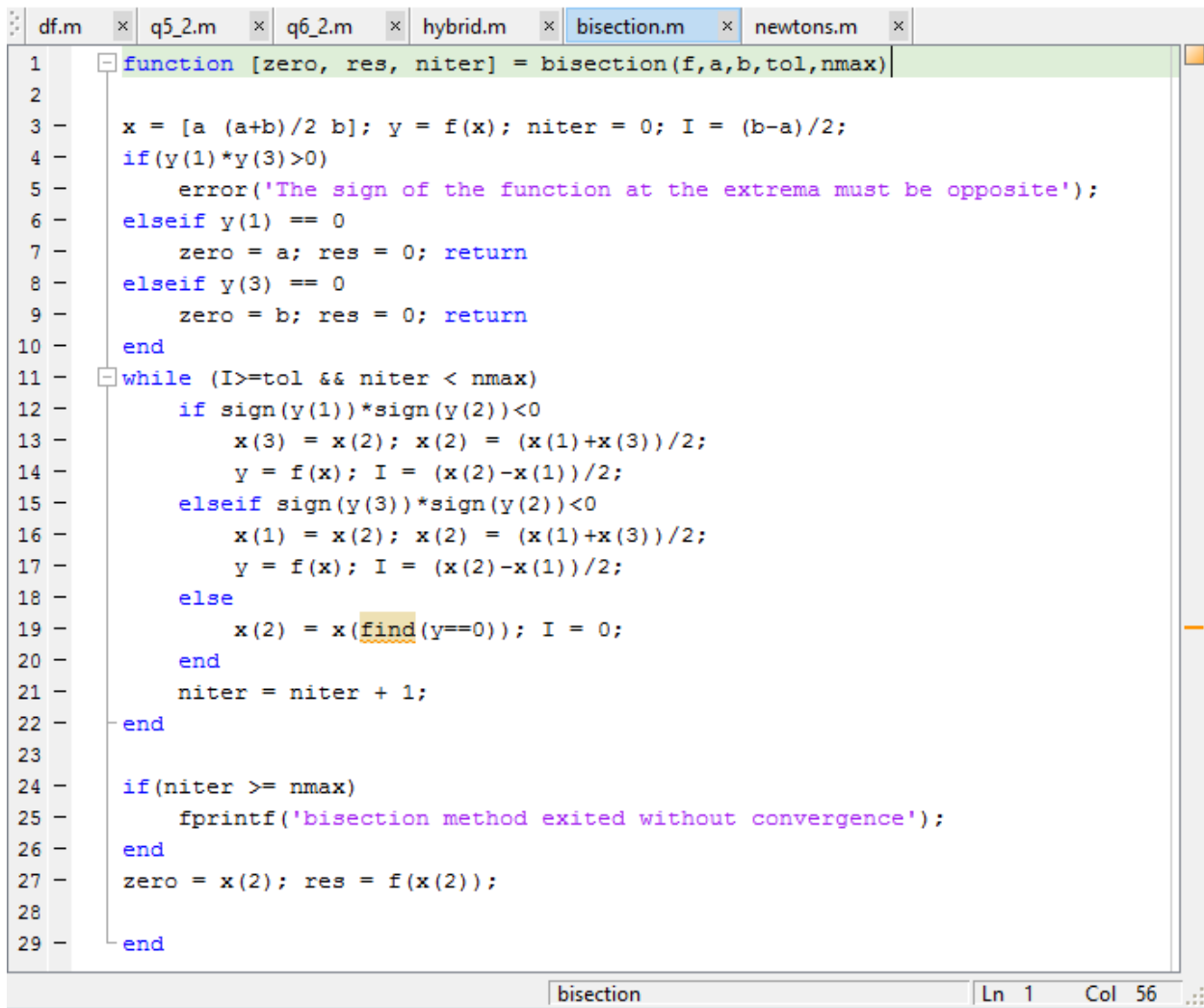


Implementation

(4)

