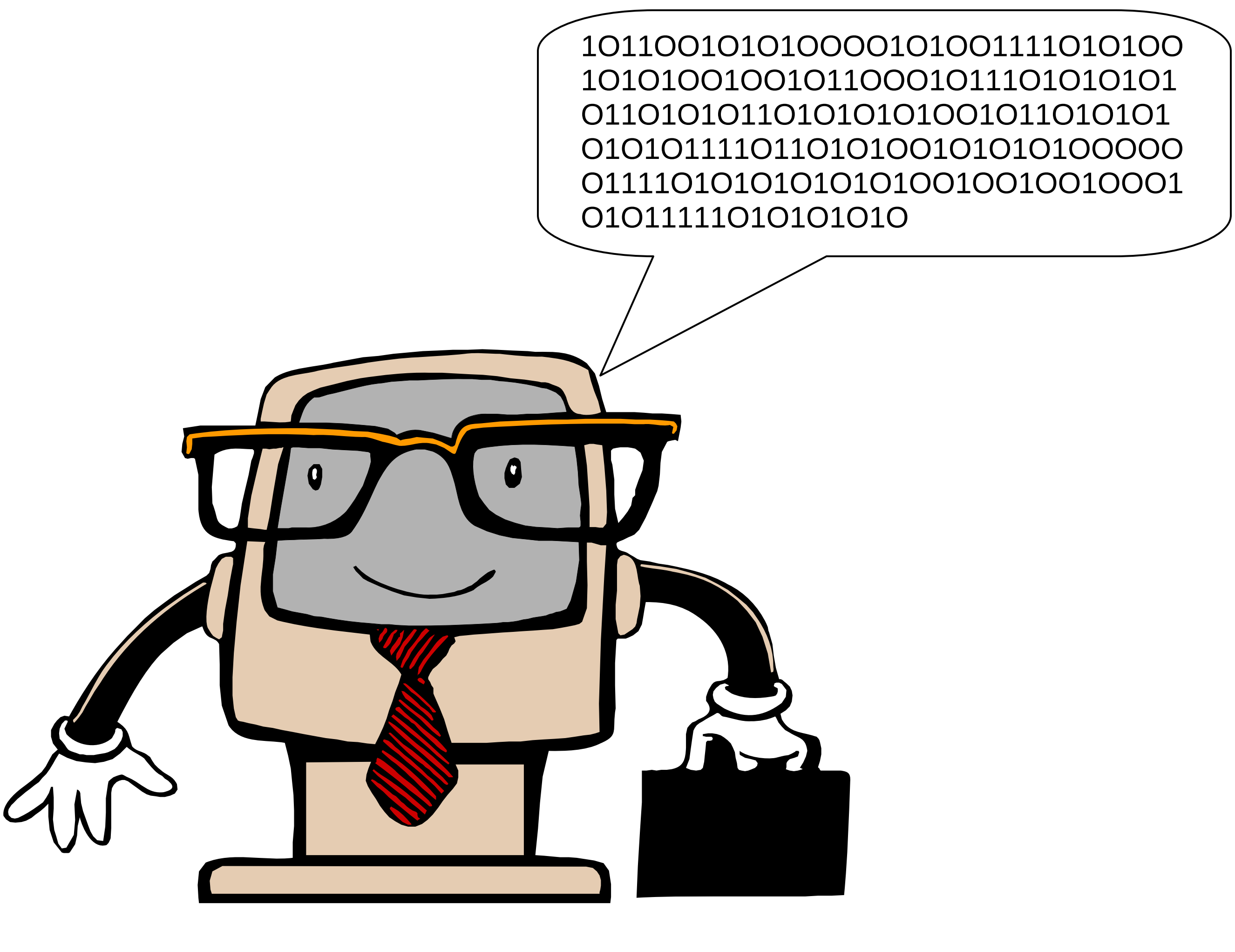
MATLAB7

Companion



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YOT VIDEOS

The following video examples can be viewed online at www.YourOtherTeacher.com:

Example 1-1

Use MATLAB to compute the following expressions:

a) $6\frac{10}{13}+\frac{18}{5(7)}+5(9^2)$

b) $6(35^{1/4})+14^{0.35}$

Example 1-2

Given $x=-5+9i$ and $y=6-2i$, use MATLAB to show that $x+y=1+7i$, $xy=-12+64i$, and $x/y=-12+1.1i$.

Example 1-3

Use MATLAB to determine how many elements are in the array $\left[\cos(0):0.02:\log10(100)\right]$. Use MATLAB to determine the 25th element.

Example 1-4

Use MATLAB to find the roots of the polynomial $290-11x+6x^2+x^3$.

Example 1-5

Use MATLAB to plot the function $s = 2\sin(3t+2) + \sqrt{5t+1}$ over the interval $0 \le t \le 5$. Put a title on the plot, and properly label the axes. The variable *s* represents speed in feet per second; the variable *t* represents time in seconds.

Example 1-6

Use MATLAB to plot the functions $y = 4\sqrt{6x+1}$ and $z = 5e^{0.3x} - 2x$ over the interval $0 \le x \le 1.5$. Properly label the plot for each curve. The variable y and z represent force in newtons; the variable x represents distance in meters.

