INTRODUCTION
(Spreadsheet, i.e. MS Excel)

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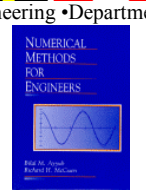


by

Dr. Ibrahim A. Assakkaf

Spring 2001

ENCE 203 - Computation Methods in Civil Engineering II

Department of Civil and Environmental Engineering
University of Maryland, College Park

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN (introduced by IBM in 1957)
  - FORTRAN = *FORmula TRANslation*
  - *Developed for the IBM 704 Computer*
  - *Developed by John Backus and a team of 13 other programmers*
- BASIC
- Pascal
- Others such as C and C++

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- Software Packages
  - MATLAB
  - MathCad
  - Spreadsheet
    - MS Excel
    - Quattro Pro
    - Lotus 123

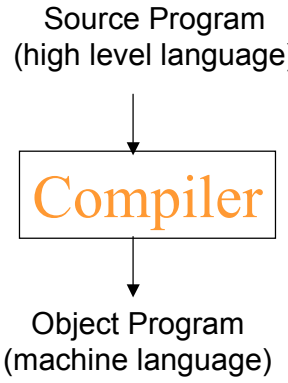
High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN
  - FORTRAN is a high-level language such as BASIC, C, and C++
  - A *compiler* translates each statement in the program into a sequence of basic machine language instruction

$$X = A * B + C$$

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN



High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN
  - A FORTRAN program consists of
    - Input
    - An execution logic (computation)
    - Output
  - A flow chart is used to develop the structure

High-level Languages vs. Spreadsheets, MATLAB & MathCad

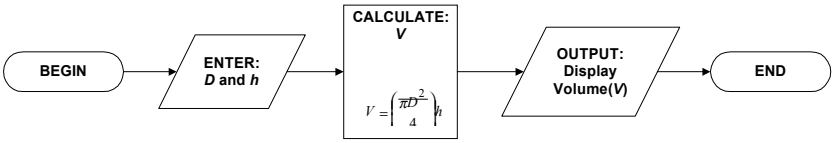
- FORTRAN
  - EXAMPLE 1: Volume of a Cylinder
    - Input
      - Diameter, *D*
      - Height, *h*
    - Computation

$$V = \left(\frac{\pi D^2}{4}\right) \times h$$

    - Output
      - Volume, *V*

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN
  - Flow Chart for the Example 1



A flow chart is a block diagram that summarizes the program structure and logic flow

High-level Languages vs. Spreadsheets, MATLAB & MathCad

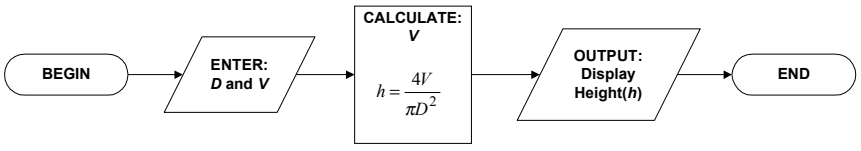
- FORTRAN
  - EXAMPLE 2: Height of a Cylinder
    - Input:
      - Diameter, *D*
      - Volume, *V*
    - Computation

$$h = \frac{4V}{\pi D^2}$$

    - Output:
      - Height, *h*

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN
  - Flow Chart for Example 2



High-level Languages vs. Spreadsheets, MATLAB & MathCad

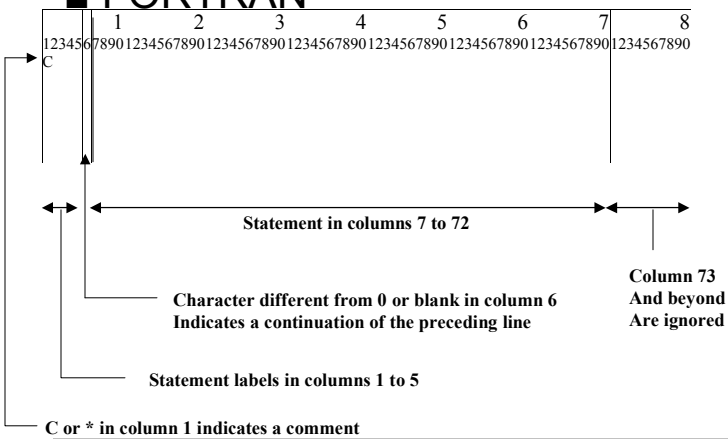
- FORTRAN
  - The following is a format of a simple program:
    - PROGRAM NAME
    - Opening documentation use
    - Variables declaration
    - Program statements
    - END

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN Statements
  - Positions 7 to 72 of a line can be used. To continue on the next line, use any character on position 6 of the next line
- Constants
  - Examples
    - -12
    - 1.2345
    - 12.45-e10

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN



High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN
  - Data Types
    - Integer
    - Real
    - Double Precision
    - Complex
    - Character
    - Logical