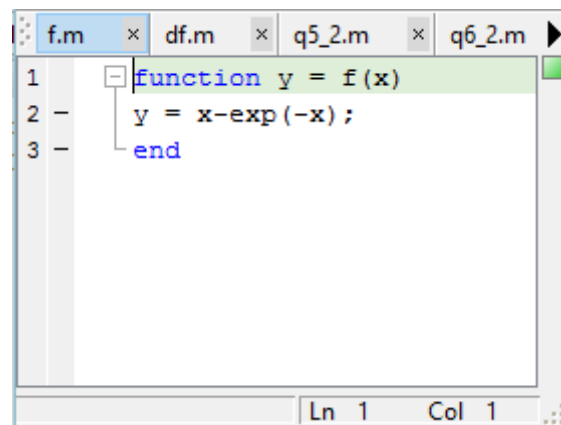


The image shows a MATLAB editor window with several tabs: df.m, q5_2.m, q6_2.m, hybrid.m, bisection.m (selected), and newtons.m. The code in the bisection.m file is as follows:

```
1 function [zero, res, niter] = bisection(f,a,b,tol,nmax)
2
3 x = [a (a+b)/2 b]; y = f(x); niter = 0; I = (b-a)/2;
4 if(y(1)*y(3)>0)
5     error('The sign of the function at the extrema must be opposite');
6 elseif y(1) == 0
7     zero = a; res = 0; return
8 elseif y(3) == 0
9     zero = b; res = 0; return
10 end
11 while (I>=tol && niter < nmax)
12     if sign(y(1))*sign(y(2))<0
13         x(3) = x(2); x(2) = (x(1)+x(3))/2;
14         y = f(x); I = (x(2)-x(1))/2;
15     elseif sign(y(3))*sign(y(2))<0
16         x(1) = x(2); x(2) = (x(1)+x(3))/2;
17         y = f(x); I = (x(2)-x(1))/2;
18     else
19         x(2) = x(find(y==0)); I = 0;
20     end
21     niter = niter + 1;
22 end
23
24 if(niter >= nmax)
25     fprintf('bisection method exited without convergence');
26 end
27 zero = x(2); res = f(x(2));
28
29 end
```

The status bar at the bottom indicates the file is 'bisection' and the cursor is at 'Ln 1 Col 56'.

Figure 1: Bisection Method Code

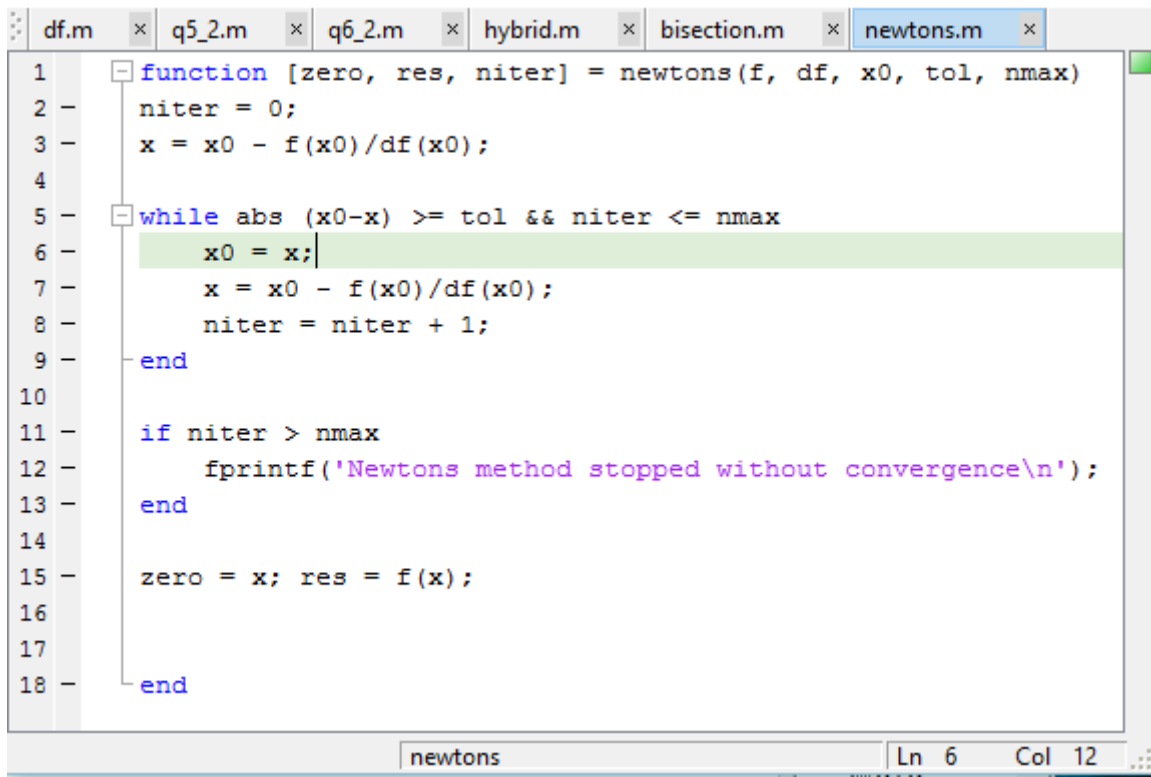


The image shows a MATLAB editor window with tabs: f.m (selected), df.m, q5_2.m, and q6_2.m. The code in the f.m file is as follows:

```
1 function y = f(x)
2     y = x-exp(-x);
3 end
```

The status bar at the bottom indicates the file is 'f.m' and the cursor is at 'Ln 1 Col 1'.

Figure 2: Equation for (4)

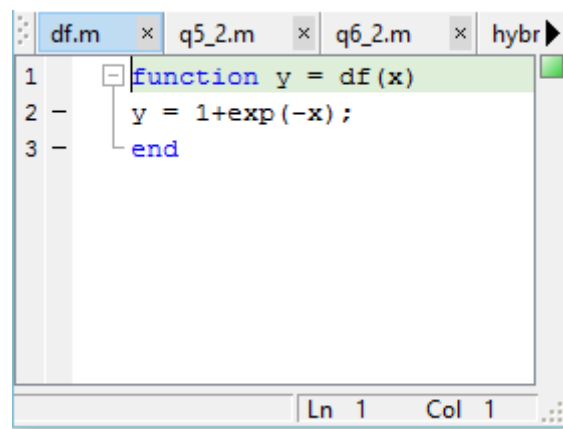


The image shows a MATLAB editor window with several tabs: df.m, q5_2.m, q6_2.m, hybrid.m, bisection.m, and newtons.m. The newtons.m tab is active, displaying the following code:

```
1 function [zero, res, niter] = newtons(f, df, x0, tol, nmax)
2     niter = 0;
3     x = x0 - f(x0)/df(x0);
4
5     while abs(x0-x) >= tol && niter <= nmax
6         x0 = x;
7         x = x0 - f(x0)/df(x0);
8         niter = niter + 1;
9     end
10
11     if niter > nmax
12         fprintf('Newtons method stopped without convergence\n');
13     end
14
15     zero = x; res = f(x);
16
17
18 end
```

The status bar at the bottom indicates the file is newtons, at line 6, column 12.

Figure 3: Newton's Method Code



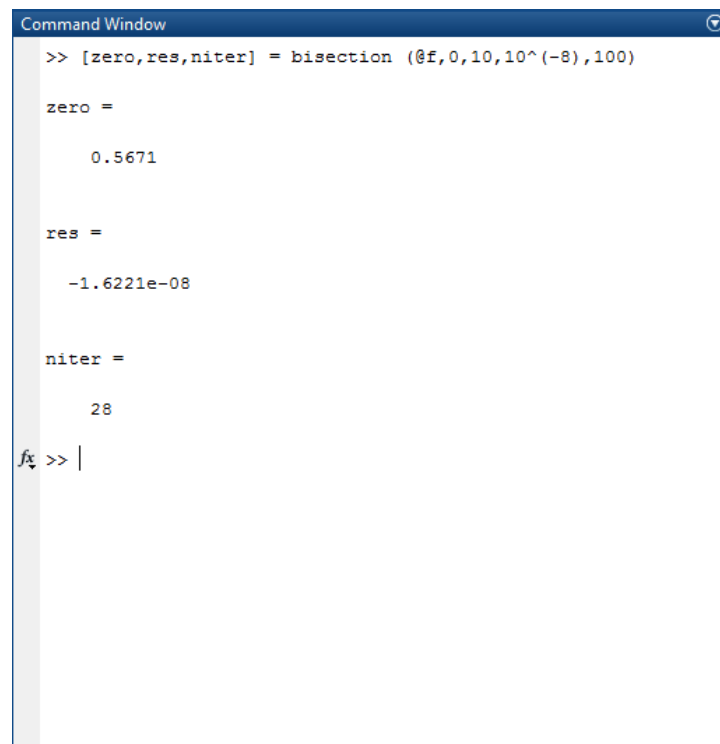
The image shows a MATLAB editor window with tabs: df.m, q5_2.m, q6_2.m, and hybrid.m. The df.m tab is active, displaying the following code:

```
1 function y = df(x)
2     y = 1+exp(-x);
3 end
```

The status bar at the bottom indicates the file is df, at line 1, column 1.

Figure 4: Derived equation for (4)

(a)



```
Command Window

>> [zero,res,niter] = bisection (@f,0,10,10^(-8),100)

zero =

    0.5671

res =

   -1.6221e-08

niter =

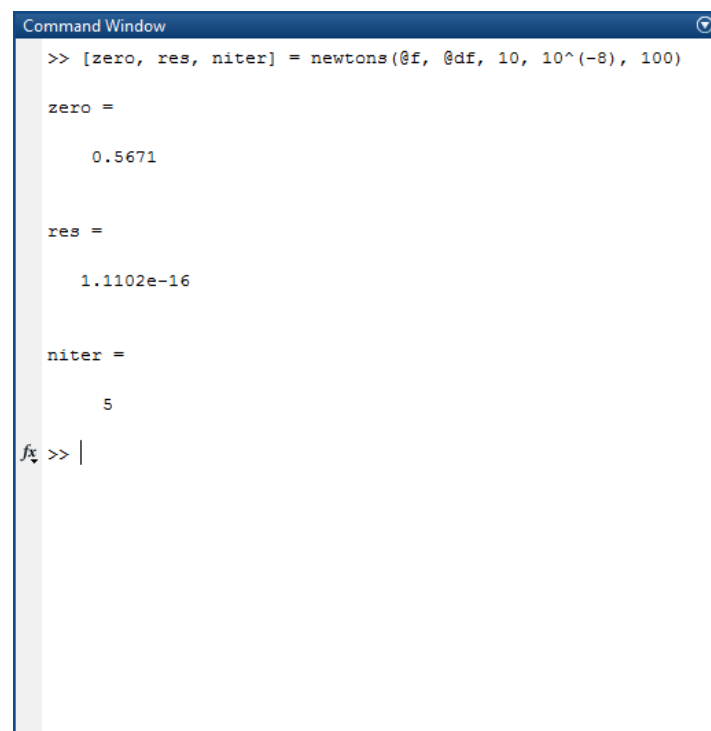
    28

fx >> |
```

The image shows a MATLAB Command Window with a dark blue title bar. The text inside shows the execution of the `bisection` function. The output displays the root `zero` as 0.5671, the residual `res` as -1.6221e-08, and the number of iterations `niter` as 28. The prompt `fx >> |` is visible at the bottom.

Figure 5: Answer for (4)(a)

(b)



```
Command Window

>> [zero, res, niter] = newtons (@f, @df, 10, 10^(-8), 100)

zero =

    0.5671

res =

   1.1102e-16

niter =

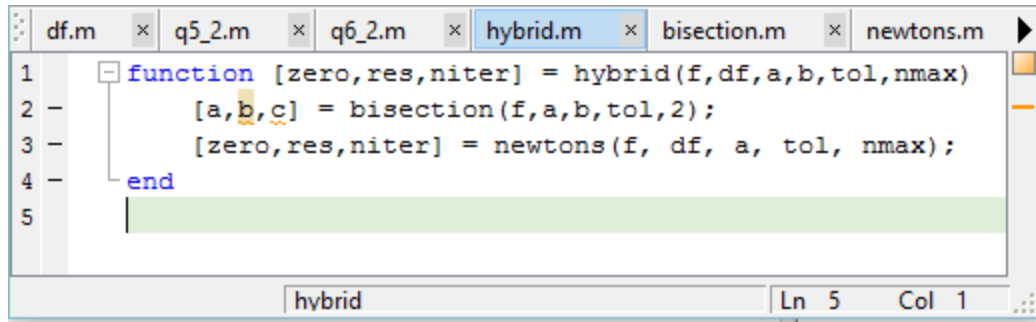
     5

fx >> |
```

The image shows a MATLAB Command Window with a dark blue title bar. The text inside shows the execution of the `newtons` function. The output displays the root `zero` as 0.5671, the residual `res` as 1.1102e-16, and the number of iterations `niter` as 5. The prompt `fx >> |` is visible at the bottom.

