```
% How to solve Problem 4.39 using multiple terms in the series (Table 4.1
% page 249)
%run the MATLAB script
format short g
Bi=4.0;r0=0.05;alfa=1.28e-7;
%define the Bessel function
fb=@(x)x*besselj(1,x)/besselj(0,x)-Bi;
%determine first 3 roots as lambdas
l1=fzero(@(x)fb(x),[1 2])
l2=fzero(@(x)fb(x),[3 5])
l3=fzero(@(x)fb(x),[6 8])
l4=fzero(@(x)fb(x),[9 11])
l5=fzero(@(x)fb(x),[12 14])

%calculate the coefficients A's
a1=2/l1*(besselj(1,l1)/(besselj(0,l1)^2+besselj(1,l1)^2))
a2=2/l2*(besselj(1,l2)/(besselj(0,l2)^2+besselj(1,l2)^2))
a3=2/l3*(besselj(1,l3)/(besselj(0,l3)^2+besselj(1,l3)^2))
a4=2/l4*(besselj(1,l4)/(besselj(0,l4)^2+besselj(1,l4)^2))
a5=2/l5*(besselj(1,l5)/(besselj(0,l5)^2+besselj(1,l5)^2))

%define the series solution
thetas=(420-550)/(15-550)
fth1=@(x)a1*exp(-l1^2*x)*besselj(0,l1)-thetas
fth2=@(x)a1*exp(-l1^2*x)*besselj(0,l1)+a2*exp(-l2^2*x)*besselj(0,l2)-thetas
fth3=@(x)a1*exp(-l1^2*x)*besselj(0,l1)+a2*exp(-l2^2*x)*besselj(0,l2)...
    +a3*exp(-l3^2*x)*besselj(0,l3)-thetas
fth4=@(x)a1*exp(-l1^2*x)*besselj(0,l1)+a2*exp(-l2^2*x)*besselj(0,l2)...
    +a3*exp(-l3^2*x)*besselj(0,l3)+a4*exp(-l4^2*x)*besselj(0,l4)-thetas

%solve for the Fourier numbers
t1=fzero(@(x)fth1(x),0.1)
t2=fzero(@(x)fth2(x),0.1)
t3=fzero(@(x)fth3(x),0.1)
t4=fzero(@(x)fth4(x),0.1)

%calculate the times in seconds
time1=t1*r0^2/alfa
time2=t2*r0^2/alfa
time3=t3*r0^2/alfa
time4=t4*r0^2/alfa
```

```
l1 =

    1.9081

l2 =

    4.6018
```

```
l3 =

    7.5201

l4 =

    10.542

l5 =

    13.612

a1 =

    1.4698

a2 =

   -0.72781

a3 =

    0.41835

a4 =

   -0.26993

a5 =

    0.18981

thetas =

    0.24299

fth1 =

    @(x)a1*exp(-l1^2*x)*besselj(0,l1)-thetas

fth2 =

    @(x)a1*exp(-l1^2*x)*besselj(0,l1)+a2*exp(-l2^2*x)*besselj(0,l2)-thetas
```

```
fth3 =

    @(x)a1*exp(-l1^2*x)*besselj(0,l1)+a2*exp(-l2^2*x)*besselj(0,l2)+a3*exp

fth4 =

    @(x)a1*exp(-l1^2*x)*besselj(0,l1)+a2*exp(-l2^2*x)*besselj(0,l2)+a3*exp

t1 =

      0.14188

t2 =

      0.15183

t3 =

      0.15185

t4 =

      0.15185

time1 =

       2771.2

time2 =

       2965.4

time3 =

       2965.8

time4 =

       2965.8
```

Published with MATLAB® R2014a