```
x =
        440.06
y =
     158423.02
```

7.6 EXAMPLES OF SIMPLE USER-DEFINED FUNCTIONS

Sample Problem 7-1: User-defined function for a math function

Write a function file (name it `chp7one`) for the function $f(x) = \frac{x^4\sqrt{3x+5}}{(x^2+1)^2}$. The input to the function is x and the output is $f(x)$. Write the function such that x can be a vector. Use the function to calculate:
(*a*) $f(x)$ for $x = 6$.
(*b*) $f(x)$ for $x = 1, 3, 5, 7, 9$, and 11.

Solution

The function file for the function $f(x)$ is:

```
function y=chp7one(x)                     Function definition line.
y=(x.^4.*sqrt(3*x+5))./(x.^2+1).^2;  Assignment to output argument.
```

Note that the mathematical expression in the function file is written for element-by-element calculations. In this way if x is a vector, y will also be a vector. The function is saved and then the search path is modified to include the directory where the file was saved. As shown below, the function is used in the Command Window.

(*a*) Calculating the function for $x = 6$ can be done by typing `chp7one(6)` in the Command Window, or by assigning the value of the function to a new variable:

```
>> chp7one(6)
ans =
    4.5401
>> F=chp7one(6)
F =
    4.5401
```

(*b*) To calculate the function for several values of x, a vector with the values of x is created and then used for the argument of the function.

```
>> x=1:2:11
x =
     1     3     5     7     9    11
```

```
>> chp7one(x)
ans =
    0.7071    3.0307    4.1347    4.8971    5.5197    6.0638
```

Another way is to type the vector x directly in the argument of the function.

```
>> H=chp7one([1:2:11])
H =
    0.7071    3.0307    4.1347    4.8971    5.5197    6.0638
```

Sample Problem 7-2: Converting temperature units

Write a user-defined function (name it `FtoC`) that converts temperature in degrees F to temperature in degrees C. Use the function to solve the following problem. The change in the length of an object, ΔL, due to a change in the temperature, ΔT, is given by: $\Delta L = \alpha L \Delta T$, where α is the coefficient of thermal expansion. Determine the change in the area of a rectangular (4.5 m by 2.25 m) aluminum ($\alpha = 23 \cdot 10^{-6}$ 1/°C) plate if the temperature changes from 40°F to 92°F.

Solution

A user-defined function that converts degrees F to degrees C is:

```
function C=FtoC(F)                          Function definition line.
%FtoC converts degrees F to degrees C
C=5*(F-32)./9;                              Assignment to output argument.
```

A script file (named Chapter7Example2) that calculates the change of the area of the plate due to the temperature is:

```
a1=4.5; b1=2.25; T1=40; T2=92; alpha=23e-6;
deltaT=FtoC(T2)-FtoC(T1);     Using the FtoC function to calculate the
                              temperature difference in degrees C.
a2=a1+alpha*a1*deltaT;        Calculating the new length.
b2=b1+alpha*b1*deltaT;        Calculating the new width.
AreaChange=a2*b2-a1*b1;       Calculating the change in the area.
fprintf('The change in the area is %6.5f meters square.',AreaChange)
```

Executing the script file in the Command Window gives the solution:

```
>> Chapter7Example2
The change in the area is 0.01346 meters square.
```