CS1675 Recitation #2
9/7/2018

Differentation problems from right side of slide 102 of 1675 intro slides

(1) $s(y) = 4ye^{2y}$

We can use the product rule: $uv' + u'v$
where $u = 4y$ and $v = e^{2y}$.
$u' = 4$.
For v', we use the chain rule (derivative of $f(g(x)) = f'(g(x))g'(x)$) where $g(x) = 2y$: $v' = 2e^{2y}$

Substituting:
$uv' + u'v = 4y2e^{2y} + 4e^{2y} = (8y + 4)e^{2y}$

(2) $p(x) = \frac{log(x^2)}{x}$

Rearranging: $p(x) = log(x^2)x^{-1}$

Using product rule, where $u = log(x^2)$, $v = x^{-1}$, $v' = -x^{-2}$
u' (by chain rule, where $g(x) = x^2$) : $2x(1/x^2) = 2/x$

Substituting:
$uv' + u'v = -log(x^2)x^{-2} + 2/x * 1/x = \frac{-log(x^2)+2}{x^2}$

(3) $q(z) = (e^z - z)^3$

By the chain rule, where $g(x) = (e^z - z)$, and $g'(x) = (e^z - 1)$:

$q'(z) = 3(e^z - z)^2(e^z - 1)$

Linear algebra review problems

The following two example problems are from MIT Open Courseware, 18.06SC Linear Algebra, Fall 2011 (see ocw.mit.edu):

Problem 1.2: Multiply: $\begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 4 & 1 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$.

Solution: $$\begin{bmatrix} 1\cdot 3+2\cdot(-2)+0\cdot 1 \\ 6+0+3 \\ 12-2+1 \end{bmatrix} = \begin{bmatrix} -1 \\ 9 \\ 11 \end{bmatrix}$$

Problem 1.3: True or false: A 3 by 2 matrix A times a 2 by 3 matrix B equals a 3 by 3 matrix AB. If this is false, write a similar sentence which is correct.

Solution: The statement is true. In order to multiply two matrices, the number of columns of A must equal the number of rows of B. The product AB will have the same number of rows as the first matrix and the same number of columns as the second:

$$A(m \text{ by } n) \text{ times } B(n \text{ by } p) \text{ equals } AB(m \text{ by } p).$$

Matrix Properties question:

The following are possible statements regarding the properties of matrix multiplication in general. Which of the following properties is not guaranteed to hold?
$A(B * C) = (A * B)C$
$A(B + C) = A * B + A * C$
$A * B = B * A$

Solution:
$A * B = B * A$ is false. The commutative property does not hold for matrix multiplication. Even if B*A is defined (i.e., inner dimensions match), the contents of an individual cell in A*B may differ from the same cell in B*A (e.g., dot(A(1,:),B(:,1)) does not necessarily equal dot(B(1,:),A(:,1))).