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- FORTRAN
  - This program calculates the velocity and height of a projectile given its initial height, velocity,and constant acceleration

$$\text{Height}: \quad h = \frac{1}{2}at^2 + v_0 t + h_0$$

$$\text{Velocity}: \quad v = at + v_0$$

High-level Languages vs. Spreadsheets, MATLAB & MathCad

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- FORTRAN

```
      PROGRAM PROJECT
      1                                                              7
1234567890
C     This program calculates the velocity and height of a projectile given its
C     initial height, initial velocity, and constant acceleration. Variables used are:
C     HGHT0    :    initial height
C     HGHT     :    height at any time
C     VELOC0   :    initial vertical velocity
C     VELOC    :    vertical velocity at any time
C     ACCEL    :    vertical acceleration (Gravity)
C     TIME     :    time elapsed since projectile was launched

      REAL HGHT0, HGHT, VELOC0, VELO, ACCEL, TIME

      ACCEL = -9.807
      PRINT *, `Enter initial height, initial velocity, and time?`
      READ *, HGHT0, VELOC0, TIME

      HGHT = 0.5 * ACCEL * TIME ** 2 +VELOC0 * TIME + HGHT0
      VELOC = ACCEL * TIME + VELOC0

      PRINT *,  `AT TIME `, TIME,  ` THE VERTICAL VELOCITY IS `, VELOC
      PRINT *, `AND THE HEIGHT IS `, HGHT
      END
```

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- Spreadsheets
  - Spreadsheet is special type software that allow the user to enter and perform calculations on rows and columns of data displayed on computer monitor.
  - Advantages of Spreadsheet
    - Easy to use and understand
    - Provide organized record of user computation
    - Entire calculation can be updated easily
    - Suitable for “what if?” scenarios

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- Spreadsheet Calculations

B5 = B3 + B4

	A	B	C	D	E	F	I
1							
2							
3	X =	10					
4	Y =	13.5					
5	Sum =	23.5					
6							
7							
8	u =	45					
9	v =	25					
10	$\sqrt{uv}$ =	33.54102					
11							
12							

B10 = sqrt(B8*B9)

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- Spreadsheet
  - EXAMPLE 1: Volume of a Cylinder
    - Input
      - Diameter, *D*
      - Height, *h*
    - Computation

$$V = \left(\frac{\pi D^2}{4}\right) \times h$$

    - Output
      - Volume, *V*

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- Spreadsheet (Example 1)

B5 = B3 + B4

	A	B	C	D	E	F	I
1							
2				Volume of Cylinder:			
3	X =	10		*D* =	20	in	
4	Y =	13.5		*h* =	76	in	
5	Sum =	23.5		Volume =	23876.1	in^2	
6							
7							
8	u =	45					
9	v =	25					
10	$\sqrt{uv}$ =	33.54102					
11							
12							

B10 = sqrt(B8*B9)

(PI()*E3^2/4)*E4

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- Spreadsheet
  - EXAMPLE 2: Height of a Cylinder
    - Input:
      - Diameter, *D*
      - Volume, *V*
    - Computation

$$h = \frac{4V}{\pi D^2}$$

    - Output:
      - Height, *h*

High-level Languages vs. Spreadsheets, MATLAB & MathCad

- Spreadsheet (Example 2)

B5 = B3 + B4

	A	B	C	D	E	F	I
1							
2				Volume of Cylinder:			
3	X =	10		*D* =	20	in	
4	Y =	13.5		*V* =	23876.10417	in^3	
5	Sum =	23.5		*h* =	76	in	
6							
7							
8	u =	45					
9	v =	25					
10	$\sqrt{uv}$ =	33.54102					
11							
12							

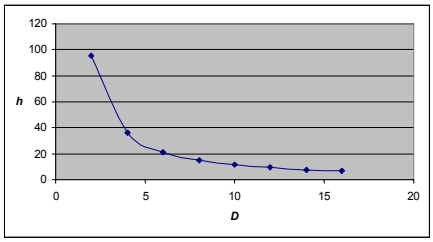
B10 = sqrt(B8*B9)

E5 = (4*E4/(PI()*E3^2)))

High-level Languages vs. Spreadsheets, MATLAB & MathCad

■ Spreadsheet Calculations

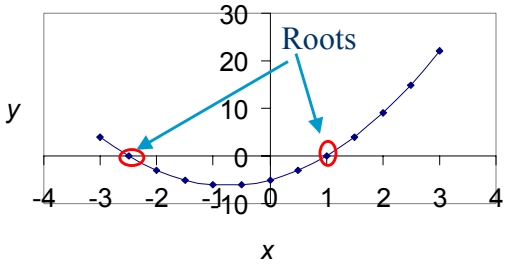
	A	B	C	D	E
1					
2		Diameter, *D*	Volume, *V*	Calculated Height, *h*	
3		2	300	*95.49296586*	
4		4	450	*35.8098622*	
5		6	600	*21.22065908*	
6		8	750	*14.92077591*	
7		10	900	*11.4591559*	
8		12	1050	*9.284038347*	
9		14	1200	*7.795344151*	
10		16	1350	*6.714349162*	
11					
12					



High-level Languages vs. Spreadsheets, MATLAB & MathCad

■ Spreadsheet &Numerical Solutions

x	*y*
-3	4
-2.5	**0**
-2	-3
-1.5	-5
-1	-6
-0.5	-6
0	-5
0.5	-3
1	**0**
1.5	4
2	9
2.5	15
3	22



$$y = 2x^2 + 3x - 5 = 0$$

Introduction to MS Excel

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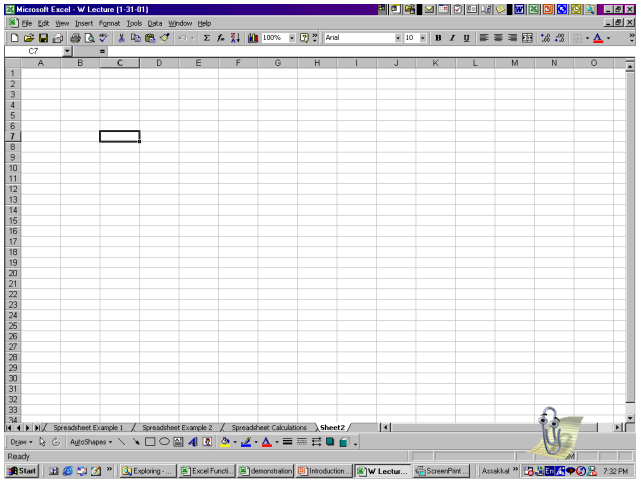
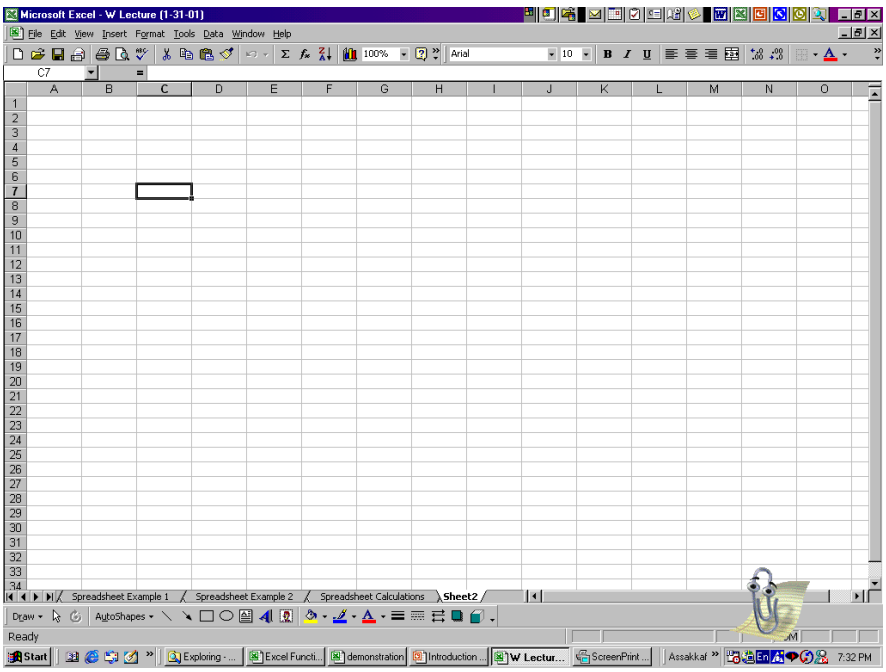
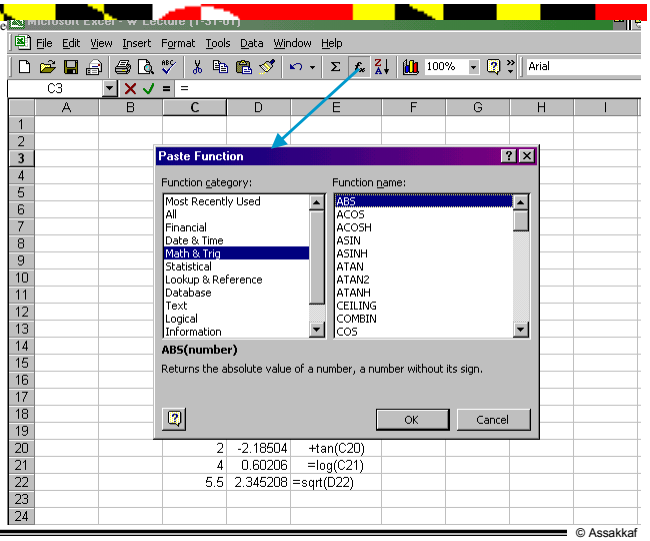
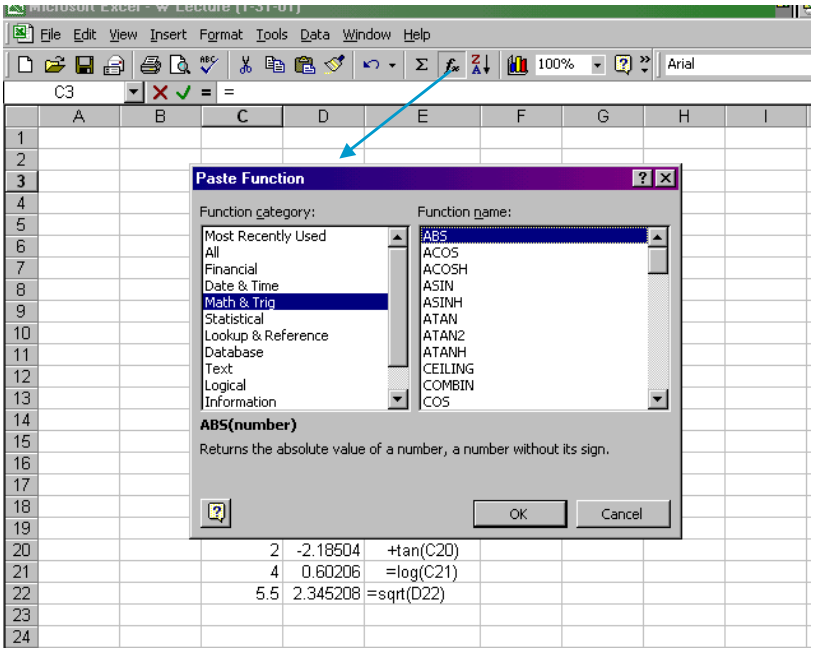