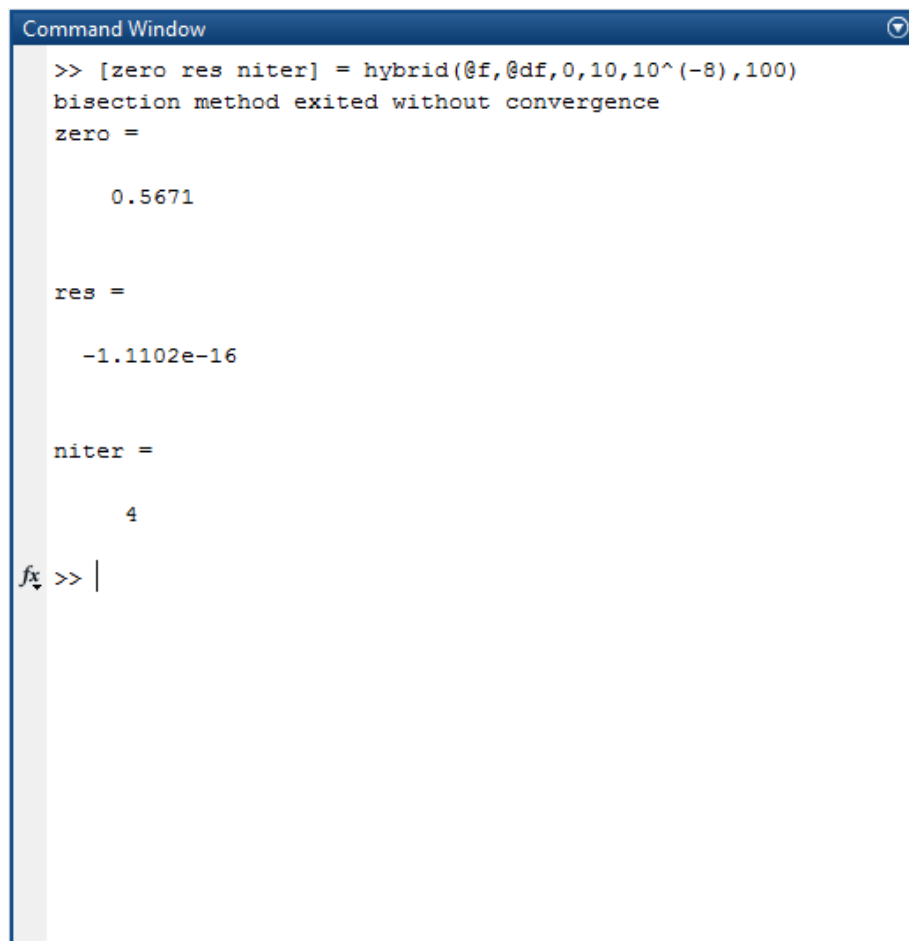
Figure 6: Answer for (4)(b)

(c)



```
df.m x q5_2.m x q6_2.m x hybrid.m x bisection.m x newtons.m
1 function [zero,res,niter] = hybrid(f,df,a,b,tol,nmax)
2     [a,b,c] = bisection(f,a,b,tol,2);
3     [zero,res,niter] = newtons(f, df, a, tol, nmax);
4 end
5
```

Figure 7: Hybrid Method Code



```
Command Window
>> [zero res niter] = hybrid(@f,@df,0,10,10^(-8),100)
bisection method exited without convergence
zero =

    0.5671

res =

-1.1102e-16

niter =

     4

fx >> |
```

