Lesson 3
Megha Sunny
18 October 2012

Solving systems of equations using MATLAB

This lesson gives an introduction to solve systems of linear equations with two unknowns. Students will learn the MATLAB commands - solve and ezplot to solve linear equations and plot the two lines. S = solve(expr) solves the equation expr = 0 for its default variable and assigns the result to S. ezplot(fun) plots the expression fun(x) over the default domain $-2\pi < x < 2\pi$, where fun(x) is not an implicit function of only one variable. Students were able to solve two equations with two unknowns by using the solve command. Graphing the equations using ezplots can also be used to solve the systems of equations. The points where both the graphs intersect represent the solutions.

Science Lesson Plan

Teacher: Megha Sunny
Period: Lesson Plan 3
Date(s): October 18 2012

SETTING THE STAGE	
Essential Question	How to solve problems in MATLAB? In this lesson we will introduce solving systems of equations with two unknowns in MATLAB
Content Objective(s) (Student-friendly)	To understand the MATLAB command "solve " and "ezplot" to solve linear equations with two unknowns and plot the equations.
Connection to previous or future lessons	This is the third lesson in MATLAB. An introduction to basic MATLAB programming was provided in the first lesson.
Critical Thinking Questions	What is the purpose of learning MATLAB? How to solve problems in MATLAB?
Key Vocabulary	Solve, ezplot
Materials Needed/Safety	Laptops, MATLAB, Pencil, Paper
ACTIVE INSTRUCTION	
• Launch (Engage)	Students will turn on the laptops and open MATLAB in it. Working with laptops will grab the student's attention.
• Investigation (Explore)	
TIME FOR REFLECTION	
• Summarization (Explain & Extend)	Students will learn about solving linear equations with two unknowns using the MATLAB command 'solve'. They were able to plot the equations using 'ezplot' to see whether the solutions obtained using solve command was correct.
• Assessment (Evaluate)	Observation Listening

*This template is available in electronic form.

Science Lesson Plan

	Questions
• Homework	None

Solving Systems of Equations with Matlab

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Matlab Symbolic Math Solutions

- Use Symbolic Math Toolbox to solve math expressions.
- When variables are recognized as symbolic, range of values is not needed for solution.
- Matlab Symbolic Math engine is usually used to solve complex, non-linear expressions.
- One way to define a symbolic expression is placing single quotes around it.
  - Example: 'y=3*x+2'

solve and ezplot

- solve(expression): gives solution for expression
- Try:

  solve(‘5*x+81’)

  solve(‘5*x+81=0’)

  solve(‘5*x+81-y’ ,’ x’)

  solve(‘5*x+81-y’ ,’ y’)
- ezplot: plot expressions

  ezplot(‘5*x+81’)
- You can assign the equation to a variable so you don’t have to retype it.

  a = ‘y=5*x+81’

  solve(a)

  ezplot(a)

Linear System Equations

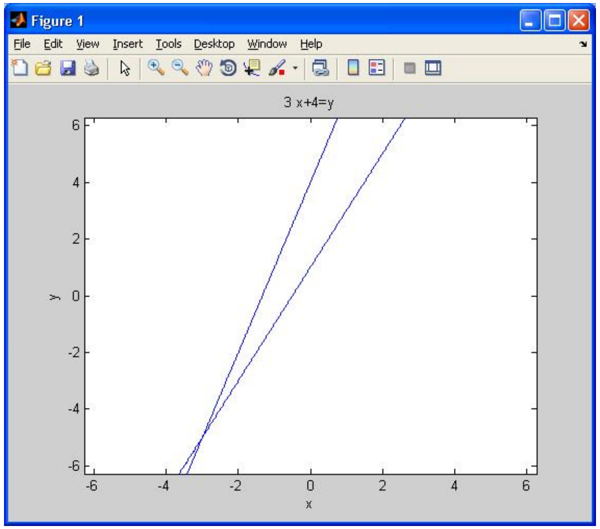
- Two unknowns, two equations

Try:

```
eq1= '2*x+1-y=0' ;
eq2= '3*x+4=y' ;
S=solve(eq1,eq2);
S=[S.x S.y]
ezplot(eq1)
hold on
ezplot(eq2)
hold off
```

Results:

x=-3
y=-5



Problem 1

- Dr. Nano wants to create a nano particle with a diameter that is 3nm more than twice the diameter of a sugar molecule. He also knows the diameter will be five times the diameter of a sugar molecule. What is the diameter of Dr. Nano's nano particle and what is the diameter of a sugar molecule?

Solution

- n=3+2s
- n=5s

Matlab Entries:

```
eq1=' n=3+2*s' ;
eq2= 'n=5*s' ;
A=solve(eq1,eq2)
A=[A.n A.s]
ezplot(eq1)
hold on
ezplot(eq2)
grid on
hold off
```

Results:

n=1nm
s=5nm

Diameter of Sugar Molecule is 1nm
Diameter of Nano Particle is 5 nm

Problem 2

- One medical application of nano particles is that they can be sent through the blood stream to reach particular destinations in the human body. If it takes 1 second for a nano particle to travel 300 cm in the direction of blood flow and 6 seconds to go the same distance against blood flow, what is the speed of the blood flow and what would be the speed of the nano particle in still blood?

Solution

- distance = speed * time
- n: Nano Particle’s Speed, b: Speed of Blood Flow
- (n+b)*1=300 -> n+b=300
- (n-b)*6 =300 -> n-b=50

Matlab Entries:

```
eq1= ‘n+b=300’ ;
eq2= ‘n-b=50’ ;
S=solve(eq1,eq2)
S=[S.n S.b]
ezplot(eq1,[0,300])
hold on
ezplot(eq2,[0,300])
grid on
hold off
```

Results:
n=175 cm/s
w=125 nm/s

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Problem 1.

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Representing the problem with equations:

MATLAB code:

Problem 2.

One medical application of nano particles is that they can be sent through the blood stream to reach particular destinations in the human body. If it takes 1 second for a nano particle to travel 300 cm in the direction of blood flow and 6 seconds to go the same distance against blood flow, what is the speed of the blood flow and what would be the speed of the nano particle in still blood?

Representing the problem with equations:

MATLAB code: