Limits in MATLAB

The function ***limit*** is used to solve the limits in MATLAB. Below some examples of the limits.

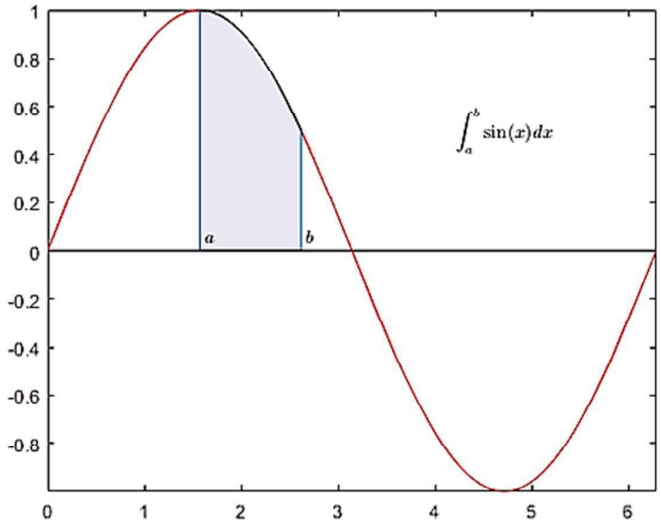
Example: solve the following limit $\lim_{n\to 1}\left(\frac{1-n}{\sin(n-1)}\right)$

```
>>  syms n
>> L=limit((n-1)/sin(n-1), n,1)
 L =1
```

Example: solve the following limit $\lim_{n\to \infty}\left(\frac{n-1}{\sin(n^2+6)}\right)$

```
>> syms n
>> L=limit((n-1)/sin(n^2-1),n,inf)
 L = NaN
```

Symbolic and Numerical Integration in MATLAB



1. Symbolic Integration in MATLAB

Certain functions can be symbolically integrated in MATLAB with the *int* command.

Example . Find an antiderivative for the function

$f(x) = x^2$

We can do this in different ways. The shortest is:

```
>>int('x^2')

ans =

1/3*x^3
```

Alternatively, we can define x symbolically first, and then leave off the single quotes in the

int statement.

```
>>syms x

>>int(x^2)

ans =

1/3*x^3
```

Example: solve the following integration $\boldsymbol{k = \int (x^2 - 1) dx}$

```
>> syms x

>> k=int(x^2-1)

 k = (x*(x^2 - 3))/3
```

The int command can also be used with limits of integration.

Example: solve the following integration $\boldsymbol{k = \int_1^2 (x^2 - 1) dx}$

```
>> syms x
```

```
>> k=int((x^2-1),1,2)
k = 4/3
```

Example . **Evaluate** the integral

$$\int_1^2 x \cos x dx$$

In this case, we will only use the first method from Example 1, though the other two methods will work as well. We have

```
>> int(sym('x*cos(x)'),1,2)
ans =
cos(2)+2*sin(2)-cos(1)-sin(1)
>>eval(ans)
ans =
0.0207
```

Notice that since MATLAB is working symbolically here the answer it gives is in terms of the sine and cosine of 1 and 2 radians. In order to force MATLAB to evaluate this, we have to use the *eval* command.

Find the solution of D:

$$D = \int_0^{+\infty} e^{-x^2} dx$$

```
>> syms x
>> D=int(exp(-x^2),x,0,+inf)
 D = pi^(1/2)/2
```

Double Integral

Find I from the following:

$$I = \int_{1}^{2} \int_{0}^{1} xy \, . dydx$$

>> syms x y

>> I=int(int(x*y,y,0,1),x,1,2)

I = ¾

2. Numerical Integration in MATLAB

MATLAB has a primary tool for the numerical evaluation of integrals of real-valued functions, the quad command.

Example. Evaluate the integral

$$\int_{1}^{2} e^{-x} dx$$

We use

quad('exp(-x.^2)',1,2)

ans =

0.1353

The quad command requires an input function that can be appropriately evaluated for vector values of the argument, and so we have used an array operation.