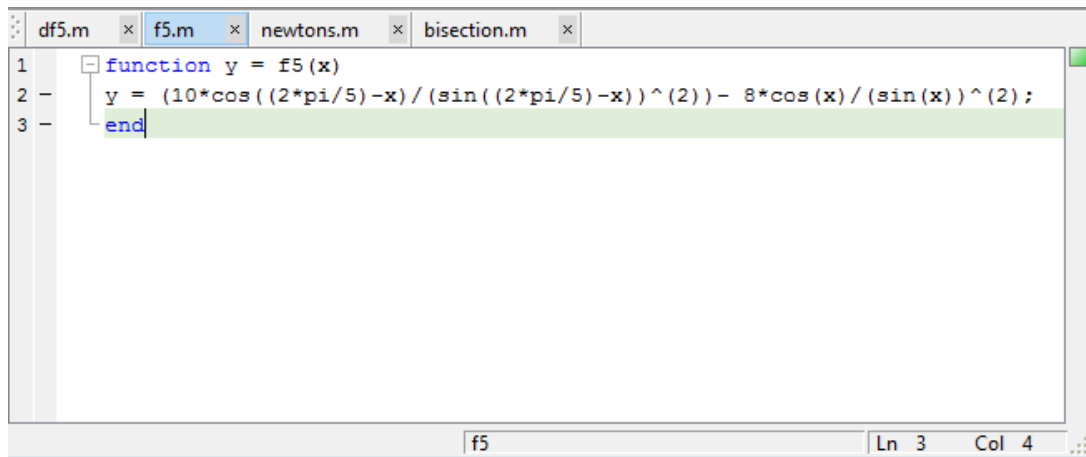
Figure 8: Answer for (4)(c)

(d)

Method	Bisection	Newton	Hybrid
Number of iterations	28	5	4

Fastest algorithm to solve this problem is the Hybrid algorithm.

(5)

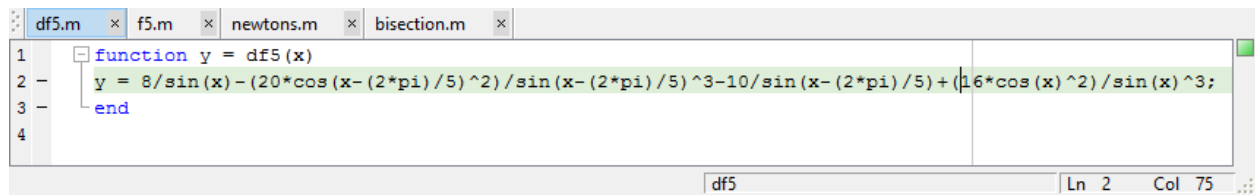


The image shows a MATLAB editor window with several tabs: df5.m, f5.m, newtons.m, and bisection.m. The f5.m tab is active, displaying the following code:

```
1 function y = f5(x)
2 y = (10*cos((2*pi/5)-x)/(sin((2*pi/5)-x))^2) - 8*cos(x)/(sin(x))^2;
3 end
```

The status bar at the bottom indicates the cursor is at line 3, column 4.

Figure 9: Equation for (5)