Example 1-7

Use MATLAB to solve the following set of equations:

$$\begin{aligned} 2x \quad -3y \quad +4z \quad &= 230 \\ -1x \quad -5y \quad +3z \quad &= 90 \\ 10x \quad +12y \quad -8z \quad &= -42 \end{aligned}$$

Example 1-8

Create and run a script file to solve the following set of equations.

$$\begin{aligned} 2x \quad -3y \quad +4z &= 230 \\ -1x \quad -5y \quad +3z &= 90 \\ 10x \quad +12y \quad -8z &= -42 \end{aligned}$$

Example 1-9

Write a script file that prompts the user to enter the radius of a sphere, computes its weight knowing that the density is 100 lb/ft^3, and displays weight on the screen.

Example 1-10

What is the result of the following operations, given?

$$x = [-5 \quad 3 \quad 0 \quad 9 \quad 2]$$
$$y = [0 \quad 6 \quad -3 \quad 2 \quad 4]$$

a) $z = (x > 3)$
b) $z = (x < y)$
c) $z = (x > y)$
d) $z = (x == y)$
e) $z = (x \sim= y)$

Example 1-11

Given x and y below, find the values and the indices of the elements in x that are greater than the corresponding elements in y.

$$x = [-5 \quad 3 \quad 0 \quad 9 \quad 2]$$
$$y = [0 \quad 6 \quad -3 \quad 2 \quad 4]$$

Example 1-12

Determine the sum for the first 15 terms in the series *16t²*, where *t*= 1, 2, 3,…15.

Example 1-13

Write a script file to plot the following for values of x between 0 and 30:

$y = 4x^2 + 2$ for $0 \le x \le 10$

$y = -6x^2 + 1002$ for $10 < x \le 20$

$y = x^2 - 1798$ for $x > 20$

Example 1-14

Determine how many terms in the series
$16t^2$ t= 1, 2, 3, … there are if the sum of the terms does not exceed 3000.

Example 1-15

Determine how many terms in the series $16t^2$ t= 1, 2, 3, … there are if the sum of the terms does not exceed 3000. Print the last term that meets this criterion.

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The following video examples can be viewed online at www.YourOtherTeacher.com:

Example 2-1

For the matrix **A**, find the array [A;A´]. Use MATLAB to find what is in row 6, column 2 of [A;A´].

$$\mathbf{A} = \begin{bmatrix} 2 & 24 & 31 & 9 \\ 67 & 4 & 78 & 4 \\ 54 & 65 & 38 & 6 \\ 55 & 32 & 89 & 53 \end{bmatrix}$$

Example 2-2

Find the largest and smallest element in **A** and their corresponding indices. (b) Sort in acending order each column in **A** to create a new matrix **B**.

$$\mathbf{A} = \begin{bmatrix} 2 & 24 & 31 & 9 \\ 67 & 4 & 78 & 4 \\ 54 & 65 & 38 & 6 \\ 55 & 32 & 89 & 53 \end{bmatrix}$$

Example 2-3

Use MatLAB to generate a vector $\mathbf{x}$ having 5 regularly spaced values starting at 20 and ending at 40.

Example 2-4

Use MatLAB to generate a vector **x** having a regular spacing of 3 starting at -10 and ending at 20.

Example 2-5

Using the matrix below:

$$\mathbf{A} = \begin{bmatrix} 2 & 24 & 31 & 9 \\ 67 & 4 & 78 & 4 \\ 54 & 65 & 38 & 6 \\ 55 & 32 & 89 & 53 \end{bmatrix}$$

a. Create a vector **x** consisting of the elements in the second column of **A**.
b. Create a vector **y** consisting of the elements in the second row of **A**.

Example 2-6

Using the matrix below:

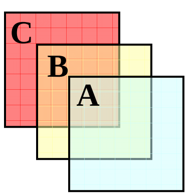
$$\mathbf{A} = \begin{bmatrix} 2 & 24 & 31 & 9 \\ 67 & 4 & 78 & 4 \\ 54 & 65 & 38 & 6 \\ 55 & 32 & 89 & 53 \end{bmatrix}$$

Create a vector **x** consisting of the elements in the shaded column of **A**.

Example 2-7

Create a three-dimensional array **D** whose three "layers" are made up of the following matrices.

$$\mathbf{A} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} \quad \mathbf{C} = \begin{bmatrix} 9 & 10 \\ 11 & 12 \end{bmatrix}$$



Example 2-8

Given the matrices

$$\mathbf{A} = \begin{bmatrix} 16 & 10 \\ -25 & 18 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 4 & -2 \\ 5 & 2 \end{bmatrix}$$

find their (a) array product **AB**, (b) array right division **A**/**B**, and (c) $\mathbf{A}^2$ (element by element).

