Integration

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Integration can be indefinite or definite. Matlab can do both. If the definite integration is too tricky or impossible, Matlab can approximate.

Indefinite Integrals

Suppose you'd like to integrate the function `7/(1+x^2)`. Hmmm.... that reminds me of something I've seen before, but I can't recall the formula... Something about an inverse trig function... Ah, let's just ask Matlab:

```
int(7/(1 + x^2))
```

```
ans =

7*atan(x)
```

That's it! Matlab uses `atan` for arctangent which is the same as inverse tangent.

With Symbolic Functions

We can do the same with symbolic functions:

```
syms f(x);
f(x) = x^3-x*log(x);
int(f(x))
```

```
ans =

(x^2*(x^2 - 2*log(x) + 1))/4
```

Where's the +C?

Matlab doesn't put the `+C`, which I find odd since it does for differential equations as we'll see later.

Definite Integrals

Suppose we'd like to compute the area under the curve `f(x) = x^3 + ln x` over the interval where `x` is between 5 and 10. Just pass those end-points to the `int` command as two additional parameters:

```
int(x^3+log(x),5,10)
```

```
ans =

5*log(20) + 9355/4
```

Approximating Integrals

We've seen how the `int` command can be used to find definite integrals. You should know that `int` does its job using *symbolic* integration techniques, similar to the ones you would use if you were integrating something with paper and pencil in a first semester calculus course. Unfortunately, there are many functions that are difficult or impossible to integrate this way since no nice antiderivative exists. For example:

```
int(sqrt(sin(x).*5), 1, 2)
```

```
ans =

-2*5^(1/2)*(ellipticE(pi/4 - 1, 2) - ellipticE(pi/4 - 1/2, 2))
```

That answer is not really what we were after - We just wanted a number! What in the world is `ellipticE` anyway?! In order to apply some numerical integration techniques and get approximations we'll need to wait until we have function handles later.

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