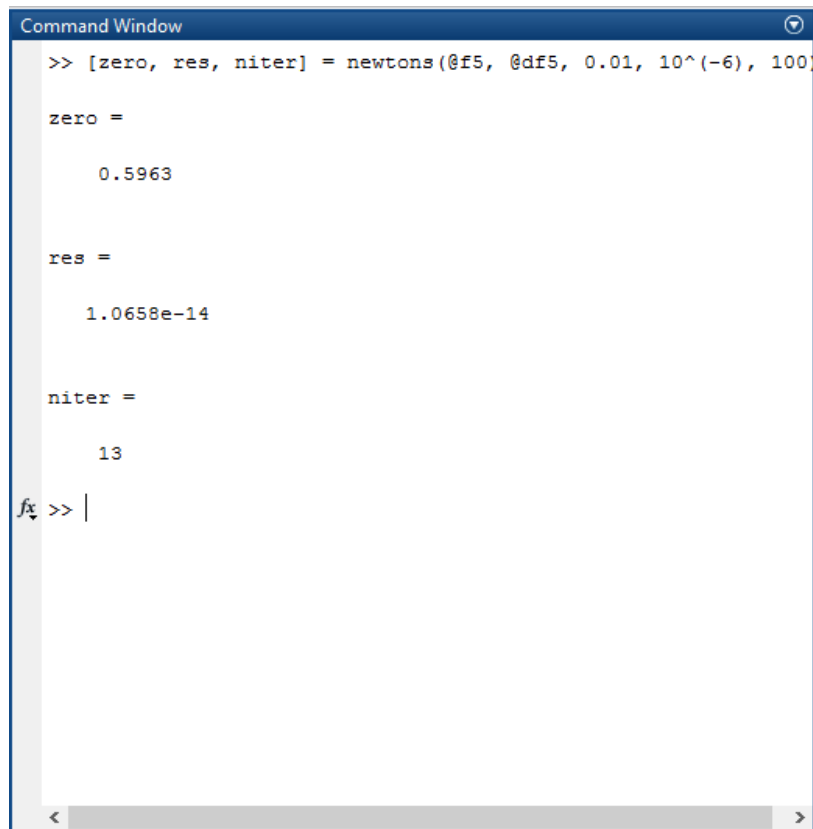


The image shows a MATLAB editor window with the same tabs as Figure 9. The df5.m tab is active, displaying the following code:

```
1 function y = df5(x)
2 y = 8/sin(x) - (20*cos(x-(2*pi)/5)^2)/sin(x-(2*pi)/5)^3 - 10/sin(x-(2*pi)/5) + (16*cos(x)^2)/sin(x)^3;
3 end
4
```

The status bar at the bottom indicates the cursor is at line 2, column 75.

Figure 10: Derived equation for (5)



The image shows the MATLAB Command Window with the following output:

```
>> [zero, res, niter] = newtons(@f5, @df5, 0.01, 10^(-6), 100)

zero =

    0.5963

res =

    1.0658e-14

niter =

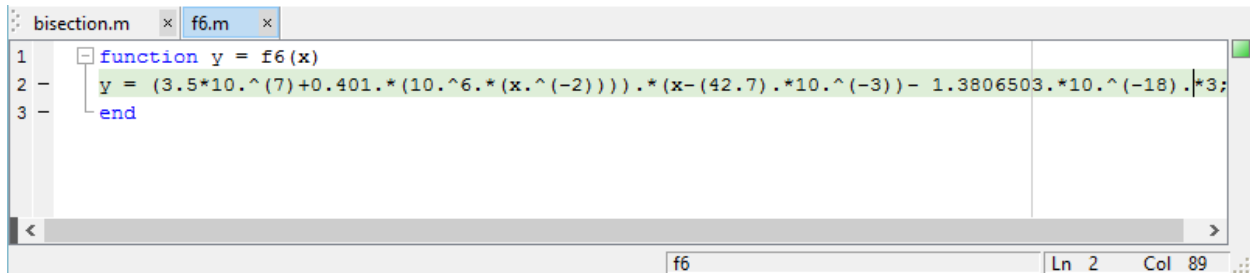
    13

fx >> |
```

Figure 11: Answer for (5)

In 5th question initial point was chosen by considering the alpha's characteristics. Alpha is an acute angle. Therefore minimum value was chosen as the initial point.

(6)