Example 2-9

Compute the dot product $\mathbf{A} \bullet \mathbf{B}$.

$$\mathbf{A} = 5\mathbf{i} - 9\mathbf{j} + 12\mathbf{k}$$
$$\mathbf{B} = 21\mathbf{i} + 23\mathbf{j} - 5\mathbf{k}$$

Example 2-10

Compare the results of **AB** using element by element multiplication with matrix multiplication.

$$\mathbf{A} = \begin{bmatrix} 3 & 6 \\ -9 & 8 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 5 & -9 \\ -3 & 5 \end{bmatrix}$$

Example 2-11

Compare the matrix multiplication results of **AB** and **BA**.

$$\mathbf{A} = \begin{bmatrix} 3 & 5 \\ -9 & 8 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 5 & -9 \\ -3 & 5 \end{bmatrix}$$

Example 2-12

Compare the matrix multiplication results of $\mathbf{A}^2$ (element by element) and $\mathbf{A}^2$ (matrix multiplication).

$$\mathbf{A} = \begin{bmatrix} 3 & 5 \\ -9 & 8 \end{bmatrix}$$

Example 2-13

Find the roots of

$$x^3 - 18x^2 + 92x - 120 = 0$$

Example 2-14

Find the product of

$$(2x^4 + 53x^2 - x + 5)(8x^2 + 17x - 38)$$

Example 2-15

Find the division of

$$\frac{(2x^4 + 53x^2 - x + 5)}{(8x^2 + 17x - 38)}$$

Example 2-16

Solve for x=14, 16, 18, 20

$$\frac{(2x^4 + 53x^2 - x + 5)}{(8x^2 + 17x - 38)}$$

Example 2-17

Plot the polynomial

$$(2x^4 + 53x^2 - x + 5)$$

over the range $-3 \le x \le 2$.

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The following video examples can be viewed online at www.YourOtherTeacher.com:

Example 3-1

Write a function that returns the two roots of a quadratic equation given the three terms *a, b, c*.

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example 3-2

Write a function that will read a text string (M, m, E, e) and displays the word “Metric” if M or m is entered, and display “English” if E or e is entered. Display “Error” if anything other than M, m, E, or e is entered.

Example 3-3

Use the MatLAB function fminbnd to find the minimum value for the equation below for the range $-1 \le x \le 5$. As a second check, graph the function to visually verify the minimum.

$$y = x + 2^{-x} - 3$$

Example 3-4

Create a data file using Notepad and store the following matrix in it.

$$\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \end{bmatrix}$$

Example 3-5

Create a data file using Excel and store the following matrix in it.

$$\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \end{bmatrix}$$

Example 3-6

Create a data file using MatLAB's Import command and store the following matrix in it.

$$\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \end{bmatrix}$$

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The following video examples can be viewed online at www.YourOtherTeacher.com:

Example 4-1

Compute the sum of the first 20 terms of the series

$$y = 24k^4 - 35k^2 + 42, \quad k = 1, 2, 3, \ldots$$

a. Develop the pseudocode.
b. Write and run the program in part a.

Example 4-2

Suppose that x= 25. Find the results of the following operations:

a. z= (x<20)
b. z= (x==25)
c. z= (x>=35)
d. z= (x~=12)

Example 4-3

Find the results of the following operations:

a. z= 18<20/2
b. z= 18<(20/2)
c. z= 45+5==5
d. z= 63>=9*7

Example 4-4

Find all of the elements in x that are less than the corresponding elements in y.

$$x = [34 \quad 85 \quad -32 \quad 0 \quad 47 \quad -56]$$
$$y = [43 \quad 79 \quad -39 \quad 2 \quad 47 \quad -74]$$

Example 4-5

Find the results of the following operations given,

$$x = [34 \quad 85 \quad -32 \quad 0 \quad 47 \quad -56]$$
$$y = [43 \quad 0 \quad -39 \quad 0 \quad 47 \quad -74]$$

a. z= y<~x
b. z= x&y
c. z= x|y
d. z= xor(x,y)

Example 4-6

The price, in dollars, of a certain stock over a 10-day period is given in the following array.

$$\text{price} = [19, 18, 22, 21, 25, 19, 17, 21, 27, 29]$$

Suppose you owned 1000 shares at the start of the 10-day period, and you bought 100 shares every day the price was below \$20 and sold 100 shares every day the price was above \$25. Compute the amount you spent in buying shares, (b) the amount you received from the sale of the shares, (c) the total number of shares you own after the 10^{th} day, and (d) the net increase in worth of your portfolio.

Example 4-7

Write a function that sets the value of y as follows:

$y = 4$ if $3 < x < 10$
otherwise $y = 7$

Example 4-8

Write a function that sets the value of y as follows:

$y = 4$ if $3 < x < 10$
$y = 5$ if $10 \le x < 20$
otherwise $y = 7$

Example 4-9

Write a function that sets the value of y as follows:

$$y = 4 \text{ if } 3 < x < 10$$
$$y = 5 \text{ if } 10 \le x < 20$$
$$y = 6 \text{ if } x \ge 20 \text{ and } k = 1$$
$$\text{otherwise } y = 7$$

Example 4-10

Write a function that reads a user’s first name and changes it if it meets the following criteria:

change “Fred” to “FREDRICK”
change “Jeff” to “JEFFREY”

Example 4-11

Write a function that reads a user's first name and changes it if it meets the following criteria:

change "Fred" to "FREDRICK"
change "Jeff" to "JEFFREY"
change "Sam" to "SAMUAL"

Example 4-12

Using FOR loops, generate the following matrix:

$$\begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \\ 4 & 7 & 10 \end{bmatrix}$$

Example 4-13

Write a FOR loop that asks the user to input a number, save it in an array called score and then computes the average score.

