3450:427/527 Applied Numerical Methods I, Kreider

Using the Composite Gaussian 5 point rule

As we discussed in class, implementing a composite Gaussian rule is easy. Here is the 5 point rule:

```
function y = gauss5(f,c,d)

% standard rule
a = -1;
b = 1;
n = 5;
x = [ -.906179845938664 -.538469310105683 0 .538469310105683 .906179845938664];
w = [ .236926885056189 .478628670499366 .568888888888889 .478628670499366 .236926885056189];
y = 0;
for k=1:n
   t = (d-c)*(x(k)-a)/(b-a)+c;
   y = y + w(k)*f(t);
end
y = y*(d-c)/(b-a);
```

The composite rule calls gauss5.m on each subinterval:

```
function y = cg5(f,a,b,n)

h = (b-a)/n;
x = a:h:b; % length(x) should be n+1
y = 0;
for k=1:n
    y = y + gauss5(f,x(k),x(k+1));
end
```

To use the rule:

```
f = @(x) (4*sin(3.4*x)-cos(5.1*x)).*sin(x)./(x.^2+1)

for n=1000:1000:50000
    y = cg5(f,0,10000,n);
    fprintf('%6d  %20.16f\n',n,y)
end
```

Results

1000	3.7439745504832880	
2000	-1.1302537552009857	
3000	0.6913227270531558	
4000	0.2838895846159350	
5000	0.2857274621330446	
6000	0.2939707854719373	
7000	0.2958642946868113	
8000	0.2962309266550722	First n with 3 accurate digits
9000	0.2962764279130662	
10000	0.2962506019115509	
11000	0.2962326382659771	
12000	0.2962239701536775	
13000	0.2962198280715237	
14000	0.2962179004917650	
15000	0.2962170180553714	
16000	0.2962166191557762	
17000	0.2962164415223374	
18000	0.2962163642520496	First n with 7 accurate digits
19000	0.2962163319778678	
20000	0.2962163194923527	
21000	0.2962163154222286	
22000	0.2962163147173620	
23000	0.2962163151975666	
24000	0.2962163159679498	
25000	0.2962163166956586	
26000	0.2962163172834698	
27000	0.2962163177254439	
28000	0.2962163180453620	
29000	0.2962163182721227	
30000	0.2962163184310576	
31000	0.2962163185419192	
32000	0.2962163186192058	
33000	0.2962163186732085	
34000	0.2962163187111257	
35000	0.2962163187379170	
36000	0.2962163187569750	
37000	0.2962163187706379	
38000	0.2962163187805284	
39000	0.2962163187877359	
40000	0.2962163187930351	
41000	0.2962163187969724	
42000	0.2962163187999086	
43000	0.2962163188021311	First n with 10 accurate digits
44000	0.2962163188038173	
45000	0.2962163188051030	
46000	0.2962163188061065	
47000	0.2962163188068707	
48000	0.2962163188074678	
49000	0.2962163188079408	
50000	0.2962163188083219	