Introduction to MS Excel

MS Excel Math and Trig. functions





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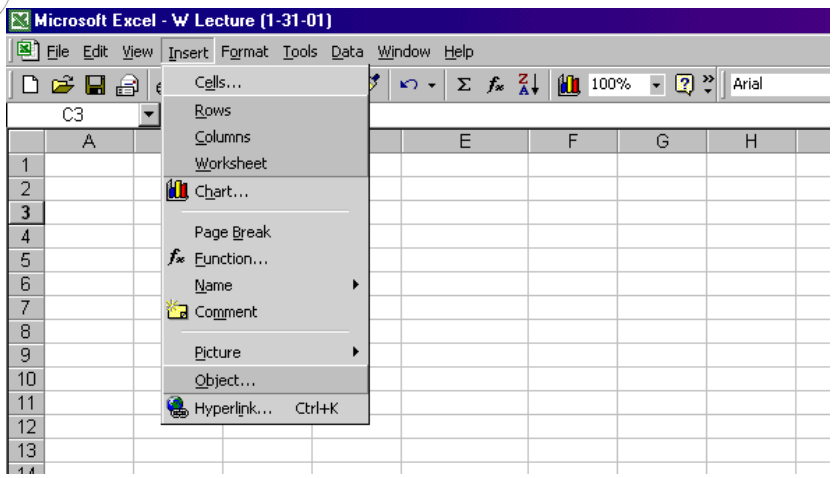

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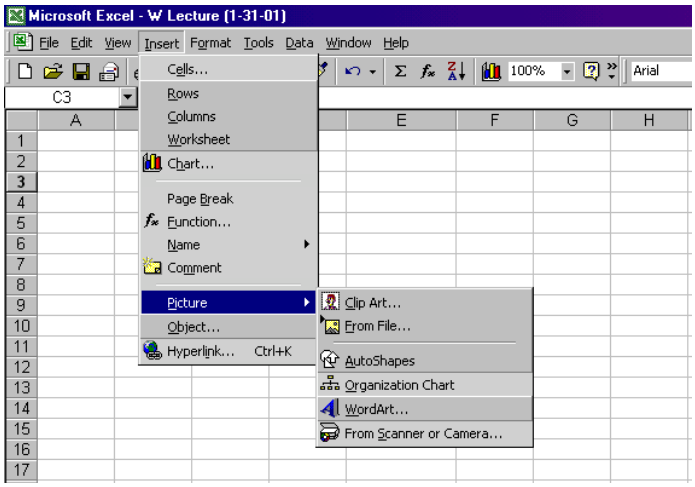

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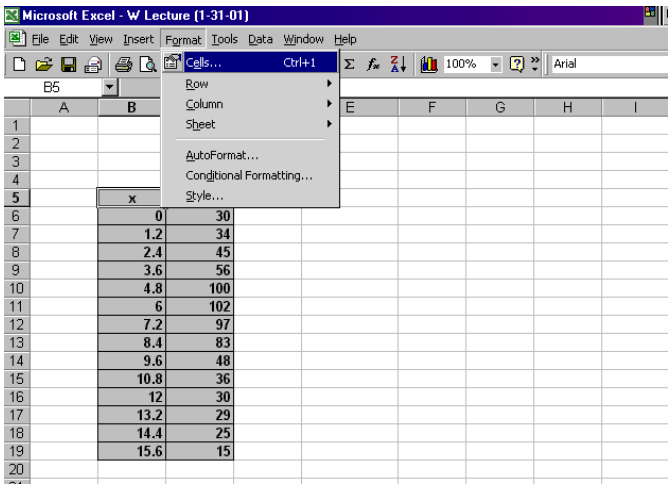

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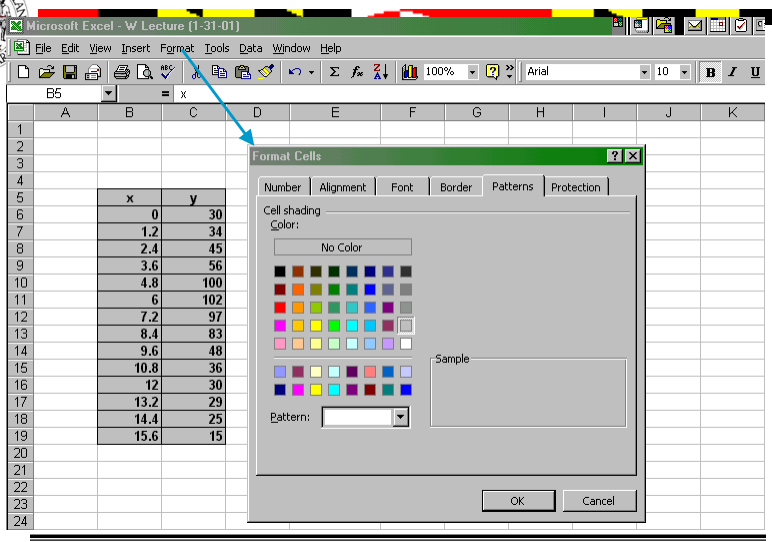