Sample program:

Welcome to GradesRus, version 1.0!
Enter the number of scores: 4
Enter the score: 78
Enter the score: 96
Enter the score: 69
Enter the score: 54

The average score is: 74.2500

Example 4-14

Write a FOR loop that asks the user to input a number, save it in an array called score and then computes the average score.

Sample program:

Welcome to GradesRus, version 1.0!
Enter a value less than 0 or greater than 100 to terminate.

Enter the score: 78
Enter the score: 96
Enter the score: 69
Enter the score: 54
Enter the score: 200

The average score is: 74.2500

Example 4-15

Write a FOR loop that asks the user to input a number, save it in an array called score. If the user enters -99 then terminate the loop and compute the average score.

Sample program:

Welcome to GradesRus, version 1.0!
Enter the score (-99 to terminate): 78
Enter the score (-99 to terminate): 96
Enter the score (-99 to terminate): 69
Enter the score (-99 to terminate): 54
Enter the score (-99 to terminate): -99

The average score is: 74.2500

Example 4-16

Write a FOR loop that asks the user to input a number, save it in an array called score. If the user enters -99 then terminate the loop and compute the average score. If the score is negative (other than -99) or greater than 100, ask the user to re-enter the data.

Sample program:

Welcome to GradesRus, version 1.0!
Enter the score (-99 to terminate): 78
Enter the score (-99 to terminate): 96
Enter the score (-99 to terminate): 169
That score is invalid. Please re-enter.
Enter the score (-99 to terminate): 69
Enter the score (-99 to terminate): -54
That score is invalid. Please re-enter.
Enter the score (-99 to terminate): 54
Enter the score (-99 to terminate): -99

The average score is: 74.2500

Example 4-17

Compute the number of terms (x) required for the sum of the following equation to reach 1000. x= 1, 2, 3 …

$$y = 5x^2$$

Example 4-18

Write a program that reads a value (x) from the keyboard and if

if x=1, then y=45
if x=2, then y=93
any other value, y= 75

Example 4-19

Write a program that reads an integer score and assigns a letter grade based on the criteria below.

A: $90 \le score \le 100$
B: $80 \le score \le 89$
C: $70 \le score \le 79$
D: $60 \le score \le 69$
F: $score \le 59$

YOT VIDEOS

The following video examples can be viewed online at www.YourOtherTeacher.com:

Example 5-1

Create a plot of Temperature (*temp*, °C) versus Time (*t*, seconds) using the function below for a time range of $0 \le time \le 88$. Label both axis.

$$temp = 1.2t^2$$

Example 5-2

Create a plot of Temperature (*temp*, °C) versus Time (*t*, seconds) using the function below for a time range of $0 \le time \le 88$. Add a grid pattern, show the maximum time on the axis to 110 seconds, and the maximum temperature to 20,000 degrees.

$$temp = 1.2t^2$$

Example 5-3

Create a plot of the function below using the command fplot. $1 \le x \le 2$

$$y = \cos(\tan x) - \tan(\sin x)$$

Example 5-4

Create a plot of the function below using the command polyval. $1 \le x \le 2$

$$y = 10x^4 + 11x^3 + 12x^2 + 13x + 14$$

Example 5-5

Create two plots of the two functions below in one graphics window. $0 \le x \le 10$.

$$y = 7x^3$$
$$z = -5x + 100$$

Example 5-6

Plot the two functions below in one graph. $0 \le x \le 10$.

$$y = 7x^3$$
$$z = -500x + 6000$$

Example 5-7

Plot the two functions below at every 1 second increments in one graph. $0 \le x \le 10$. Add data markers for each plotted value.

$$y = 7x^3$$
$$z = -500x + 6000$$

Example 5-8

Plot the two functions below at every 1 second increments in one graph. $0 \le x \le 10$. Add data markers for each plotted value. Also add lines connecting each data marker.

$$y = 7x^3$$
$$z = -500x + 6000$$

Example 5-9

Create 3 plots (Stair, bar, stem) in one graphics window.

$$y = [5 \quad 9 \quad 4 \quad 10 \quad 145 \quad 12 \quad 4 \quad 11 \quad 7 \quad 9]$$

Discussion 5-10

$$y(x) = mx + b$$
$$y(x) = bx^m$$
$$y(x) = b(10)^{mx} = be^{mx}$$

$$y(x) = a_n x^n + a_{n-1}x^{n-1} + ... + a_1 x + a_0$$

Example 5-11

Assuming that the data (*x,y*) below fits one of 3 equations below, determine which equation best describes the data. Evaluate the function at $x = 8.5$.

$$y(x) = mx + b$$
$$y(x) = bx^m$$
$$y(x) = b(10)^{mx} = be^{mx}$$

x	3	7	10	12
y	13.5	171.5	500	864

Example 5-12

Determine the polynomial that best describes the data below. Evaluate the resulting function at $x = 2.5$.

