Exam 1 - MATLAB

Name: ___Answer Key____

1) (6 points) How many times will the display command in the following script be executed?

```matlab
x = 3;
while (x < 8)
    disp('Am I done yet?')
    x = x + 2.5;
end
```

Answer: _____2___________

2) (12 points) Given the function prototype

```matlab
function [out] = examfcn(in)
```

Write four (4) different calls to the function, each of which uses a distinctly different method to provide a value for the required parameter. Assume any variables that you need are available.

a) hardwire:  \( x = \text{examfcn}(3) \)

b) variable:  \( x = \text{examfcn}(y) \)

c) arith expr:  \( x = \text{examfcn}(2*y/3) \)

d) another fcn:  \( x = \text{examfcn}(%(y)%) \)
3) **(10 points)** Answer the following questions about data analysis using MATLAB.

Given the MATLAB variables (vectors)

- $x$: independent variable
- $y$: dependent variable

a) You decide to investigate a *power-law* fit to the data.

Write the MATLAB command(s) to display the data on logarithmically-scaled axes

Answer: `loglog(x, y, 'r*')`

Write the MATLAB command(s) to find a least-squares fit to the data

Answer: `coeff = polyfit(log(x), log(y), 1)`

b) You are now investigating an exponential fit to the data.

The MATLAB `polyfit` command

```matlab
coeff = polyfit(x, log10(y), 1)
```

returned the following

```
coeff =
 3  2
```

Write the corresponding equation in ($x, \log_{10}(y)$) notation

Answer: $\log_{10}(y) = 3x + 2$

Write the corresponding equation in ($x, y$) notation

Answer: $y = 10^{(3x + 2)} = 100(10^{3x})$
4) **(6 Points)** You wish to write a script that will analyze the following function:

\[ y = \frac{2x^2 \cos(x)}{\exp(0.1x)} \]

Write the m-file, `fun_x.m`, required to define this as a MATLAB function.

```matlab
function [y] = func_x(x)
    y = 2*x.^2.*cos(x)./exp(0.1*x)
end
```

5) **(12 points)** Write the screen display for the following script. **Credit only given for work shown.**

```matlab
message = ('rent strapped');
concat = ['me']
for i = 1:3
    j = 3*i;
    concat = [concat, message(j)];
    disp(concat)
end
```

<table>
<thead>
<tr>
<th>Display #</th>
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<tbody>
<tr>
<td>1</td>
<td>concat = me</td>
</tr>
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<td>2</td>
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</table>
6) (10 points) Answer the following questions about functional analysis using MATLAB.

   a) \texttt{fcn\_name} has been declared as an inline function.

   Write the MATLAB command(s) to find a zero near \( x = 1.5 \)

   
   Answer: \texttt{xzero = fzero(fcn\_name,1.5)}

   Write the MATLAB command(s) to find a minimum between \(-1 < x < 1.5\)

   
   Answer: \texttt{xmin = fminbnd(fcn\_name,-1,1.5)}

   b) \texttt{fcn\_name} has been declared as the string: \( '2*x./(x.^4+2)' \).

   Write the MATLAB command(s) to find a zero near \( x = 1.5 \)

   
   Answer: \texttt{xzero = fzero(fcn\_name,1.5)}

   Write the MATLAB command(s) to find a minimum between \(-1 < x < 1.5\)

   
   Answer: \texttt{xmin = fminbnd(fcn\_name,-1,1.5)}

   c) \texttt{fcn\_name} has been assigned the path\filename of MATLAB m-file.

   Write the MATLAB command(s) to find a zero near \( x = 1.5 \)

   
   Answer: \texttt{xzero = fzero(fcn\_name,1.5)}
7) **(20 points)** Write the screen display for the following script and associated functions in the space provided. **Credit only given for work shown.**

%% script
\begin{verbatim}
x = 4
y = 3
z = [2 4 5 3 1];
for i = 1:2:5
    if (i <= 2)
        back1 = fcn1(i,x,y,z)
    elseif (i > 3)
        disp('done')
    else
        back2 = fcn2(i,y,x,z)
    end
end
\end{verbatim}

% function
\begin{verbatim}
function \[out2\] = fcn1(j,y,x,k)
out2 = [0 0 0 0 0]
for i=1:3:5
    out2(i) = fcn2(i,x,y,k);
end
\end{verbatim}

% function
\begin{verbatim}
function \[out1\] = fcn2(j,d,s,k)
switch (k(j))
    case {1,2}
        out1 = d+9
    case {3,4}
        out1 = 2*s
    otherwise
        out1 = d+s
end
\end{verbatim}

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>x = 4</td>
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<tr>
<td>2</td>
<td>y = 3</td>
</tr>
<tr>
<td>3</td>
<td>out2 = 0 0 0 0 0</td>
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<td>4</td>
<td>out1 = 12</td>
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<td>5</td>
<td>out1 = 8</td>
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<td>6</td>
<td>back1 = 12 0 0 8 0</td>
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<td>7</td>
<td>out1 = 7</td>
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<td>8</td>
<td>back2 = 7</td>
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<td>9</td>
<td>done</td>
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8) **(24 points)** A student produced the following script, `eqnsolver.m`, in response to a programming assignment to create a script that would solve a set of linear equations given an augmented coefficient matrix file.

```
1. % script to solve linear set of equations
2. %     A*x = b
3. % requires augmented coefficient matrix file
4. 5.  header();
6. 7. % get augmented coefficient matrix, decompose
8. % to coefficient matrix, Amat, and right hand side, rhs
9. 10. disp(' ')
11. 12. fname = input('Augmented coefficient matrix file name? ==> '); %<--- line 5
13. 14. augmat = load(fname);
15. 16. [Nrow, Ncol] = size(fname);
17. 18. Amat = augmat(:,1:Nrow);
19. 20. rhs = augmat(:,Ncol);
21. 22. disp(' ')
23. 24. disp(The solution vector is)
25. 26. disp(soln)

However, the following messages appeared when the student attempted to run the script using a properly configured augmented coefficient matrix, called `test.dat`, as a test case.

Your job is to
(1) find the offending line of code and
(2) show a fix to the error in the spaces provided below the message.

(a) ??? Error: File: C:\temp\eqnsolver.m Line: 5 Column: 13
    Expected a variable, function, or constant, found ")".

(1) Offending line of code, Line #: 5
(2) Correction: header

(b) Augmented coefficient matrix file name? ==> test.dat
    ??? Undefined variable 'test' or class 'test.dat'.

(1) Offending line of code, Line #: 10
(2) Correction: fname = input('Augmented coefficient matrix file name? ==> ', 's');
(c) ??? Index exceeds matrix dimensions.

Error in ==> C:\temp\eqnsolver.m
On line 14 ==> rhs = augmat(:,Ncol);

1. Offending line of code, Line #: 12
2. Correction: [Nrow, Ncol] = size(augmat);

(d) ??? Error using ==> /
Matrix dimensions must agree.

Error in ==> C:\temp\eqnsolver.m
On line 17 ==> soln = Amat/rhs;

1. Offending line of code, Line #: 17
2. Correction: soln = Amat\rhs;
   soln = inv(Amat)*rhs;
   soln = (Amat^(-1))*rhs;

(e) ??? Error: File: C:\temp\eqnsolver.m Line: 21 Column: 14 ")" expected, "identifier" found.

1. Offending line of code, Line #: 21
2. Correction: disp('The solution vector is')

(f) What will be displayed if help eqnsolver is entered at the command window prompt?

script to solve linear set of equations
A*x = b
requires augmented coefficient matrix file