Course: Machine Learning - Foundations
Week 3: Test questions

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1. (1 point)

   Answer: $Length = \sqrt{1^2 + 2^2 + (-1)^2}$

2. (1 point)

   Answer: $1 \times -1 + 2 \times 1 + 3 \times 5 = 16$

3. (1 point)

   Answer: $rank + nullity = n$
   $or, 1 + nullity = 3$
   $or, nullity = 2$

4. (1 point)

   Answer: for option D inner product is zero

5. (1 point)

   Answer: Applying $R_2 - 2R_1$ and $R3 - 3R_1$ we get rank 1

6. (1 point)

   Answer: D

7. (1 point)

   Answer: $5Peaches + 6oranges = 150$
   $10Peaches + 12oranges = 300$
   in matrix form $\begin{bmatrix} 5 & 6 & 150 \\ 10 & 12 & 300 \end{bmatrix}$

8. (1 point)

   Answer: Solving $A^T A\hat{\theta} = A^T b$ with $A = \begin{bmatrix} 1 & 1 \\ -1 & 1 \\ 3 & 1 \end{bmatrix}$, $b = \begin{bmatrix} 6 \\ 3 \\ 15 \end{bmatrix}$ we get $\hat{\theta} = (3, 5)$

9. (1 point)

   Answer: Reducing the given matrix to echelon form we get $\begin{bmatrix} 1 & 0 & 9 & 2 \\ 0 & 1 & -3 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$
   writing in equation form,
   $x_1 + 9x_3 + 2x_4 = 0$
   $x_2 - 3x_3 + x_4 = 0$
   Let $x_3 = s$ and $x_4 = t$ Therefore, $x_1 = -9s - 2t$

$$x_2 = 3s - t$$
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} -9s - 2t \\ 3s - t \\ s \\ t \end{bmatrix}$$

10. (1 point)

    Answer: Check dot product

11. (1 point)

    Answer: Use projection of vector $\vec{u}$ on $\vec{v}$ as $p = \frac{v^T u}{v^T v} v$

12. (1 point)

    Answer: A

13. (1 point)

    Answer: Use projection of vector $\vec{u}$ on $\vec{v}$ as $p = \frac{v^T u}{v^T v} v$