$$y(x) = a_n x^n + a_{n-1} x^{n-1} + ... + a_1 x + a_0$$

x	0	1	2	3	4	5
y	7	4.5	-13	-42.5	-81	-125.5

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The following video discussions and examples can be viewed online at www.YourOtherTeacher.com:

Discussion 6-1

Linear Algebraic Equations

$$\begin{aligned} 5x &\quad -2y &\quad = 1 \\ -2x &\quad +6y &\quad = 6 \end{aligned}$$

Solving by hand:

1) Successive elimination of variables (Gauss Elimination)

2) Cramer's Method

Use Matlab to
- -solve using Gauss Elimination
- -solve using Cramer's Method
- -determine whether a set has
  - -a unique solution
  - -multiple solutions
  - -no solution at all

Example 6-2

Solve the following by hand using Gauss Elimination.

$$\begin{aligned} 5x \quad -2y \quad &= 1 \\ -2x \quad +6y \quad &= 6 \end{aligned}$$

Example 6-3

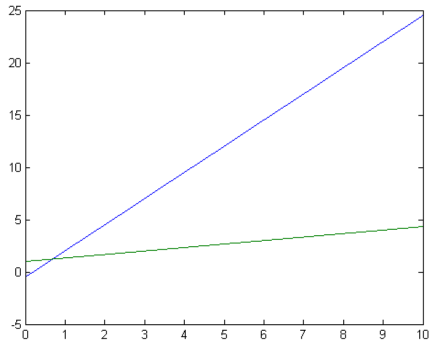
Solve the following by hand using Gauss Elimination.

$$\begin{aligned} 2x &\quad -3y &\quad +4z &\quad = 230 \\ -1x &\quad -5y &\quad +3z &\quad = 90 \\ 10x &\quad +12y &\quad -8z &\quad = -42 \end{aligned}$$

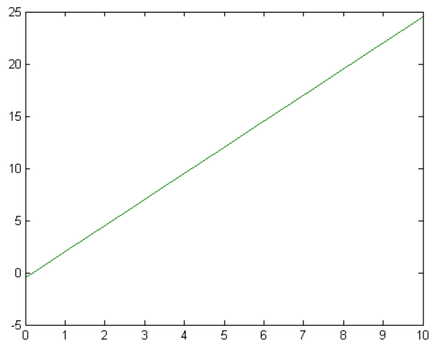
Discussion 6-4

Singular Problems

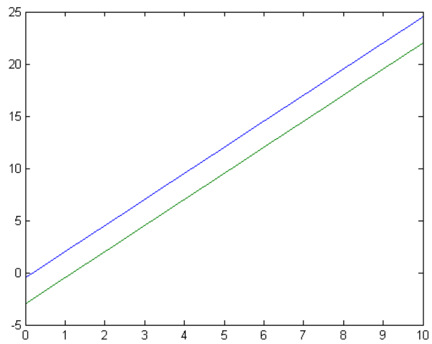
A *singular* problem refers to a set of equations having either no unique solution or no solution at all.



$$\begin{aligned} 5x &\quad -2y &= 1 \\ -2x &\quad +6y &= 6 \end{aligned}$$



$$\begin{aligned} 5x &\quad -2y &= 1 \\ 15x &\quad -6y &= 3 \end{aligned}$$



$$\begin{aligned} 5x &\quad -2y &= 1 \\ \frac{-15}{2}x &\quad +3y &= -9 \end{aligned}$$

Discussion 6-5

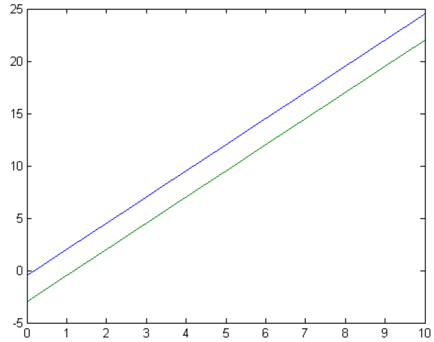
Homogeneous Equations

$$\begin{aligned} 6x \quad &+ay \quad &= 0 \\ 2x \quad &+4y \quad &= 0 \end{aligned}$$

Discussion 6-6

Ill-Conditioned Problems

An ill-conditioned set of equations is a set that is close to being singular.



$$\begin{aligned} 5x &\quad -2y &&= 1 \\ \frac{-15}{2}x &\quad +3.001y &&= -9 \end{aligned}$$

Discussion 6-7

Matrix Methods for Linear Equations

$$\begin{aligned} 5x \quad -2y \quad &= 1 \\ -2x \quad +6y \quad &= 6 \end{aligned}$$

$$\begin{bmatrix} 5 & -2 \\ -2 & 6 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \end{bmatrix}$$

In General,

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \qquad \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \qquad \mathbf{b} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

Discussion 6-8

Determinates

$$D = \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$$

$$D = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$$

Example 6-9

Find the determinate of the following by hand:

$$\begin{bmatrix} 5 & -2 \\ -2 & 6 \end{bmatrix}$$

Example 6-10

Find the determinate of the following by hand:

$$\begin{vmatrix} 2 & -3 & 4 \\ -1 & -5 & 3 \\ 10 & 12 & -8 \end{vmatrix}$$

Example 6-11

Using MatLab find the determinate of the following:

$$\begin{vmatrix} 5 & -2 \\ -2 & 6 \end{vmatrix}$$

Example 6-12

Using MatLab find the determinate of the following:

$$\begin{vmatrix} 2 & -3 & 4 \\ -1 & -5 & 3 \\ 10 & 12 & -8 \end{vmatrix}$$

Discussion 6-13

Determinates and Singular Problems

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

where,

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \qquad \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \qquad \mathbf{b} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

If $|\mathbf{A}| = 0$ then the equation set is singular.