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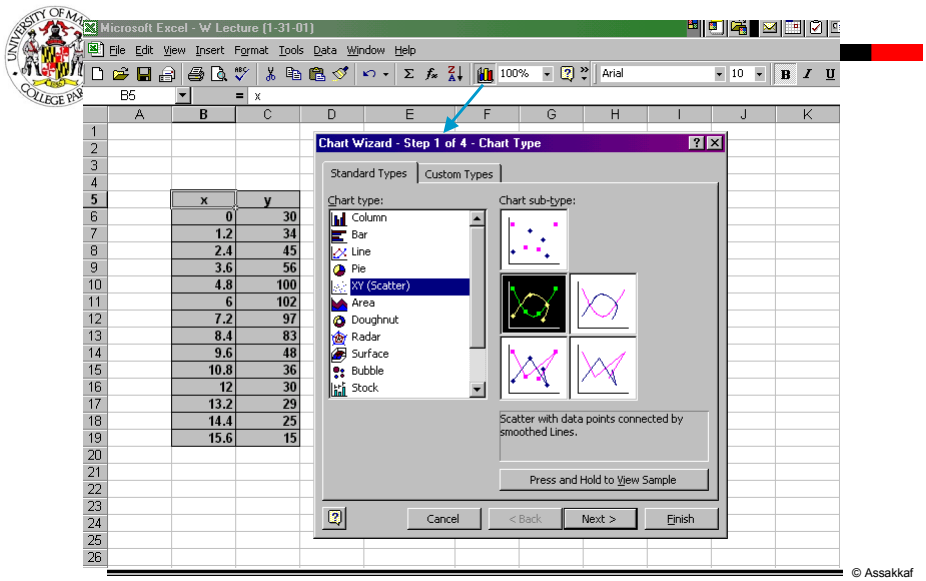
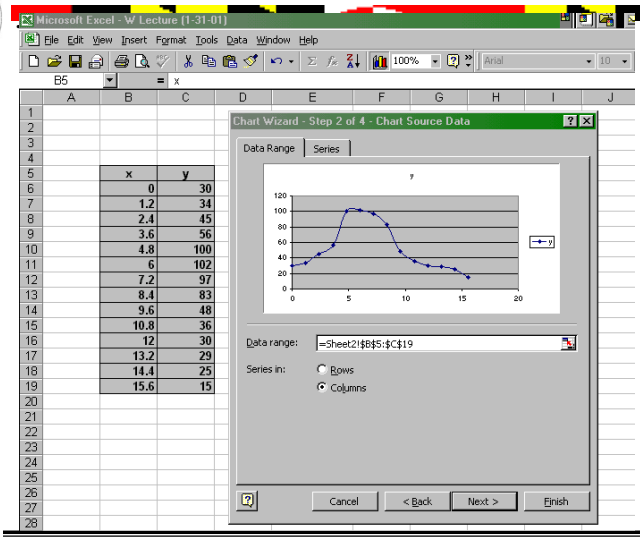


x	y
0	30
1.2	34
2.4	45
3.6	56
4.8	100
6	102
7.2	97
8.4	83
9.6	48
10.8	36
12	30
13.2	29
14.4	25
15.6	15

Introduction to MS Excel



x	y
0	30
1.2	34
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4.8	100
6	102
7.2	97
8.4	83
9.6	48
10.8	36
12	30
13.2	29
14.4	25
15.6	15

