}$

13) Find the parametric equations for the line passing through the points $P(5,-1)$ and $Q(2,3)$. 13) _____

A) $x_1 = -3 + 5t$, $x_2 = 4 - t$

B) $x_1 = 2 - 3t$, $x_2 = 3 + 4t$

C) $x_1 = 5 + 2t$, $x_2 = -1 + 3t$

D) $x_1 = 3 + 2t$, $x_2 = -4 + 3t$

14) Find the parametric equations of the line passing through the point (1,-1,2) and parallel to the line $x_1 = 2 + 5t, x_2 = 3 - 2t, x_3 = -2 + t$. 14) _____

A) $x_1 = 1 + 5t, x_2 = 4 - 2t, x_3 = -4 + t$

B) $x_1 = 1 + 5t, x_2 = -1 - 2t, x_3 = 2 + t$

C) $x_1 = 1 + 2t, x_2 = -1 + 3t, x_3 = 2 - 2t$

D) $x_1 = 7 + 5t, x_2 = 5 - 2t, x_3 = t$

15) Determine which vector from the options below is in the plane: $\vec{x} = s \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix} + t \begin{bmatrix} 0 \\ 2 \\ 1 \end{bmatrix}$. 15) _____

A) $\begin{bmatrix} 0 \\ 3 \\ 0 \end{bmatrix}$

B) $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

C) $\begin{bmatrix} 2 \\ 8 \\ -1 \end{bmatrix}$

D) $\begin{bmatrix} 1 \\ 3 \\ 3 \end{bmatrix}$

16) Determine a scalar equation for the line through the points $P(3,1)$, $Q(0,-2)$. 16) _____

A) $x_2 = x_1 - 2$

B) $x_2 = 1 - \frac{(x_1 - 3)}{3}$

C) $x_2 = 3 + \frac{x_1 - 3}{3}$

D) $x_2 = -2 + \frac{x_1}{3}$

17) Let $a_1 = \begin{bmatrix} 4 \\ 1 \\ -2 \end{bmatrix}$, $a_2 = \begin{bmatrix} -1 \\ 3 \\ 3 \end{bmatrix}$, and $b = \begin{bmatrix} -14 \\ 3 \\ 12 \end{bmatrix}$. 17) _____

Determine whether b can be written as a linear combination of a_1 and a_2. In other words, determine whether weights x_1 and x_2 exist, such that $x_1 a_1 + x_2 a_2 = b$. Determine the weights x_1 and x_2 if possible.

A) $x_1 = -2, x_2 = 1$ B) $x_1 = -3, x_2 = 3$ C) $x_1 = -3, x_2 = 2$ D) No solution

18) Let $a_1 = \begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix}$, $a_2 = \begin{bmatrix} -3 \\ -4 \\ 1 \end{bmatrix}$, $a_3 = \begin{bmatrix} 2 \\ 1 \\ 6 \end{bmatrix}$, and $b = \begin{bmatrix} -4 \\ 2 \\ 2 \end{bmatrix}$. 18) _____

Determine whether b can be written as a linear combination of a_1, a_2 and a_3. In other words, determine whether weights x_1, x_2, and x_3 exist, such that $x_1 a_1 + x_2 a_2 + x_3 a_3 = b$. Determine the weights x_1, x_2, and x_3, if possible.

A) $x_1 = -6, x_2 = 0, x_3 = 1$ B) No solution

C) $x_1 = -2, x_2 = -1, x_3 = 2$ D) $x_1 = 2, x_2 = 1, x_3 = -\frac{3}{2}$

19) Determine which of the following sets are linearly independent. 19) _____

$V = \left\{ \begin{bmatrix} 1 \\ -3 \\ 8 \end{bmatrix}, \begin{bmatrix} -3 \\ 8 \\ 5 \end{bmatrix}, \begin{bmatrix} 2 \\ -2 \\ -6 \end{bmatrix} \right\}$, $U = \left\{ \begin{bmatrix} -2 \\ 4 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \\ 7 \end{bmatrix}, \begin{bmatrix} 4 \\ -4 \\ -12 \end{bmatrix} \right\}$

A) V only B) U only C) V and U D) None of them

20) For what values of h are the given vectors linearly independent? 20) _____

$\begin{bmatrix} 1 \\ -6 \\ 1 \end{bmatrix}, \begin{bmatrix} -4 \\ 24 \\ h \end{bmatrix}$

A) Vectors are linearly dependent for all h.
B) Vectors are linearly independent for h = -4.
C) Vectors are linearly independent for $h \neq -4$.
D) Vectors are linearly independent for all h.