Discussion 6-14

The Left-Division Method

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

$\mathbf{Ax} = \mathbf{b}$

Example 6-15

Using MatLab, solve the following. Check your results to very that a solution exists.

$$
\begin{aligned}
5x &\quad -2y &&= 1 \\
-2x &\quad +6y &&= 6
\end{aligned}
$$

Example 6-16

Using MatLab, solve the following. Check your results to very that a solution exists.

$$
\begin{aligned}
2x &\quad -3y &\quad +4z &&= 230 \\
-1x &\quad -5y &\quad +3z &&= 90 \\
10x &\quad +12y &\quad -8z &&= -42
\end{aligned}
$$

Discussion 6-17

The Matrix Inverse in MatLab

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

Ax = b

Example 6-18

Using the matrix inverse method of MatLab, solve the following. Check your results to very that a solution exists.

$$
\begin{aligned}
5x \quad -2y \quad &= 1 \\
-2x \quad +6y \quad &= 6
\end{aligned}
$$

Example 6-19

Using the matrix inverse method of MatLab, solve the following. Check your results to very that a solution exists.

$$\begin{aligned} 2x \quad -3y \quad +4z &= 230 \\ -1x \quad -5y \quad +3z &= 90 \\ 10x \quad +12y \quad -8z &= -42 \end{aligned}$$

Example 6-20

Using Cramer's Method, manually solve the following. Check your results to very that a solution exists.

$$\begin{aligned} 5x \quad &-2y \quad = 1 \\ -2x \quad &+6y \quad = 6 \end{aligned}$$

Example 6-21

Using Cramer's Method, manually solve the following. Check your results to very that a solution exists.

$$\begin{aligned} 2x &\quad -3y &\quad +4z &\quad = 230 \\ -1x &\quad -5y &\quad +3z &\quad = 90 \\ 10x &\quad +12y &\quad -8z &\quad = -42 \end{aligned}$$

Example 6-22

Using Cramer's Method, solve the following using MatLab. Check your results to very that a solution exists.

$$\begin{aligned} 5x &\quad -2y &\quad = 1 \\ -2x &\quad +6y &\quad = 6 \end{aligned}$$

Example 6-23

Using Cramer's Method, solve the following using MatLab. Check your results to very that a solution exists.

$$\begin{aligned} 2x \quad -3y \quad +4z &= 230 \\ -1x \quad -5y \quad +3z &= 90 \\ 10x \quad +12y \quad -8z &= -42 \end{aligned}$$

Example 6-24

Using Cramer's Method, solve the following using MatLab. Check your results to very that a solution exists.

$$\begin{aligned} 5x \quad -2y &= 1 \\ \frac{-15}{2}x \quad +3y &= -9 \end{aligned}$$

Example 6-25

Determine whether the following set has a unique solution, and if so, find it:

$$\begin{aligned} 2x \quad -3y \quad +4z &= 230 \\ -1x \quad -5y \quad +3z &= 90 \\ 10x \quad +12y \quad -8z &= -42 \end{aligned}$$

Example 6-26

Determine whether the following set has a unique solution, and if so, find it:

$$
\begin{aligned}
2x \quad -3y \quad +4z \quad &= 230 \\
-1x \quad -5y \quad +3z \quad &= 90 \\
1x \quad -8y \quad +7z \quad &= 320
\end{aligned}
$$

Example 6-27

Determine whether the following set has a unique solution, and if so, find it:

$$
\begin{aligned}
x \quad -3y \quad &= 2 \\
3x \quad +5y \quad &= 7 \\
70x \quad -28y \quad &= 153
\end{aligned}
$$

Example 6-28

Determine whether the following set has a unique solution, and if so, find it:

$$
\begin{aligned}
x \quad -3y \quad &= 2 \\
3x \quad +5y \quad &= 7 \\
5x \quad -2y \quad &= -4
\end{aligned}
$$

YOT VIDEOS

The following video examples can be viewed online at www.YourOtherTeacher.com:

Example 7-1

Samples of concrete are tested at a manufacturer after it has cured for 7 days. Using MatLab's "BAR" function, create a histogram.

7 Day Breaking Strength (psi)

2200, 2180, 2150, 2190, 2210, 2220, 2110, 2140, 2180, 2160, 2180, 2150, 2200, 2220, 2110, 2160, 2210, 2140, 2180, 2220

Example 7-2

Samples of concrete are tested at a manufacturer after it has cured for 7 days. Using MatLab's "HIST" function, create a histogram with 10 evenly spaced bins between the minimum and maximum values.