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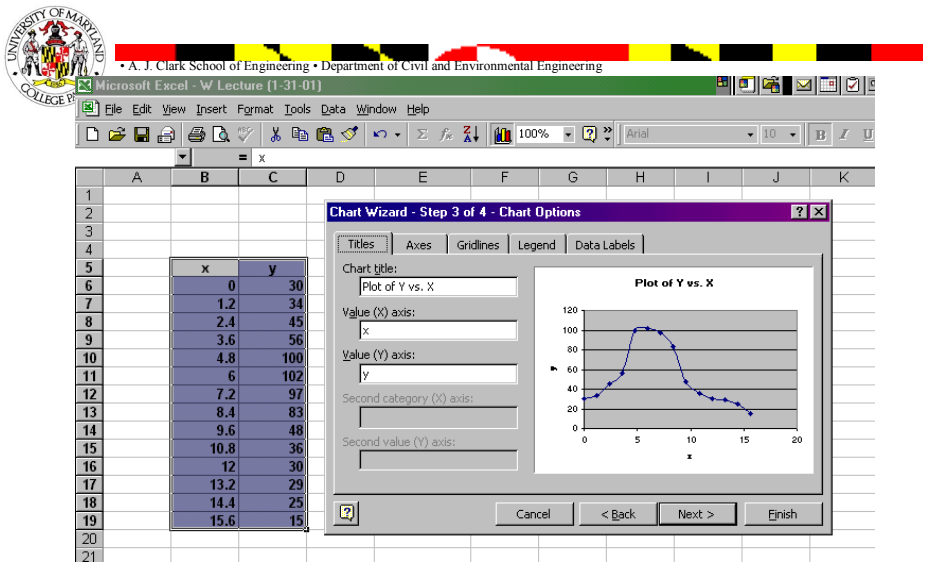
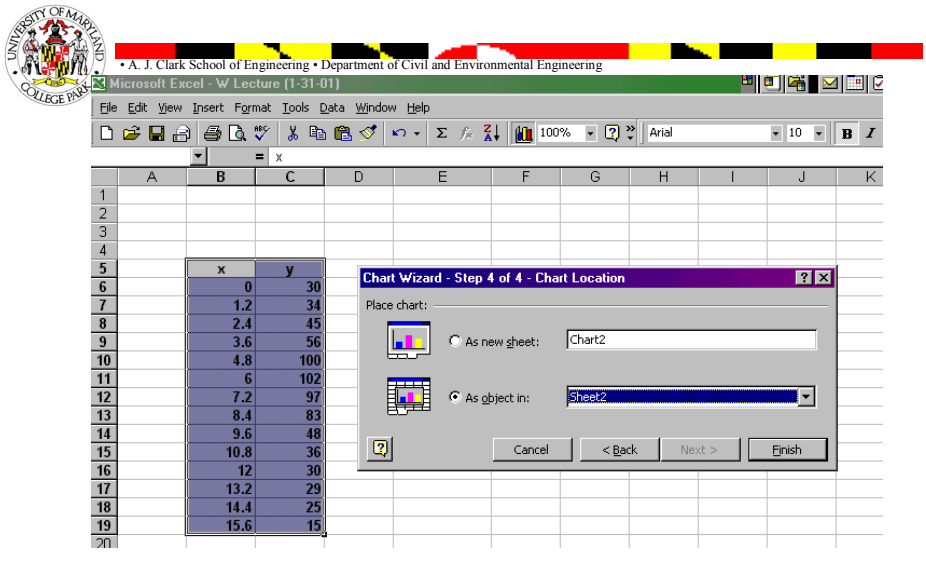
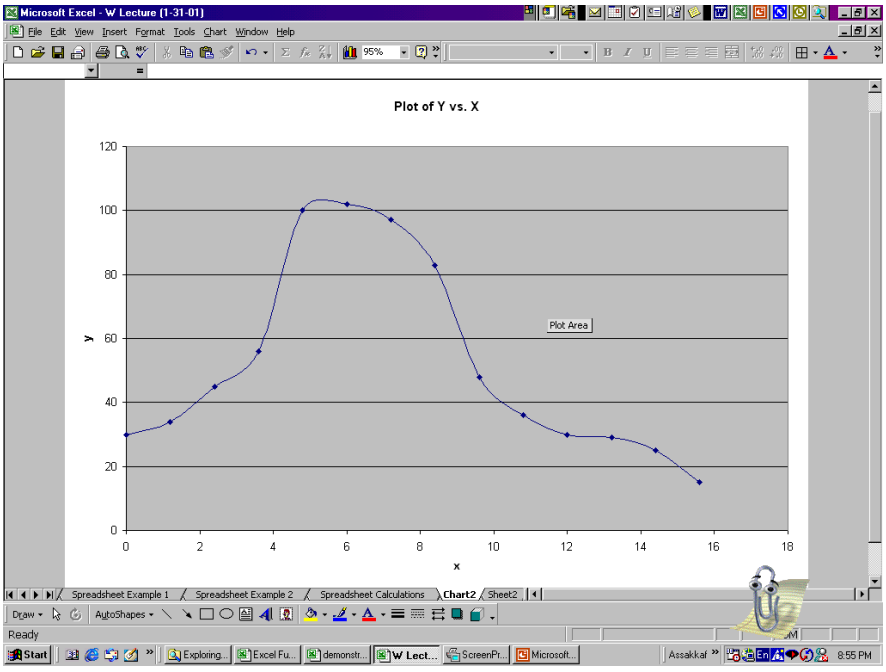


Introduction to MS Excel





Introduction to MS Excel

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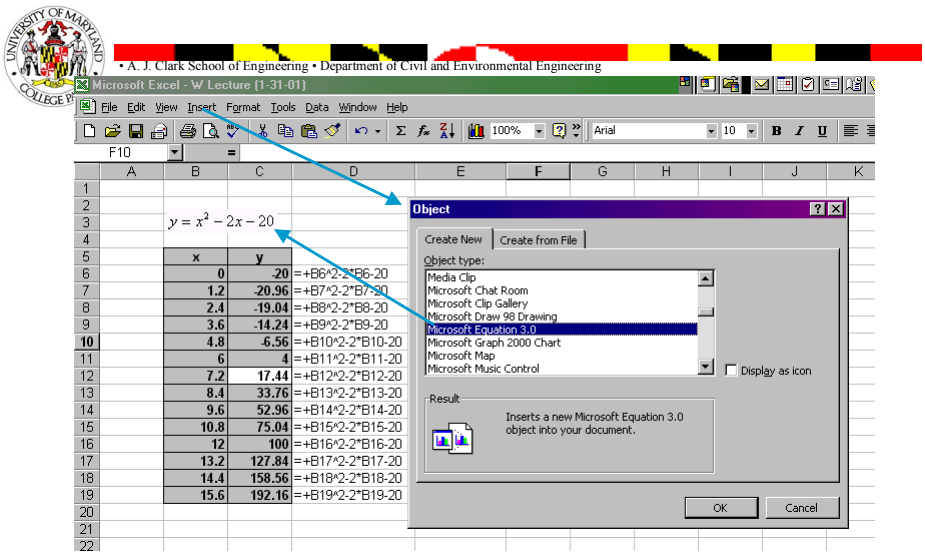
Microsoft Excel - W Lecture (1-31-01)

