

# Homework 0

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## 1 Solution to Problem 1

The problem was to find the value for  $x$  that maximizes  $g(x)$  where  $g(x) = -3x^2 + 24x - 30$ . First, you need to take the derivate and equal it to zero to solve for critical points. This is  $24 - 6x = 0$ . Now, we subtract 24 and then divide by negative 6 to prove that the value that maximizes  $x$  is equal to 4.

## 2 Solution to Problem 2

The problem was to find the partial derivate of  $f(x)$  where  $f(x) = 3x_0^3 - 2x_0x_1^2 + 4x_1 - 8$ , with respect to  $x_0$  and  $x_1$ . The first step is to treat  $x_0$  and  $x_1$  as constants. Then, you want to apply the Sum/Difference rule. Lastly, you want to simplify, resulting in:  $9x^2 - 4x_0x$

## 3 Solution to Problem 3

### 3.1

You are unable to multiply the two matrices because the number of columns in matrix A is not equal to the number of rows in matrix B.

### 3.2

The first step in the is problem is to find the transpose of matrix A. The transpose of matrix A is:

$$A^T = \begin{bmatrix} 1 & 2 \\ 4 & -1 \\ -3 & 3 \end{bmatrix}$$

Now that the colums match the number of rows in matrix B, we can now multiply them together resulting:

$$\begin{bmatrix} -2 & -2 & 13 \\ -8 & 1 & 16 \\ 6 & -3 & -3 \end{bmatrix}$$

To calculate the rank, we simply transform the matrix to its row echolon form and count the number of non-zero rows. We get an answer of 2 for our rank.

### 3.3 Code

Below, I show two code snippets of me multiplying  $A^T$  and B in Numpy along with Tensorflow.

```
#By Sami Ellougani
import numpy as np
import tensorflow as tf

#Multiplying matrix's with numpy
a = np.array([[1, 2], [4, -1], [-3, 3]])
b = np.array([[-2, 0, 5], [0, -1, 4]])
print(np.dot(a,b))

#Multiplying matrix's with tensorflow
a = tf.constant(a)
b = tf.constant(b)

with tf.Session() as sess:
    print(tf.matmul(a,b).eval())
```

Here are my results from the command line:

```
> python matrixMult.py
[[-2 -2 13]
 [-8  1 16]
 [ 6 -3 -3]]

[[-2 -2 13]
 [-8  1 16]
 [ 6 -3 -3]]
```

## 4 Solution to Problem 4

For Problem 4, we supposed that random variable  $X$  is in  $N(2, 3)$ . Therefore,  $X$  has a .5 chance of being 2, and a .5 chance of being 3. To find the expected value of  $X$ , we multiply the probability of each number, and then add them together. This then results in:  $X = 2.5$