21) For what values of h are the given vectors linearly dependent? 21) _____

$$\begin{bmatrix} -1 \\ 4 \\ 6 \end{bmatrix}, \begin{bmatrix} 5 \\ 2 \\ -3 \end{bmatrix}, \begin{bmatrix} 6 \\ 2 \\ 6 \end{bmatrix}, \begin{bmatrix} -24 \\ -8 \\ h \end{bmatrix}$$

A) Vectors are linearly dependent for $h \neq -24$.
B) Vectors are linearly dependent for $h = -24$.
C) Vectors are linearly dependent for all h.
D) Vectors are linearly independent for all h.

22) Determine which of the following sets form a basis for R^3. 22) _____

$$U = \left\{\begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}, \begin{bmatrix} -1 \\ 1 \\ 3 \end{bmatrix}\right\}, V = \left\{\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}\right\}, W = \left\{\begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 8 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 1 \\ -1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}\right\} \text{ and } X = \left\{\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ -1 \\ 1 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}\right\}$$

A) V only B) U and V C) V and X D) V and W

23) Determine which of the following sets form a basis for R^3. 23) _____

$$U = \left\{\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}\right\}, V = \left\{\begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 3 \\ 6 \end{bmatrix}\right\}, W = \left\{\begin{bmatrix} -3 \\ 6 \end{bmatrix}, \begin{bmatrix} 2 \\ -4 \end{bmatrix}\right\}, X = \left\{\begin{bmatrix} -1 \\ 5 \end{bmatrix}, \begin{bmatrix} 1 \\ -4 \end{bmatrix}\right\}$$

A) U and X B) U and V C) U only D) V and X

24) Which vectors are in the span of $B = \left\{\begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 3 \\ 6 \end{bmatrix}\right\}$? 24) _____

$$\vec{u} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \vec{v} = \begin{bmatrix} 0 \\ 5 \end{bmatrix}, \vec{w} = \begin{bmatrix} 4 \\ 8 \end{bmatrix}, \vec{x} = \begin{bmatrix} -1 \\ -2 \end{bmatrix}$$

A) $\vec{w}$ and $\vec{x}$ B) $\vec{v}$ and $\vec{x}$ C) $\vec{w}$ D) $\vec{x}$

25) Which vectors are in the span of $B = \left\{\begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 0 \\ 2 \end{bmatrix}\right\}$? 25) _____

$$\vec{u} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \vec{v} = \begin{bmatrix} 0 \\ 5 \end{bmatrix}, \vec{w} = \begin{bmatrix} 4 \\ 8 \end{bmatrix}, \vec{x} = \begin{bmatrix} -1 \\ -2 \end{bmatrix}$$

A) $\vec{v}$ B) $\vec{v}, \vec{w}$ and $\vec{x}$
C) $\vec{w}$ and $\vec{x}$ D) All of the vectors are in the span

26) Compute the dot product $u \cdot v$ where $u = \begin{bmatrix} -15 \\ 9 \end{bmatrix}$, $v = \begin{bmatrix} -14 \\ -4 \end{bmatrix}$. 26) _____

A) 210 B) 174 C) -36 D) 246

27) Compute the dot product $u \cdot v$ where $u = \begin{bmatrix} -12 \\ 4 \end{bmatrix}$, $v = \begin{bmatrix} 0 \\ 15 \end{bmatrix}$. 27) _____

A) 72 B) 48 C) -180 D) 60

28) Compute the dot product $u \cdot v$ where $u = \begin{bmatrix} 1 \\ 14 \end{bmatrix}$, $v = \begin{bmatrix} 7 \\ 1 \end{bmatrix}$. 28) _____

A) 23 B) 21 C) 100 D) 7

29) Compute the dot product $u \cdot v$ where $u = \begin{bmatrix} -1 \\ 3 \\ 3 \end{bmatrix}$, $v = \begin{bmatrix} 5 \\ 2 \\ -3 \end{bmatrix}$. 29) _____

A) 0 B) -8 C) 8 D) -2

30) Compute the dot product $u \cdot v$ where $u = \begin{bmatrix} -16 \\ 0 \\ -8 \end{bmatrix}$, $v = \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}$. 30) _____

A) -21 B) -24 C) -40 D) 0

31) Find the distance between the two points, P (6, -1), and Q (1, 6). 31) _____

A) $\sqrt{37}$ B) $\sqrt{74}$ C) 74 D) 37

32) Find the distance between the two points, P (-8, 16), and Q (16, -16). 32) _____

A) 8 B) 1,600 C) 200 D) 40

33) Find the distance between the two points, P (0, 0, 0), and Q (6, 9, 9). 33) _____