$y = x^2 - 2x - 20$

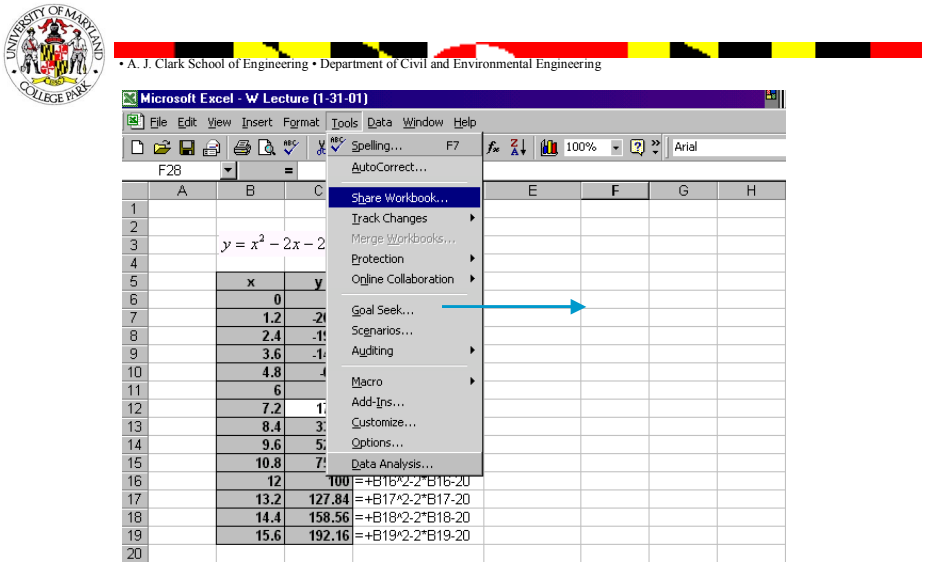
	x	y	
6	0	-20	=+B6^2-2*B6-20
7	1.2	-20.96	=+B7^2-2*B7-20
8	2.4	-19.04	=+B8^2-2*B8-20
9	3.6	-14.24	=+B9^2-2*B9-20
10	4.8	-6.56	=+B10^2-2*B10-20
11	6	4	=+B11^2-2*B11-20
12	7.2	17.44	=+B12^2-2*B12-20
13	8.4	33.76	=+B13^2-2*B13-20
14	9.6	52.96	=+B14^2-2*B14-20
15	10.8	75.04	=+B15^2-2*B15-20
16	12	100	=+B16^2-2*B16-20
17	13.2	127.84	=+B17^2-2*B17-20
18	14.4	158.56	=+B18^2-2*B18-20
19	15.6	192.16	=+B19^2-2*B19-20

Introduction to MS Excel



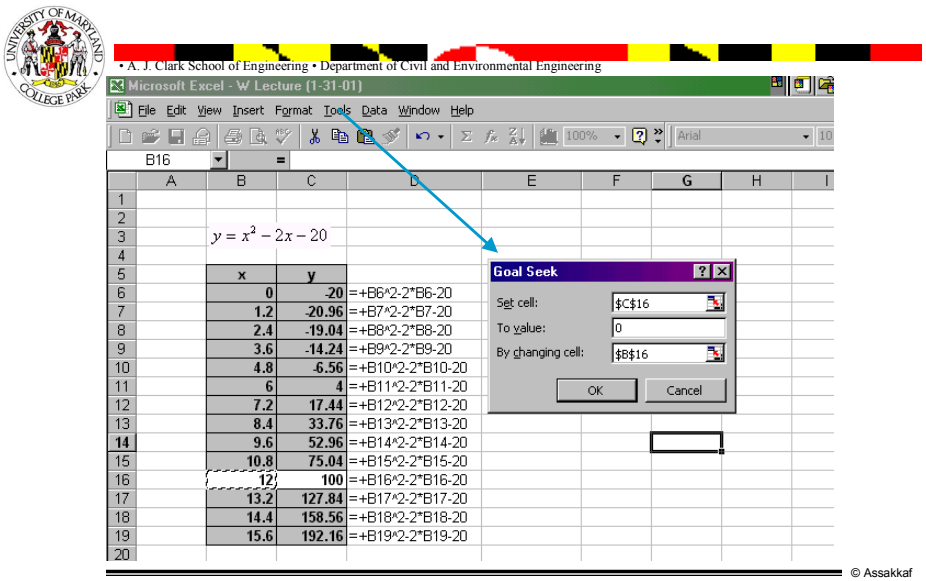
x	y	
0	-20	=+B6^2-2*B6-20
1.2	-20.96	=+B7^2-2*B7-20
2.4	-19.04	=+B8^2-2*B8-20
3.6	-14.24	=+B9^2-2*B9-20
4.8	-6.56	=+B10^2-2*B10-20
6	4	=+B11^2-2*B11-20
7.2	17.44	=+B12^2-2*B12-20
8.4	33.76	=+B13^2-2*B13-20
9.6	52.96	=+B14^2-2*B14-20
10.8	75.04	=+B15^2-2*B15-20
12	100	=+B16^2-2*B16-20
13.2	127.84	=+B17^2-2*B17-20
14.4	158.56	=+B18^2-2*B18-20
15.6	192.16	=+B19^2-2*B19-20

