422 Quiz 1 Solutions.

① $f(x,y,z) = 3* x^2z - 2yz^2 + xy^3 - y^2$

$$\frac{df}{2x} = 2xz + y^3$$

$$\frac{df}{2y} = -2z^2 + 3xy^2 - 2y$$

$$\frac{df}{2z} = x^2 - 4yz$$

$$\nabla f = \left(2xz + y^3, -2z^2 + 3xy^2 - 2y, x^2 - 4yz\right)$$

② Classification because we are trying to predict a category, not a real value.

③ $A \cdot B = (1, 2, 3, 4) \cdot (4, -3, -2, 2)$

$$= 4 - 6 - 6 + 8 = 0$$

$A \cdot B = 0$ if and only if $A \perp B$. So yes!

(4) $g(x,y) = 3x + 2y^2 + x^2 y + 5$

$$\frac{\partial g}{\partial x} = 3 + 2xy$$

$$\frac{\partial g}{\partial y} = 4y + x^2$$

$$\nabla g = (3 + 2xy, \; 4y + x^2)$$

$$\nabla g(1,2) = (3 + 2(1)(2), \; 4(2) + (1)^2)$$

$$= (3 + 4, \; 8 + 1)$$

$$= (7, 9)$$

622 Quiz 1 Solutions

(1) Same as 422

(2) Regression because we are trying to predict a price, which is a real value.

(3)
$$A \cdot C = 0 \implies 8x + 4y + 2z = 0 \qquad \text{①}$$
$$B \cdot C = 0 \implies x - 2y = 0 \qquad \text{②}$$

Plug in some #'s that work!

$y = 1$ makes $x = 2$ according to ②

Let's use ① to solve for z.

$$2z = -8(2) - 4(1) = -20$$
$$z = -10$$

$$C = \begin{pmatrix} 2 \\ 1 \\ -10 \end{pmatrix}$$

now we need to make it unit length

$$\|C\| = \sqrt{2^2 + 1^2 + 10^2} = \sqrt{105}$$

$$C = \frac{1}{\sqrt{105}} \begin{pmatrix} 2 \\ 1 \\ -10 \end{pmatrix} = \begin{pmatrix} \frac{2}{\sqrt{105}} \\ \frac{1}{\sqrt{105}} \\ \frac{-10}{\sqrt{105}} \end{pmatrix}$$

(4) Same as 422