Homework 3: Estimations and MatLab

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1 Estimations

1.1

The number of blades of grass on a football field.
Approach:
How many blades of grass in a square foot?
According to the Oklahoma Museum of Natural History, there are roughly 3000 blades of grass per square foot.
A standard NFL football field is 160ft wide and 360ft long, so $160 \times 360 = 57600 ft^2$.
Therefore, $57600 \times 3000 = 172.8$ million blades of grass in one football field.

2 MatLab

2.1

Solve the following system of linear equations using Matlab/Octave, using any method you like:

$$4x - 2y + 6z = 8$$
$$2x + 8y + 2z = 4$$
$$6x + 10y + 3z = 0$$

Solution:

```
Editor:
A = [4,-2,6;2,8,2;6,10,3];
b = [8;4;0];

x = A\b
Command Window:
x =

  -1.8049
   0.2927
   2.6341

```

2.2

Write code to generate the following matrix:

$$\begin{bmatrix} 3 & 0 & \dots & 0 & 1 \\ 0 & 3 & \dots & 0 & 2 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \dots & 3 & 51 \\ 2 & 2 & \dots & 2 & 52 \end{bmatrix}$$

```
Editor:
x = diag(3*ones(1,51));
y = linspace(1,52,52);
z = linspace(2,2,51);

A = [x;z];
At = A';
B = [At;y];
C = B'

Command Window:
%It prints C, the requested matrix which is too large to show here.

```

2.3

Create a nonzero vector x of any dimension and verify using a conditional statement that the norm (length, in the geometric sense) of $x, ||x||$ is equal to $\sqrt{x \cdot x}$ where $\cdot$ denotes the dot product.

```
Editor:
x = linspace(1,20,20)
length1 = norm(x)
length2 = sqrt(dot(x,x))

Command Window:
x =

    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20

length1 = 53.572
length2 = 53.572

```

2.4

Generate a 10 × 10 matrix full of floats (not just integers) in the interval (0, 10), and then plot the mesh surface associated with your matrix.

```
Editor:
C = linspace(0.1,2*pi,10);
for i = 1:9;
  x = linspace(i+0.1,2*pi,10);
  C = [C;x]
end;

mesh(C)

Command Window:
C =

    0.1000   0.7870   1.4740   2.1611   2.8481   3.5351   4.2221
4.9091   5.5962   6.2832
    1.1000   1.6759   2.2518   2.8277   3.4036   3.9795   4.5555
5.1314   5.7073   6.2832
    2.1000   2.5648   3.0296   3.4944   3.9592   4.4240   4.8888
5.3536   5.8184   6.2832
    3.1000   3.4537   3.8074   4.1611   4.5147   4.8684   5.2221
5.5758   5.9295   6.2832
    4.1000   4.3426   4.5852   4.8277   5.0703   5.3129   5.5555
5.7980   6.0406   6.2832
    5.1000   5.2315   5.3629   5.4944   5.6259   5.7573   5.8888
6.0203   6.1517   6.2832
    6.1000   6.1204   6.1407   6.1611   6.1814   6.2018   6.2221
6.2425   6.2628   6.2832
    7.1000   7.0092   6.9185   6.8277   6.7370   6.6462   6.5555
6.4647   6.3739   6.2832
    8.1000   7.8981   7.6963   7.4944   7.2925   7.0907   6.8888
6.6869   6.4851   6.2832
    9.1000   8.7870   8.4740   8.1611   7.8481   7.5351   7.2221
6.9091   6.5962   6.2832
```

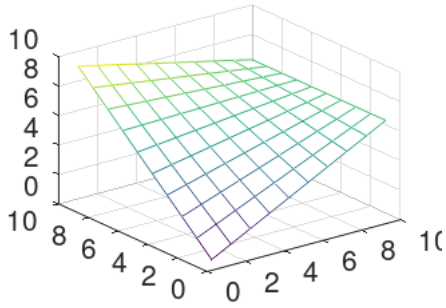

Figure 1: Mesh of C

2.5

Plot

$$f(x) = e^{-\frac{1}{1-x^2}}$$

over the interval $(-1, 1)$.

```
Editor:
x = linspace(-1,1,1000);
result = exp(-1 ./(1-x.^2));

plot(x,result)

```

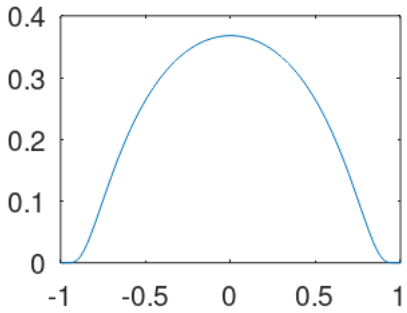

Figure 2: Function