Introduction to MS Excel



x	y	
0		
1.2	-2	
2.4	-1	
3.6	-1	
4.8		
6		
7.2	1	
8.4	3	
9.6	5	
10.8	7	
12	100	=+B16^2-2*B16-20
13.2	127.84	=+B17^2-2*B17-20
14.4	158.56	=+B18^2-2*B18-20
15.6	192.16	=+B19^2-2*B19-20

Introduction to MS Excel



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Microsoft Excel - W Lecture [1-31-01]

File Edit View Insert Format Tools Data Window Help

B16 =

$y = x^2 - 2x - 20$

x	y	
0	-20	=+B6^2-2*B6-20
1.2	-20.96	=+B7^2-2*B7-20
2.4	-19.04	=+B8^2-2*B8-20
3.6	-14.24	=+B9^2-2*B9-20
4.8	-6.56	=+B10^2-2*B10-20
6	4	=+B11^2-2*B11-20
7.2	17.44	=+B12^2-2*B12-20
8.4	33.76	=+B13^2-2*B13-20
9.6	52.96	=+B14^2-2*B14-20
10.8	75.04	=+B15^2-2*B15-20
12	100	=+B16^2-2*B16-20
13.2	127.84	=+B17^2-2*B17-20
14.4	158.56	=+B18^2-2*B18-20
15.6	192.16	=+B19^2-2*B19-20

Goal Seek

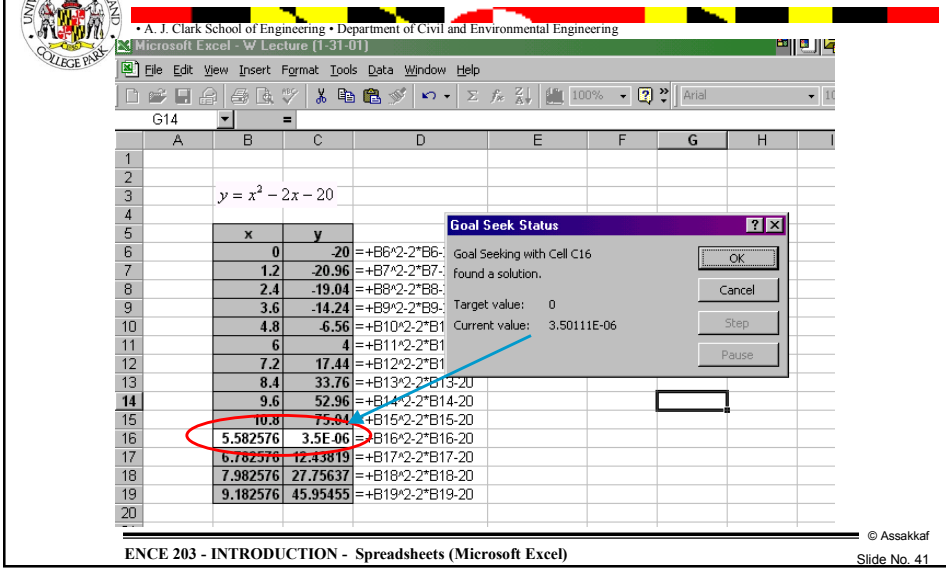
Set cell: C16

To value: 0

By changing cell: B16

OK Cancel

Introduction to MS Excel



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Microsoft Excel - W Lecture [1-31-01]

File Edit View Insert Format Tools Data Window Help

G14 =

$y = x^2 - 2x - 20$

x	y	
0	-20	=+B6^2-2*B6-
1.2	-20.96	=+B7^2-2*B7-
2.4	-19.04	=+B8^2-2*B8-
3.6	-14.24	=+B9^2-2*B9-
4.8	-6.56	=+B10^2-2*B1
6	4	=+B11^2-2*B1
7.2	17.44	=+B12^2-2*B1
8.4	33.76	=+B13^2-2*B13-20
9.6	52.96	=+B14^2-2*B14-20
10.8	75.04	=+B15^2-2*B15-20
5.582576	3.5E-06	=+B16^2-2*B16-20
6.782576	12.43819	=+B17^2-2*B17-20
7.982576	27.75637	=+B18^2-2*B18-20
9.182576	45.95455	=+B19^2-2*B19-20

Goal Seek Status

Goal Seeking with Cell C16 found a solution.

Target value: 0

Current value: 3.50111E-06

OK Cancel Step Pause