**MATLAB Review:**

Monday lab lecture covered some basics of MATLAB review: arithmetic, summations, means, etc. For loops and plotting will be used in this exercise.

**MATLAB Integration:**

**Opening a text file in MATLAB:**

*There are many ways to do this in MATLAB, feel free to use the method you are most comfortable with.*

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| [...] = textread(‘filename.txt’, ...‘formatSpec’) | Outputs an array with specified format. formatSpec options include: %f for floating point values, %d for signed integers, %s for white space, etc. |
| fileID=fopen(‘filename.txt’, ‘r’)  A=fscanf(fileID,’formatSpec’,[m n]) | Reads file into an array, with dimensions [m n], populates in column order. |

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| Exercise 0:   1. Open ‘224\_MATLAB\_practice.txt’ as an array in MATLAB. 2. Store the first row of data as x, and the second row as y. 3. Plot an x-y graph. |

**Integration commands in MATLAB:**

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| syms | Creates fresh symbolic variables for interactive symbolic workflows. Allows for the creation of symbolic expressions. |
| diff(f) | Differentiates f with respect to symbolic variables in workflow. |
| int(f) | Finds a symbolic expression, F so that diff(F) = f.  Returns indefinite integral/ antiderivative of f with respect to symbolic variables. |
| int(f, a, b) | Finds , where x is stored as a symbolic variable. |

**Integral Practice:**

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| Exercise 1:   1. Solve this integral by hand. 2. Solve this integral using MATLAB symbolic integration. 3. Compare your results.   Exercise 2:   1. Solve this integral by hand. 2. Solve this integral using MATLAB symbolic integration. 3. Compare your results. |

**Review of Riemann sums:**

For a continuous function *f* (x) on [*a,b*], the definite integral can be computed as follows:

Where, for middle Riemann sums:

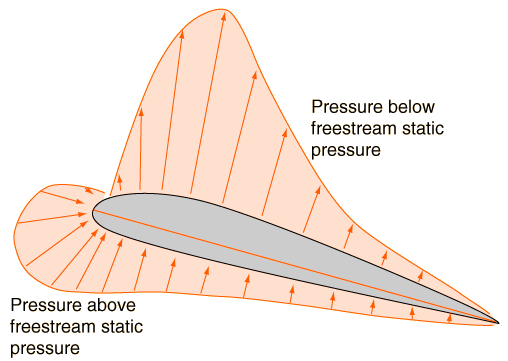
For partitions of equal size, dividing [*a,b*] into subintervals of equal length:

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| Exercise 3:   1. Solve this integral by hand. 2. Solve this integral using MATLAB numerical integration. 3. Solve this integral using Riemann summations (in MATLAB) where *n = 8*. 4. Compare your results. |

**Lab 3 Considerations:**

Consider body forces on an airfoil, where *P* is the pressure:

An example pressure distribution is visualized below:



From https://conself.com/blog/calculate-lift-drag-with-paraview/

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| 1. How would you write this in summation format? 2. Given that , how would you rewrite this summation into vector components? |

Answer key:

MATLAB Code:

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| %OPEN TEXT FILE  datatable=fopen('224\_MATLAB\_practice.txt','r');  dataarray=fscanf(datatable,'%f',[2 24]);    x=dataarray(1,:);  y=dataarray(2,:);    plot(x,y)%it's a shark lol    %INTEGRAL PRACTICE  %Example 1:  syms x theta a  f1=x^-1;  F1=int(f1)    %Example 2:  f2=sin(a\*theta);  F2=int(f2)    %Riemann sums example  a=-4;  b=12;  n=8;  f3=2\*x^3-5\*x^2+9\*x-5;  F3=int(f3, a, b)  dx=(b-a)/n;    for i= 2:n+1  x(1)=a;  x(i)=a+(i-1)\*dx;  fx(i-1)=(x(i)+x(i-1))/2;  F(i-1)=(2\*fx(i-1)^3-5\*fx(i-1)^2+9\*fx(i-1)-5);  end    Rsum=sum(F)\*dx |

Lab 3 Considerations: