Technology Supplement #3: Numerical Integration

The Matlab command `trapz (x,y)` uses the Trapezoidal Rule to compute a decimal approximation to the value of the integral of $f(x)$ over the interval $[a,b]$.

**Example 1:** Compute a numerical approximation to the value of the integral $\int_{1}^{5} \frac{1}{x^2 \sqrt{x+2}} \, dx$ using the command `trapz (x,y)` with $n = 30$.

```matlab
» deltax=(5-1)/30;
» x=1:deltax:5;
» trapz(x,1./(x.^2.*sqrt(x+2)))
ans =   .40891
```

The decimal approximation Matlab displays when in its default setting `format short` has four digit accuracy. If one enters the command `format long e` before the computation command the value displayed will be expressed in scientific notation.

**Example 2:** Suppose we want to know how accurate the answer is in the above example. Let’s repeat the process with $n = 60$ and $n = 120$.

```matlab
» format long e
» deltax=(5-1)/60;
» x=1:deltax:5;
» trapz(x,1./(x.^2.*sqrt(x+2)))
ans = 4.075408256000782e-01
» deltax=(5-1)/120;
» x=1:deltax:5;
» trapz(x,1./(x.^2.*sqrt(x+2)))
ans =    4.071957339894877e-01
```

**Example 3:** Compute a numerical approximation to the value of the integral $\int_{1}^{5} \frac{1}{x^2 \sqrt{x+2}} \, dx$ using the Midpoint Rule with $n = 30$, first with format long and then with format long e.

```matlab
» format long
» deltax=(5-1)/30;
» xi=1+deltax/2:deltax:5-deltax/2;
» y=1./((xi.^2).*sqrt(xi+2));
» midpt=sum(y).*deltax
midpt =   0.40616528912268
» format long e
» deltax=(5-1)/30;
» xi=1+deltax/2:deltax:5-deltax/2;
» y=1./((xi.^2).*sqrt(xi+2));
» midpt=sum(y).*deltax
midpt =      4.061652891226772e-01
```