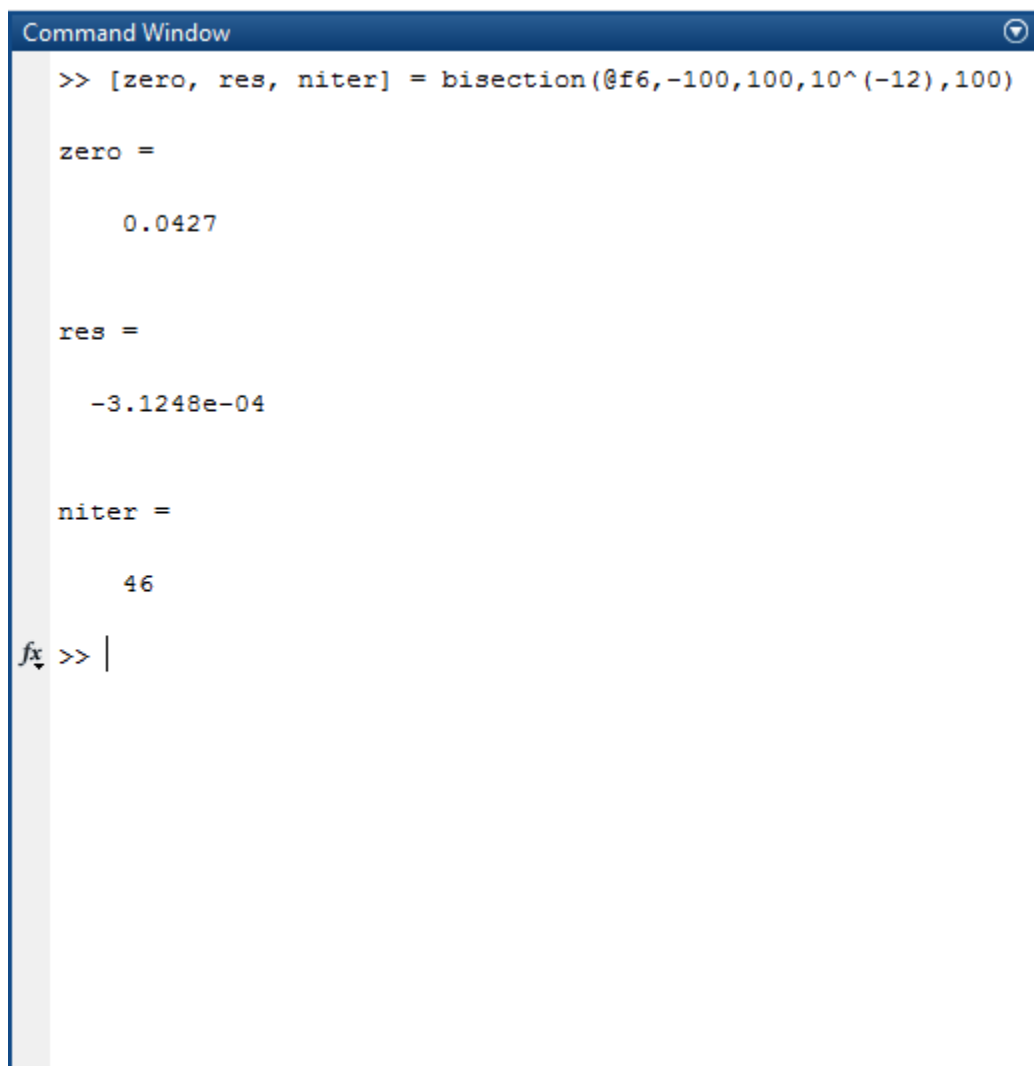
```
bisection.m x f6.m x
1 function y = f6(x)
2 y = (3.5*10.^(7)+0.401.*(10.^6.*(x.^(-2)))).*(x-(42.7).*10.^(-3))- 1.3806503.*10.^(-18).|*3;
3 end
```

The image shows a MATLAB editor window with two tabs: 'bisection.m' and 'f6.m'. The 'f6.m' tab is active, displaying a function definition for 'f6'. The function takes 'x' as input and returns 'y'. The equation for 'y' is: $y = (3.5 \cdot 10^7 + 0.401 \cdot 10^6 \cdot x^{-2}) \cdot (x - 42.7 \cdot 10^{-3}) - 1.3806503 \cdot 10^{-18} \cdot x^3$. The code is as follows:

```
function y = f6(x)
y = (3.5*10.^(7)+0.401.*(10.^6.*(x.^(-2)))).*(x-(42.7).*10.^(-3))- 1.3806503.*10.^(-18).|*3;
end
```

The status bar at the bottom indicates the file is 'f6', line 2, column 89.

Figure 12: Equation for (6)



```
Command Window
>> [zero, res, niter] = bisection(@f6,-100,100,10^(-12),100)

zero =

    0.0427

res =

-3.1248e-04

niter =

    46

fx >> |
```

The image shows the MATLAB Command Window. It displays the execution of the bisection method on the function 'f6'. The command is: `[zero, res, niter] = bisection(@f6,-100,100,10^(-12),100)`. The results are:

- zero = 0.0427
- res = -3.1248e-04
- niter = 46

The prompt 'fx >> |' is shown at the bottom.

Figure 13: Answer for (6)