

Math 694 Professional Tools Seminar - Matlab

Spring 2014, Tuesday 4:00-4:50, Room 215 Armstrong Hall

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Class 1 & 2 (Jan 14 & 21)

Calculus and Plot

Example 1. Find the value of the following function. $\sin(3.1\pi)$, $\sin^{-1}(0.2)$, e^2 .

Example 2. Explore the command 'help'.

Example 3. Plot the function e^x .

Example 4. Let $f(x) = \cos x \left[0.5 + \frac{3 \sin x}{1+x^2} \right]$. Find $f(-0.5)$, $f(0.7)$. Plot the function in $x = [0, 2\pi]$.
(.^, ./, .* , subs, eval and format long)

Exercise 1. Let $f(x) = \sin \frac{1}{x}$. Find $f(0.05)$, $f(0.007)$. Plot the function in $x = [0, \pi]$.

Example 5. Find the derivative of the function $xy^4 + \sin(xy) = \sin(\tan x)$ with respect to x and y .

Example 6. Let $y = \sin^4 x + \cos^4 x$. Then find the derivative $y^{(18)}$.

Exercise 2. Let $z = y^4 \sin^4 x + x^4 \cos^4 y$. Then find $\frac{\partial z}{\partial x}$.

Exercise 3. Let $y = xe^{2x}$. Then find the derivative $y^{(20)}$.

Example 7. Find $\int \frac{\sin(\ln t)}{t} dt$, $\int \frac{1}{(x^2+1)(x^2-1)}$ and $\int_0^1 \frac{t^2+1}{t^2-1} dt$.

Exercise 4. Find $\int \frac{1}{(x^2+1)(x^2-1)}$.

Exercise 8. Graph the curve of the polar equation $r = \sin \theta + \left(\sin \frac{5\theta}{2}\right)^3$. (Calculus P502)

Exercise 5. Graph the curve of the polar equation $r = \sin \frac{8\theta}{5}$. (Calculus P502)

Example 9. 3D plot. Plot the function $f(x, y) = -xye^{-x^2-y^2}$. (Calculus p597)

Exercise 6. 3D plot. Plot the function $f(x, y) = \frac{\sin x \cdot \sin y}{xy}$. (Calculus p594)

Class 3 (Jan 28)

Linear Algebra, Curve Fitting and Interpolation

Example 1. Solve the following linear system.

$$\begin{cases} 2y - z = 3 \\ x + y + 2z = 1 \\ x + y + z = -1 \end{cases}$$

Example 2. Let $A = \begin{bmatrix} 1 & 0 \\ 0 & a \\ b & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 & 1 \\ a & 1 & 0 \end{bmatrix}$. Then find A^T . Let $C=AB$ and k be the row 2 column 3 element in AB . Let d be the 3rd column vector. Find kd .

Example 3. Let A be a random matrix with size 10×10 . Let the diagonal elements be 0.

Exercise 7. Let A be a random matrix with size 5×5 . Let the antidiagonal elements be 1.

Example 4. Fit the over time temperature and return a linear function, and a polynomial. Plot the 2 resulting function together with the original data.

```
hours=1:12; % time
```

```
temps=[5 8 9 15 25 29 31 30 22 25 27 24];
```

Example 5. Interpolate the temperature using linear and polynomial interpolates and estimate temperature at hour=9.3 and 4.7. Plot the result and compare.

Exercise 8. Generate two 6×8 matrices, one with random distribution, and one with normal distribution. Find the mean and variance of each row. For the normal distribution data, sort it and then make a plot.

Class 4 (Feb 4)

Scripts

Example 1. Find square root of the sum over all the primes in $[1, 100]$.

Example 2. Create an `m` file with the following function. Input the password from the keyboard. If it is 123, display 'Your password is correct. Your lucky number is 765', otherwise, display 'Your password is incorrect' and input the password again.

Example 3. Assuming an aunt is walking on the xy -plane starting from the origin. In each step, it can only walk NSEW, the direction of its walk is random. Display the trajectory of the aunt for 20 steps.

Exercise 9. Input the numbers one by one from keyboard until you enter the number 0. Find the mean and variance.