MatLab Project Three: due Wednesday, May 3rd, 2017 at 7:30 p.m.

Integration with MATLAB – Indefinite Integrals

The symbolic toolkit can be used to find the symbolic representation of integrals. Integrating ∫cos(x) dx using "paper and pencil" give the answer: sin(x) + C. In MatLab, we need:

```
>> syms x      % defines symbolic variable x
>> f=cos(x)    % defines a function of the symbolic variable
>> int(f)      % evaluates the indefinite integral
      ans =
            sin(x)
```

Integrating with parameters

```
>> syms x a n; % defines symbolic variables x, a, and n
>> f=a*x^n     % defines a function of the symbolic variable
>> int(f, x)   % integrates in terms of x
      ans =
            a*x^(n+1)/(n+1)
```

If we use a different input as the independent variable we get:

```
>> int(f, a)   % integrates in terms of a
      ans =
            1/2*a^2*x^n
```

If you are not going to reuse the integrand, you may use the short form without defining symbolic variables

```
>> int('x^2*a','x')   % integrates in terms of x
      ans =
            1/3*x^3*a

>> int('x^2*a','a')   % integrates in terms of a
      ans =
            1/2*x^2*a^2
```

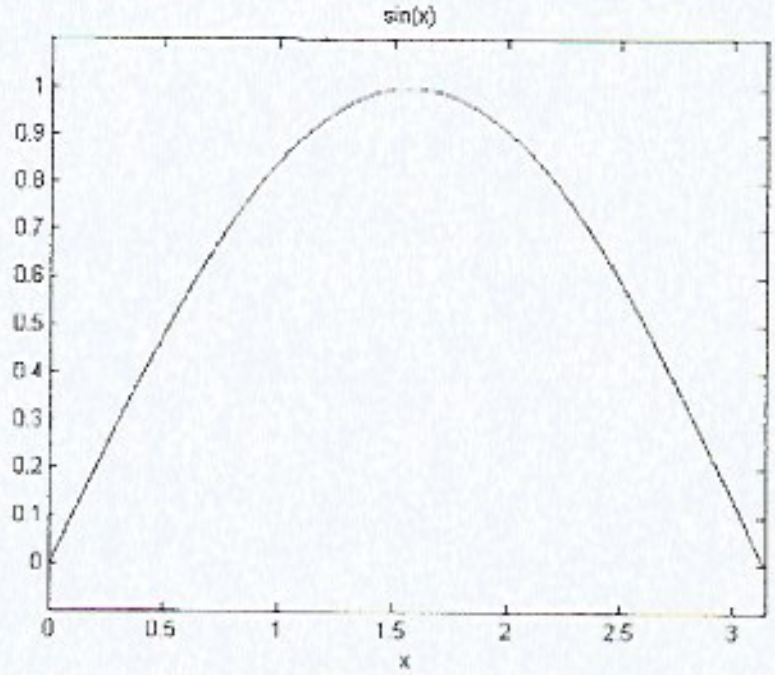
Definite Integrals

Another common request is to evaluate a definite integral with given limits. This can be easily accomplished by indicating the limits of integration. Let's use f(x) = sin(x) and integrate between [0, π]:

```
>> syms x      % defines symbolic variable x
>> f=sin(x)    % defines a function of the symbolic variable
>> int(f,0,pi) % evaluates the definite integral using the given limits
      ans =
            2
```

At the top of the next page is a graph of the curve to help us visualize the area. This graph is obtained by typing this command into MatLab:

```
>> ezplot('sin(x)',[0,pi])
```



If we add a few parameter, we can get MatLab to evaluate f(x) = asin(bx) from [0, π]

```
>> syms x a b;          % defines symbolic variables x, a, and b
>> f=a*sin(b*x)         % defines a function of the symbolic variable
>> int(f,x,0,pi)        % evaluates the definite integral using the given limits
      ans =
            -a*(cos(pi*b)-1)/b
```

Or using the short form:

```
>> int('a*sin(b*x)','x',0,pi)
      ans =
            -a*(-1+cos(b*c))/b
```

Actual Assignment: Evaluate the following integrals using MatLab:

1) $\int \sin x \cos x \, dx$

2) $\int x^2 \, dx$

3) $\int \frac{(x^2 + 4x + 1)}{x + 2} dx$

4) $\int_1^2 \frac{(x^2 + 4x + 1)}{x + 2} dx$

5) $\int_0^{\pi} \sin x \cos x \, dx$

What to turn in: five separate pages, one for each part, and each includes your name as a comment. Clearly label your work with comments. Make sure that your work concise and clear. Assignments that are difficult to read or follow will receive lower grades.