

1. Find the inverse of A. (3 points)

$$AB = I$$

if A & B are inverses

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & 6 & 1 \\ 0 & 0 & 3 \end{bmatrix} \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$A^{-1} = B = \begin{bmatrix} \frac{1}{5} & 0 & \times \\ 0 & \frac{1}{6} & \times \\ 0 & 0 & \frac{1}{3} \end{bmatrix} \begin{matrix} -\frac{1}{15} \\ -\frac{1}{18} \end{matrix}$$

$$3i = 1$$

$$i = \frac{1}{3}$$

$$5c + i = 0$$

$$6f + i = 0$$

$$c = -\frac{1}{15} \quad f = -\frac{1}{18}$$

$$5a + g = 1$$

$$6d + g = 0$$

$$3g = 0$$

$$g = 0, d = 0$$

$$a = \frac{1}{5}$$

$$6e + h = 1$$

$$3h = 0$$

$$h = 0$$

$$e = \frac{1}{6}$$

2. Why is the L1 norm referred to as the "taxicab" distance? (2 points)

The landscape is treated like a city block and we can only travel one block at a time. This is equivalent to the absolute value sum.

3. Show that the following two vectors are not perpendicular. (2 points)

$$\begin{bmatrix} 5 \\ 1 \\ 3 \end{bmatrix} \begin{bmatrix} 1 \\ -4 \\ 2 \end{bmatrix}$$

$$v \cdot u = 0 \Rightarrow \perp$$

$$5 \cdot 1 + 1 \cdot -4 + 3 \cdot 2 =$$

$$5 - 4 + 6 = 7 \neq 0$$

So not \perp

4. Find the gradient of f. Show your work. (3 points)

$$f(x, y, z, q) = xyz^3q + x^2z + 2q^4 + y + 2$$

Same as other side.

1. Why must the identity matrix be square? (2 points)

If I is not square we won't get A back unaltered.

$$AI = A \quad \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} a & b \\ d & e \\ g & h \end{bmatrix} \quad \begin{matrix} [3 \times 3] [3 \times 2] \\ = [3 \times 2] \end{matrix}$$

2. Show that B is the inverse of A . (3 points)

$AB = I$ if A & B are inverses.

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad B = \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$$\frac{1}{ad-bc} \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix} = \frac{1}{ad-bc} \begin{bmatrix} ad-bc & -ab+ab \\ dc-dc & -bc+ad \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

3. Find the gradient of f . Show your work. (3 points)

$$f(x, y, z, q) = xyz^3q + x^2z + 2q^4 + y + 2$$

$$\frac{df}{dx} = yz^3q + 2xz$$

$$\frac{df}{dz} = 3xyz^2q + x^2$$

$$\frac{df}{dy} = xz^3q + 1$$

$$\frac{df}{dq} = xyz^3 + 8q^3$$

$$\nabla f = \begin{pmatrix} yz^3q + 2xz, \\ xz^3q + 1, \\ 3xyz^2q + x^2, \\ xyz^3 + 8q^3 \end{pmatrix}$$

4. I want a model that can predict whether or not an image contains a duck. Is this a classification or regression problem? Why? (2 points)

Classification.

You are trying to categorize the image.
duck vs. something else.
not a real value.