7 Day Breaking Strength (psi)

2200, 2180, 2150, 2190, 2210, 2220, 2110, 2140, 2180, 2160, 2180, 2150, 2200, 2220, 2110, 2160, 2210, 2140, 2180, 2220

Example 7-3

Samples of concrete are tested at a manufacturer after it has cured for 7 days. Using MatLab's "HIST" function, create a histogram where each bin is 50 psi apart.

7 Day Breaking Strength (psi)

2200, 2180, 2150, 2190, 2210, 2220, 2110, 2140, 2180, 2160, 2180, 2150, 2200, 2220, 2110, 2160, 2210, 2140, 2180, 2220

Example 7-4

Samples of concrete are tested at a manufacturer after it has cured for 7 days. Using MatLab's "HIST" function, create a histogram with 3 bins evenly spaced between the minimum and maximum values.

7 Day Breaking Strength (psi)

2200, 2180, 2150, 2190, 2210, 2220, 2110, 2140, 2180, 2160, 2180, 2150, 2200, 2220, 2110, 2160, 2210, 2140, 2180, 2220

Example 7-5

Samples of concrete are tested at a manufacturer after it has cured for 30 days.
a) Plot the scaled frequency histogram with a bin size of 20 psi.
b) Compute the mean and standard deviation and use them to estimate the lower and upper limits of the breaking strength corresponding to 68%. Compare these limits with those of the data.

30 Day Breaking Strength (psi)

3170, 3180, 3150, 3190, 3210, 3170, 3190, 3140, 3180, 3160, 3180, 3150, 3200, 3150, 3110, 3160, 3150, 3140, 3180, 3130

Example 7-6

Samples of concrete are tested at a manufacturer after it has cured for 30 days.
a) Estimate the percentage of samples that will have a breaking strength $\leq$ 3200 psi.
b) Estimate the percentage of samples that will have a breaking strength $\geq$ 3100 psi and $\leq$ 3300 psi.

30 Day Breaking Strength (psi)

3170, 3180, 3150, 3190, 3210, 3170, 3190, 3140, 3180, 3160, 3180, 3150, 3200, 3150, 3110, 3160, 3150, 3140, 3180, 3130

Example 7-7

Generate a vector `y` containing 500 *uniformly* distributed random numbers in the interval [100, 150]. Check your results with the `mean`, `min`, and `max` functions. Also plot the resulting vector `y`.

Example 7-8

Generate a vector `y` containing 500 *normally* distributed random numbers with a mean of 35 and a standard deviation of 10. Check your results with the `mean`, and `std` functions. Also plot the resulting vector `y`.

Example 7-9

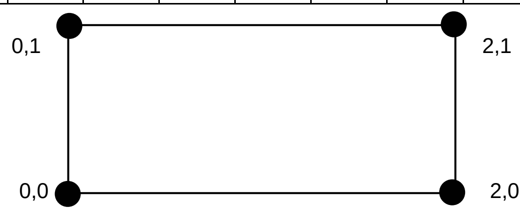
The following temperature data was collected. Using linear interpolation, estimate the temperature at 2 and 5 pm.

12 pm	1	2	3	4	5	6	7
62	63		64	63		60	59

Example 7-10

The following temperature data was collected. Using linear interpolation, estimate the temperature at 2 and 5 pm.

Coordinate	12 pm	1	2	3	4	5	6	7
0,0	62	63		64	63		60	59
3,0	58	59		61	59		57	55
0,1	63	64		65	64		61	60
3,1	59	60		62	60		58	56



Example 7-11

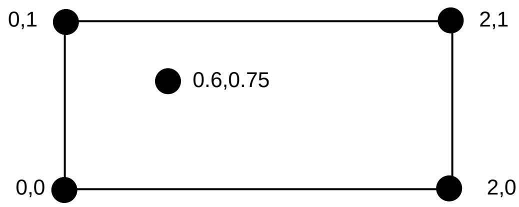
The following temperature data was collected. Using cubic-spline interpolation, estimate the temperature at 2 and 5 pm.

12 pm	1	2	3	4	5	6	7
62	63		64	63		60	59

Example 7-12

The following temperature data was collected at four points. Using linear interpolation, estimate the temperature for coordinate (0.6, 0.75).