A) 198 B) $3\sqrt{22}$ C) 24 D) $2\sqrt{6}$

34) Find the distance between the two points, P (0, 0, 0), and Q (-8, -6, -2). 34) _____

A) -16 B) 104 C) $2\sqrt{-1}$ D) $2\sqrt{26}$

35) Find the distance between the two points, P (-8, 2, -6), and Q (-3, 3, 4). 35) _____

A) 126 B) 16 C) $3\sqrt{14}$ D) $5\sqrt{6}$

36) For a set of vectors to be orthogonal, each vector in the set must be orthogonal to every other vector in the set. Determine which of the following set of vectors are orthogonal. 36) _____

$V = \left\{ \begin{bmatrix} 3 \\ 6 \\ 3 \end{bmatrix}, \begin{bmatrix} -3 \\ 0 \\ 3 \end{bmatrix}, \begin{bmatrix} 3 \\ -3 \\ 3 \end{bmatrix} \right\}$, $U = \left\{ \begin{bmatrix} 20 \\ 40 \\ 20 \end{bmatrix}, \begin{bmatrix} -20 \\ 0 \\ 20 \end{bmatrix}, \begin{bmatrix} 20 \\ 20 \\ 20 \end{bmatrix} \right\}$

A) Neither B) U and V C) U only D) V only

37) Determine for what values of k the pair of vectors $\left\{\begin{bmatrix} 1 \\ k \\ -1 \end{bmatrix}, \begin{bmatrix} -1 \\ k \\ 1 \end{bmatrix}\right\}$ is orthogonal. 37) _____

A) $-\sqrt{2}$ B) 0 C) $k = \pm\sqrt{2}$ D) $\sqrt{2}$

38) Find the angle between the vectors $\vec{x} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ and $\vec{y} = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$. 38) _____

A) $\pi/2$ B) $\pi/3$ C) $\pi/4$ D) $\pi/6$

39) Find a scalar equation for the plane through the point $P(-1, 2, 4)$ to the plane $2x + y - 2z = 4$. 39) _____

A) $2x + y - 2z = -4$ B) $2x + y - 2z = -8$

C) $2x + y - 2z = 4$ D) $2x + y - 2z = 8$

40) Find an equation of the plane such that each point of the plane is equidistant from the points $P(1, 2, 1)$ and $Q(-1, 0, 3)$. 40) _____

A) $x + y - z = -1$ B) $x + y - z = 3$ C) $x + 2y - z = -1$ D) $-x + y - z = -1$

41) Find the cross product: $\begin{bmatrix} 3 \\ -2 \\ 2 \end{bmatrix} \times \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$. 41) _____

A) $\begin{bmatrix} 2 \\ -1 \\ -4 \end{bmatrix}$ B) $\begin{bmatrix} -2 \\ 1 \\ -4 \end{bmatrix}$ C) $\begin{bmatrix} -5 \\ -1 \\ -4 \end{bmatrix}$ D) $\begin{bmatrix} 2 \\ 1 \\ -4 \end{bmatrix}$

42) Find the cross product: $\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \times \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$. 42) _____

A) $\begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix}$ B) $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ C) $\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ D) $\begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$

43) Find the scalar equation of the plane that contains (1,1,1), (3,-1,5), and (4,2,-2). 43) _____

A) $8x_1 + 2x_2 + 4x_3 = 14$ B) $x_1 + 9x_2 + 4x_3 = 14$

C) $-2x_1 + 9x_2 + x_3 = 8$ D) $x_1 + x_2 + \frac{5}{2}x_3 = 9/2$

44) Determine a vector equation of the line of intersection of the planes $x + y + z = 3$ and $x - y + z = 2$. 44) _____

A) $\vec{x} = \begin{bmatrix} 5/2 \\ 1/2 \\ 0 \end{bmatrix} + t \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}, t \in \mathcal{R}$

B) $\vec{x} = \begin{bmatrix} -1 \\ 0 \\ 4 \end{bmatrix} + t \begin{bmatrix} 3 \\ 1 \\ -5 \end{bmatrix}, t \in \mathcal{R}$

C) $\vec{x} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + t \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}, t \in \mathcal{R}$

D) $\vec{x} = \begin{bmatrix} 1 \\ 0 \\ -4 \end{bmatrix} + t \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}, t \in \mathcal{R}$

45) Calculate the area of the parallelogram induced by $\vec{u} = \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix}, \vec{v} = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}$. 45) _____

A) 7 B) $\sqrt{5}$ C) 1 D) $\sqrt{2}$

46) Determine the scalar equation of the plane with vector equation $\vec{x} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + t \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} + s \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$. 46) _____

