

1) The length of the vector $\begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$ is

☐ 2.342

☐ 2.308

☐ 2.440

☒ 2.449

2) The inner product of $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} -1 \\ 1 \\ 5 \end{bmatrix}$ is

☐ 11

☐ 12

☐ 14

☒ 16

3) The rank of a 4×3 matrix is 1, what is the dimension of its null space?

☐ 3

☐ 1

☒ 2

☐ 4

4) Which of the following vector is orthogonal to $\begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix}$?

☐ $[-1 \ 1 \ -3]$

☐ $[1 \ 2 \ 1]$

☐ $[-1 \ 1 \ -3]$

☒ $[-3 \ 0 \ 1]$

5) The rank of the following matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ is

☒ 1

☐ 2

☐ 3

☐ 4

6) Which of the following would be the smallest subspace containing the first quadrant of the space \mathbb{R}^2 ?

☐ The first quadrant

☐ The first and the third quadrant

☐ The first and second quadrant

☒ The whole space \mathbb{R}^2

7) 5 peaches and 6 oranges cost 150 rupees. 10 peaches and 12 oranges cost 300 rupees. Form a matrix out of the given information and find its rank.

☐ Rank = 2

☒ Rank = 1

☐ Rank = 0

☐ Rank = 4

8) Consider a set of 3 paired observations on (x_i, b_i) , $i = 1, 2, 3$ as $((1, 6), (-1, 3), (3, 15))$. For the closest line b to go through these points, which of the following is the least squares solution $(\hat{\theta})$?

(3,4)

(4,3)

(5,3)

(3,5)

9)

Which of the following represents the null space of the matrix $\begin{bmatrix} 2 & 4 & 6 & 8 \\ 1 & 3 & 0 & 5 \\ 1 & 1 & 6 & 3 \end{bmatrix}$

☒ $\text{Span} \left\{ \begin{bmatrix} -9 \\ 3 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -2 \\ -1 \\ 0 \\ 1 \end{bmatrix} \right\}$

☐ $\text{Span} \left\{ \begin{bmatrix} 9 \\ 3 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -2 \\ 1 \\ 0 \\ 1 \end{bmatrix} \right\}$

☐ $\text{Span} \left\{ \begin{bmatrix} 9 \\ 3 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 2 \\ 1 \\ 0 \\ 1 \end{bmatrix} \right\}$

☐ $\text{Span} \left\{ \begin{bmatrix} 1 \\ 3 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ -1 \\ 0 \\ 1 \end{bmatrix} \right\}$

10) Which of the two vectors are orthogonal to each other?

☐ $[1 \ 2 \ 3], [-1 \ -2 \ 3]$

☒ $[1 \ 2 \ 1], [0 \ -1 \ 2]$

☐ $[1 \ 2 \ 5], [1 \ 2 \ 3]$

☐ $[1 \ 2 \ 3], [2 \ 4 \ 6]$

☐ $[1 \ 2 \ 1], [-1 \ 0 \ -1]$

11) Find projection of $[5, -4, 1]$ along $[3, -2, 4]$

☐ $\begin{bmatrix} \frac{27}{29} & \frac{-18}{29} & \frac{36}{29} \end{bmatrix}$

☐ $\begin{bmatrix} \frac{27}{29} & \frac{18}{29} & \frac{36}{29} \end{bmatrix}$

☒ $\begin{bmatrix} \frac{81}{29} & \frac{-54}{29} & \frac{108}{29} \end{bmatrix}$

☐ $\begin{bmatrix} \frac{81}{29} & \frac{54}{29} & \frac{108}{29} \end{bmatrix}$

12) The projection matrix for the matrix $v = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$ is

☒ $\frac{1}{14} \begin{bmatrix} 4 & 2 & 6 \\ 2 & 1 & 3 \\ 6 & 3 & 9 \end{bmatrix}$

☐ $\frac{1}{14} \begin{bmatrix} 4 & 3 & 6 \\ 2 & 2 & 3 \\ 9 & 3 & 9 \end{bmatrix}$

☐ $\frac{1}{14} \begin{bmatrix} 4 & -2 & 6 \\ 3 & 1 & 3 \\ 6 & 6 & 9 \end{bmatrix}$

☐ $\frac{1}{14} \begin{bmatrix} 2 & 2 & -6 \\ 2 & -1 & 5 \\ 5 & 7 & 9 \end{bmatrix}$

13) Find projection of $[2, -4, 4]$ along $[2, -2, 1]$

☐ $\begin{bmatrix} \frac{-32}{9} & \frac{-32}{9} & \frac{16}{9} \end{bmatrix}$

☒ $\begin{bmatrix} \frac{32}{9} & \frac{-32}{9} & \frac{16}{9} \end{bmatrix}$

☐ $\begin{bmatrix} \frac{32}{9} & \frac{16}{9} & \frac{-32}{9} \end{bmatrix}$

☐ $\begin{bmatrix} \frac{32}{9} & \frac{-16}{9} & \frac{32}{9} \end{bmatrix}$