Coordinate	
0,0	100
2,0	200
0,1	120
2,1	400



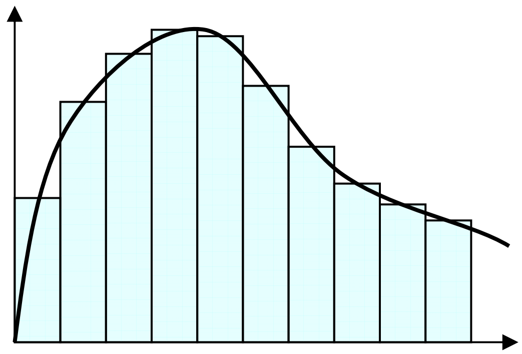
YOT VIDEOS

The following video examples can be viewed online at www.YourOtherTeacher.com:

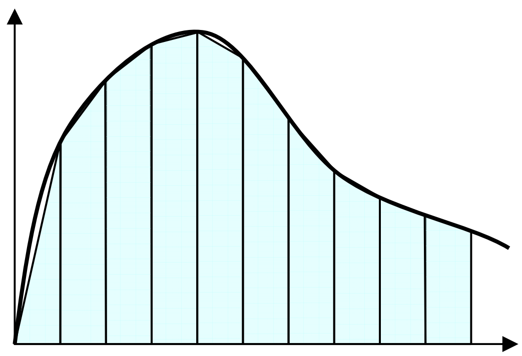
Example 8-1

Numerical Integration

Rectangular Integration



Trapezoidal Integration



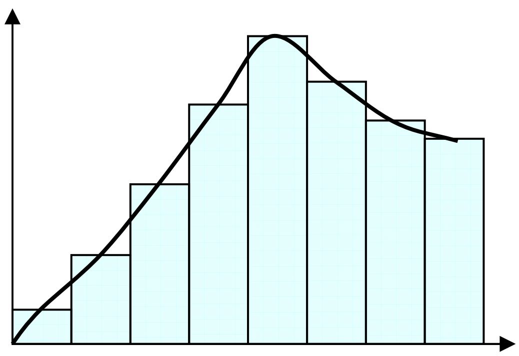
Example 8-2

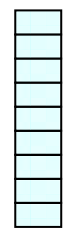
An accelerometer measures acceleration and is used to estimate velocity. If a vehicle starts from rest, compute the following using the data below.

a) Using rectangular elements, estimate the velocity after 8 seconds.
b) Estimate the velocity at one second intervals.

Time (s)	0	1	2	3	4	5	6	7	8
Acceleration (ft/s^2)	0	2	5	9	14	18	15	13	12

$$v(8) = \int_0^8 a(t) + v(0) = \int_0^8 a(t)$$





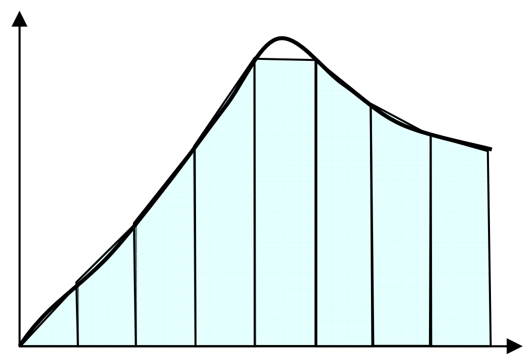
Example 8-3

An accelerometer measures acceleration and is used to estimate velocity. If a vehicle starts from rest, compute the following using the data below.

a) Using triangular elements, estimate the velocity after 8 seconds.
b) Estimate the velocity at one second intervals.

Time (s)	0	1	2	3	4	5	6	7	8
Acceleration (ft/s^2)	0	2	5	9	14	18	15	13	12

$$v(8) = \int_0^8 a(t) + v(0) = \int_0^8 a(t)$$



Example 8-4

An accelerometer measures acceleration and is used to estimate velocity. If a vehicle starts from rest, compute the following using the data below.

a) Using the TRAPZ function, estimate the velocity after 8 seconds.
b) Estimate the velocity at one second intervals.

Time (s)	0	1	2	3	4	5	6	7	8
Acceleration (ft/s^2)	0	2	5	9	14	18	15	13	12

$$v(8) = \int_0^8 a(t) + v(0) = \int_0^8 a(t)$$

Example 8-5

An accelerometer measures acceleration and is used to estimate velocity. If a vehicle starts from rest, compute the following using the data below.

a) Using the TRAPZ function, estimate the displacement after 8 seconds.
b) Estimate the displacement at one second intervals.

Time (s)	0	1	2	3	4	5	6	7	8
Acceleration (ft/s^2)	0	2	5	9	14	18	15	13	12

$$v(8) = \int_0^8 a(t) + v(0) = \int_0^8 a(t)$$

$$x(8) = \int_0^8 v(t) + x(0) = \int_0^8 x(t)$$

Example 8-6

Using MatLab’s QUAD and QUADL functions solve the following:

$$\int_0^1 \sqrt{x}dx$$

Example 8-7

Using MatLab’s QUAD and QUADL functions solve the following without using MatLab’s SQRT function:

$$\int_0^1 \sqrt{x}dx$$

Example 8-8

Using MatLab’s QUAD and QUADL functions solve the following:

$$\int_2^5 \left(x^2 + x\right) dx$$

Example 8-9

An accelerometer measures acceleration and is used to estimate velocity. If a vehicle starts from rest, compute the following using the data below.

a) Estimate the displacement after 8 seconds.
b) Estimate the displacement at one second intervals.

Time (s)	0	1	2	3	4	5	6	7	8
Acceleration (ft/s^2)	0	2	5	9	14	18	15	13	12

$$v(8) = \int_0^8 a(t) + v(0) = \int_0^8 a(t)$$

$$x(8) = \int_0^8 v(t) + x(0) = \int_0^8 v(t)$$