A) $4x + 3y - 2z = 6$

B) $4x + 3y - 2z = -6$

C) $-4x - 3y + 2z = -1$

D) $-4x - 3y + 2z = 6$

47) Determine which of the following sets is a subspace of R^2 47) _____

V is the line y = x in the xy-plane: $V = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : y = x \right\}$

W is the union of the first and second quadrants in the xy-plane: $W = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : y \geq 0 \right\}$

U is the line y = x + 1 in the xy-plane: $U = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : y = x + 1 \right\}$

A) V only B) U and V C) U only D) W only

48) Let H be the set of all points of the form (s, s -1). Determine whether H is a vector space. If it is not a vector space, determine which of the following properties it fails to satisfy. 48) _____

A: Contains zero vector
B: Closed under vector addition
C: Closed under multiplication by scalars

A) H is a vector space.

B) H is not a vector space; fails to satisfy all three properties.

C) H is not a vector space; does not contain zero vector.

D) H is not a vector space; not closed under vector addition.

49) Let H be the set of all points in the xy-plane having at least one nonzero coordinate: 49) _____

$H = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : x, y \text{ not both zero} \right\}$

Determine whether H is a vector space. If it is not a vector space, determine which of the following properties it fails to satisfy:

A: Contains zero vector
B: Closed under vector addition
C: Closed under multiplication by scalars

A) H is not a vector space; does not contain zero vector.
B) H is not a vector space; not closed under vector addition.
C) H is not a vector space; fails to satisfy all three properties.
D) H is not a vector space; does not contain zero vector and not closed under multiplication by scalars.

50) Compute the linear combination: $3\begin{bmatrix} 0 \\ 1 \\ -4 \\ 2 \end{bmatrix} + \begin{bmatrix} -1 \\ 2 \\ 10 \\ -4 \end{bmatrix} - \begin{bmatrix} 1 \\ 4 \\ 5 \\ -1 \end{bmatrix}$. 50) _____

A) $\begin{bmatrix} 3 \\ 1 \\ -7 \\ 1 \end{bmatrix}$ B) $\begin{bmatrix} 0 \\ 9 \\ 3 \\ 1 \end{bmatrix}$ C) $\begin{bmatrix} -2 \\ 1 \\ -7 \\ 3 \end{bmatrix}$ D) $\begin{bmatrix} 0 \\ -1 \\ -7 \\ 3 \end{bmatrix}$

51) Determine which of the following is a basis for the subspace spanned by the vectors in the set 51) _____

$$\left\{ \begin{bmatrix} 2 \\ 2 \\ 0 \\ 2 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 1 \\ -1 \end{bmatrix} \right\}$$

i) $\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix} \right\}$ ii) $\left\{ \begin{bmatrix} 1 \\ 1 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix} \right\}$ iii) $\left\{ \begin{bmatrix} 1 \\ -1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \\ 1 \end{bmatrix} \right\}$ iv) $\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} \right\}$

A) iii only B) ii only C) iii and iv only D) ii and iv only

52) Determine which of the following forms a basis for the plane in R^3 with scalar equation $x_1 - 2x_2 + x_3 = 0$. 52) _____

i) $\left\{ \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} -2 \\ 1 \\ 1 \end{bmatrix} \right\}$ ii) $\left\{ \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}$ iii) $\left\{ \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix} \right\}$ iv) $\left\{ \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} \right\}$

A) iii only B) ii only C) iii and iv only D) i and iv only

53) Find the projection of $\vec{v}$. $\vec{u} = \begin{bmatrix} 8 \\ -24 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 8 \\ -4 \end{bmatrix}$. 53) _____

A) $\begin{bmatrix} 16 \\ -8 \end{bmatrix}$ B) $\begin{bmatrix} 16 \\ -4 \end{bmatrix}$ C) $\begin{bmatrix} 8 \\ -4 \end{bmatrix}$ D) $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$

54) Find the projection of $\vec{u}$ onto $\vec{v}$. $\vec{u} = \begin{bmatrix} -3 \\ -4 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 5 \\ -10 \end{bmatrix}$. 54) _____

A) $\begin{bmatrix} 25 \\ -50 \end{bmatrix}$ B) $\begin{bmatrix} 1 \\ -2 \end{bmatrix}$ C) $\begin{bmatrix} 5 \\ -10 \end{bmatrix}$ D) $\begin{bmatrix} \frac{1}{5} \\ -\frac{2}{5} \end{bmatrix}$

55) Find the projection of $\vec{u}$ onto $\vec{v}$. $\vec{u} = \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$. 55) _____

