

Science Lesson Plan

Summary of Lesson: Vectors

Students were introduced to the idea that Matlab works on matrix operations. To keep this simple at first I started using 1-D arrays or vectors. This was not to be confused with vectors that they were using in their physics class which have a magnitude and direction. Vectors will be come into play when graphing data and such. Therefore, I started an M-file with them that they did a series of commands and told me what each command does. I also made the students comment the commands in the M-File and this will become their reference when trying to create and address vectors. At the end of the session the students should know three different ways to create vectors:

1) $T = \text{Begin:Interval:End}$

Example: $T = 300:10:400$

2) $\text{Time} = [1,2,3,4,5]$ or $[1\ 2\ 3\ 4\ 5]$

3) $t = \text{linspace}(x_{\min}, x_{\max}, n)$

Example: $t = \text{linspace}(200, 300, 5)$

I gave each student a “Ticket-to-Go” which had questions pertaining to vectors, both row and column, as well as other basics of Matlab coding that we had gone over prior.

Teacher: Molly Clay

Period:

Class: Honors Physics Lowell High School

Date(s): October 2011

SETTING THE STAGE	
<u>Essential Question</u>	Why use Matlab?
<u>Content Objective(s)</u> (Student-friendly)	Understand that matlab organizes sets of data into vectors. Only started them on vectors now and not working straight to matrices
<u>Connection to previous or future lessons</u>	The next step in sequential lessons of Matlab is to learn how to create vectors. This is a major part of understanding how Matlab organizes data
<u>Critical Thinking Questions</u>	
<u>Key Vocabulary</u>	Vector (row and column) Array
<u>Materials Needed/Safety</u>	Laptops Notebooks Pencil
ACTIVE INSTRUCTION	
<ul style="list-style-type: none">• Launch (Engage)	The students will get the laptop outs...working with laptops directly in the classroom will grab the students attention
<ul style="list-style-type: none">• Investigation (Explore)	The students will write a basic Matlab M-File to use as reference on how to create and manipulate vectors. I will go through this with them using slides and matlab M-files open. It will be up to the students to add comments to the code so they can use it as reference.
TIME FOR REFLECTION	
<ul style="list-style-type: none">• Summarization (Explain & Extend)	Students will be given a "Ticket-to-Go" which has basic questions on vectors and common expressions in matlab.
<ul style="list-style-type: none">• Assessment (Evaluate)	NONE
<ul style="list-style-type: none">• Homework	NONE

Name: _____

Class: _____

Date: _____

Matlab: Vectors and Arrays

Lesson 1

Review

Write down how you would do the following tasks in Matlab.

1. If you add a semicolon (;) to the end of a command what happens?
2. How would you execute $\sqrt{9}$ and $\sqrt[4]{16}$ in matlab?
3. Create a row vector(A) that has elements: 6, $8*3$, 81, $\sqrt{65}$, 23.05
4. Create a column vector (B) that has the elements: 44, 9, 2^3 , 0.1, 5.6
5. Create a row vector (C) in which the first element is 0 and the last element is 42, with an increment of 3 between the elements (0,3,6,...42)

MATLAB

Lesson 3: Vectors

Molly Clay

GK-12 Fellow

Vibes and Waves in Action

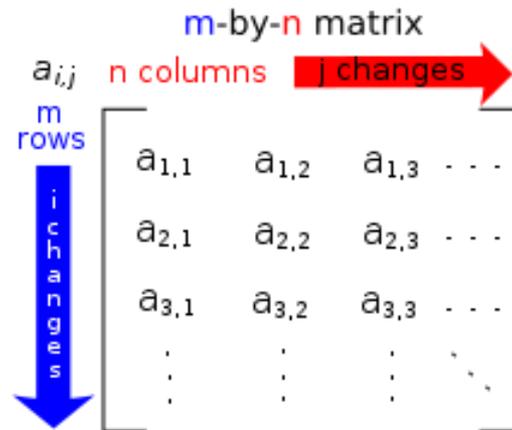
NSF Award #0841392

Physics – Lowell High School

October 25, 2011

Arrays

- ▶ Matlab Variables can be accessed by indexing
- ▶ Every element of an array is designated by its unique row and column or a number pair



- ▶ Syntax:

$A(\text{row\#}, \text{column\#})$

Vectors

- ▶ Vectors are 1-D Arrays
- ▶ There are several ways to create a vector

1. `T=Begin:Interval:End`

- Example: `T=300:10:400`

What would the values of T be?

2. `Time = [1,2,3,4,5]` or `[1 2 3 4 5]`

These are
called Row
Vectors

3. `t = linspace(xmin,xmax,n)`

- `n` = linearly spaced numbers

- Example: `t = linspace(200,300,5)`

More Vectors

▶ $X = [1, 2, 3, 4, 5]$

- What if we changed , into ; ? What is the result?
- ; is used to separate rows

Make a row vector Y:

▶ $Y = [2 \ 4 \ 6 \ 8]$

Now make another variable y:

▶ $y = Y'$

What happened?

- The row vector is now a column vector! This is called the transpose command will come in handy

Vector Addressing

$x = [1, 3, 5, 6, 9]$

- ▶ We can reach each element of array by using its order number in the vector
 - $x(4) \rightarrow$ What does this print?

- ▶ Add, remove, or change elements: Try these!

$x(4) = 8 \rightarrow$ changes element 4 from 6 to 8

$x = [-1 \ x] \rightarrow$ Adds -1 to the beginning of vector

$x = [x \ 12] \rightarrow$ Adds 12 to end of vector

$x(3) = [] \rightarrow$ Removes element 3 from vector

Try:

$x(:)$ and $x(2:4)$

Summary

- ▶ Know how to create Row and Column Vectors
 - ▶ Vector Addressing
 - ▶ Review worksheet
- 

```
%Molly Clay  
%October 20, 2011  
%Vector Tutorial
```

```
clc; clear all; close all;
```

```
%EXAMPLES ON HOW TO CREATE ROW VECTORS:
```

```
%T = Being:Interval:End  
T = 300:10:400;
```

```
%Use , to separate number gives  
Time = [1,2,3,4,5];
```

```
%Or spaces  
Time2 = [1 2 3 4 5];
```

```
%t = linspace(xmin,xmax,n) where n =linearly spaced numbers  
t = linspace(200, 300, 5);
```

```
%EXAMPLES ON HOW TO CREATE COLUMN VECTORS:
```

```
%Row Vector  
X1 = [1,2,3,4,5];
```

```
%Column Vector - use ; to separate numbers  
X2 = [1;2;3;4;5];
```

```
Y = [2 4 6 8];
```

%' is used to transpose a vector

$y = Y'$;

%VECTOR ADDRESSING:

$A = [1 \ 3 \ 4 \ 6 \ 9]$;

%x(#) calls the number in that position

$A(4)$

%x(#) = 8 changes element 4 to 8 (from 6 to 8)

$A(4) = 8$

%Adds -1 to the beginning of the vector

$B = [-1 \ A]$

%Adds 12 to the end of the vector

$C = [A \ 12]$

%[] removes element 3 from vector x

$A(3) = []$

%A(:) Refers to all elements of the vector

$D = A(:)$

%A(m:n) Refers to all elements of vector from m through n

$E = A(2:4)$