A) $\begin{bmatrix} \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{2} \end{bmatrix}$ B) $\begin{bmatrix} \frac{1}{6} \\ -\frac{1}{6} \\ \frac{1}{3} \end{bmatrix}$ C) $\begin{bmatrix} \frac{1}{6} \\ \frac{1}{6} \\ \frac{1}{3} \end{bmatrix}$ D) $\begin{bmatrix} \frac{1}{6} \\ -\frac{1}{3} \\ \frac{1}{6} \end{bmatrix}$

56) Find the point on the line $\vec{x} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + t \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$, $t \in \mathbb{R}$, closest to Q(0, 0, 1). 56) _____

A) $\left(\frac{4}{3}, \frac{1}{3}, \frac{2}{3}\right)$ B) $\left(\frac{4}{3}, \frac{1}{3}, -\frac{8}{3}\right)$ C) $\left(\frac{4}{3}, -\frac{1}{3}, -\frac{2}{3}\right)$ D) $\left(\frac{2}{3}, -\frac{1}{3}, -\frac{2}{3}\right)$

57) Find the distance from the point Q(0,0,1) to the line $\vec{x} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + t \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$, $t \in \mathbb{R}$. 57) _____

A) $\frac{\sqrt{42}}{3}$ B) $\sqrt{\frac{5}{3}}$ C) $\frac{\sqrt{10}}{3}$ D) $\sqrt{\frac{2}{3}}$

58) Find the distance from the point Q(1,-1, 2) to the plane x + y + z = 1. 58) _____

A) $\frac{1}{2}$ B) $\sqrt{\frac{2}{3}}$ C) $\frac{1}{3}$ D) $\frac{1}{\sqrt{6}}$

59) Find a unit vector in the direction of $\begin{bmatrix} 16 \\ -32 \end{bmatrix}$. 59) _____

A) $\begin{bmatrix} \frac{1}{\sqrt{5}} \\ -\frac{2}{\sqrt{5}} \end{bmatrix}$ B) $\begin{bmatrix} \frac{1}{5} \\ -\frac{2}{5} \end{bmatrix}$ C) $\begin{bmatrix} \frac{1}{\sqrt{3}} \\ -\frac{2}{\sqrt{3}} \end{bmatrix}$ D) $\begin{bmatrix} \frac{1}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} \end{bmatrix}$

60) Find a unit vector in the direction of $\begin{bmatrix} -32 \\ 32 \\ -16 \end{bmatrix}$. 60) _____

A) $\begin{bmatrix} -\frac{2}{9} \\ \frac{2}{9} \\ -\frac{1}{9} \end{bmatrix}$ B) $\begin{bmatrix} -\frac{2}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} \\ -\frac{1}{\sqrt{5}} \end{bmatrix}$ C) $\begin{bmatrix} -\frac{2}{3} \\ \frac{2}{3} \\ -\frac{1}{3} \end{bmatrix}$ D) $\begin{bmatrix} \frac{2}{3} \\ \frac{2}{3} \\ -\frac{1}{3} \end{bmatrix}$

61) Determine a normal vector of the hyperplane $3x_1 + 2x_2 - 4x_3 = 5$ in R^4. 61) _____

A) $\begin{bmatrix} 3 \\ 2 \\ -4 \\ 5 \end{bmatrix}$ B) $\begin{bmatrix} 3 \\ 2 \\ -4 \\ 1 \end{bmatrix}$ C) $\begin{bmatrix} 3 \\ 2 \\ 4 \\ 0 \end{bmatrix}$ D) $\begin{bmatrix} 3 \\ 2 \\ -4 \\ 0 \end{bmatrix}$

62) Find the distance between the lines $\vec{x} = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix} + t \begin{bmatrix} 1 \\ 0 \\ -2 \end{bmatrix}, t \in \mathbb{R}$ and $\vec{x} = \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix} + s \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} s \in \mathbb{R}$. 62) _____

A) 3 B) 2 C) 5 D) 1

1) D
2) B
3) D
4) D
5) A
6) B
7) D
8) C
9) D
10) D
11) D
12) D
13) B
14) B
15) B
16) A
17) C
18) B
19) C
20) C
21) C
22) C
23) D
24) A
25) D
26) B
27) D
28) B
29) B
30) B
31) B
32) D
33) B
34) D
35) C
36) D
37) C
38) B
39) B
40) A
41) A
42) D

43) A
44) A
45) C
46) A
47) A
48) B
49) C
50) C
51) B
52) C
53) A
54) B
55) C
56) C
57) A
58) D
59) A
60) C
61) D
62) A