HOMEWORK 2

SOLUTIONS

17. Two divers start at the surface and establish the following coordinate system: x is to the west, y is to the north, and z is down. Diver 1 swims 60 ft east, then 25 ft south, and then dives 30 ft. At the same time, diver 2 dives 20 ft, swims east 30 ft and then south 55 ft.

a. Compute the distance between diver 1 and the starting point.
b. How far in each direction must diver 1 swim to reach diver 2?
c. How far in a straight line must diver 1 swim to reach diver 2?

Solution:

Editor - que_17.m

Practice.m | que_17.m

```
1     %position of diver1 r=-60i-25j+30k (xyz coordinates)
2     %position of diver2 w=-30i-55j+20k (x-west,y-north,z-down)
3     %Distance of diver1 from starting point is magnitude-norm(r)
4 -   clc
5 -   clear all
6 -   r=[-60,-25,30];
7 -   w=[-30,-55,20];
8 -   dist1=sqrt(sum(r.*r))
9 -   disp('Distance of diver1 from starting point is:')
10 -  disp(dist1)
11    %location of diver2 wrt diver 1 is w-r
12 -  v=w-r
13    %straight line distance between 2 divers is dist2 (magnitude of v)
14 -  dist2=sqrt(sum(v.*v))
15 -  disp('Distance between diver1 and diver2 is:')
16 -  disp(dist2)
17
```

Variables - E

Details

Workspace

Name	Value
dist1	71.5891
dist2	43.5890
r	[-60,-25,30]
v	[30,-30,-10]
w	[-30,-55,20]

Command Window

```
dist1 =

   71.5891

Distance of diver1 from starting point is:
   71.5891


v =

    30   -30   -10


dist2 =

   43.5890

Distance between diver1 and diver2 is:
   43.5890
```

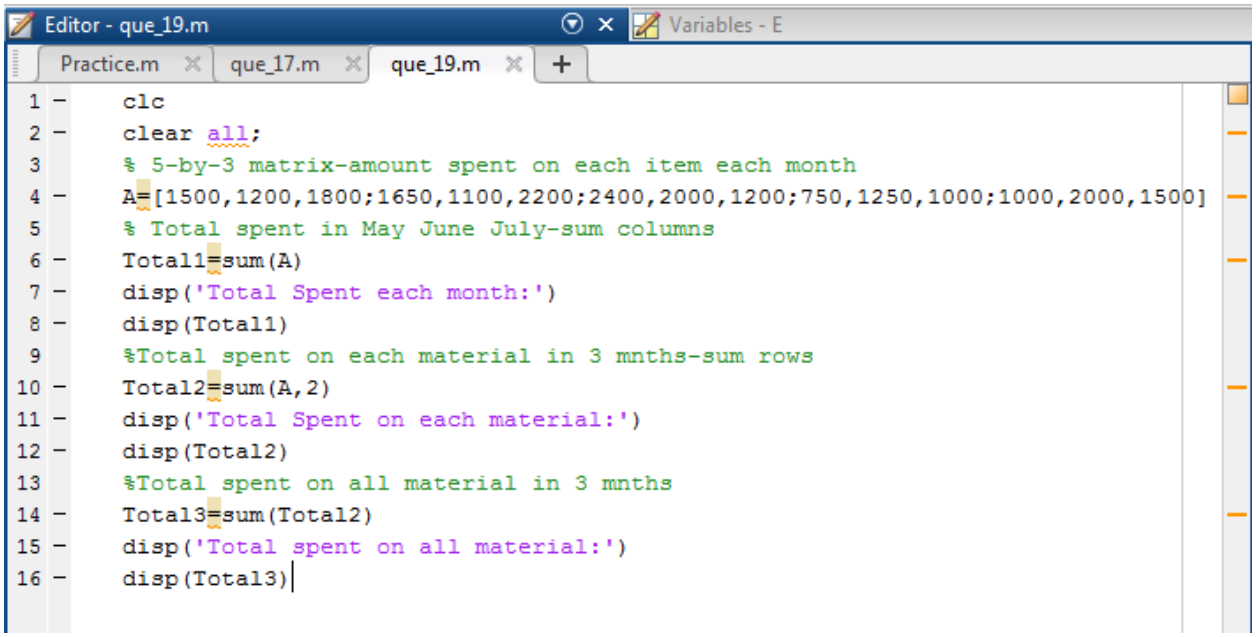
19. A company must purchase ve kinds of material. The following table gives the price the company pays per ton for each material, along with the number of tons purchased in the months of May, June, and July:

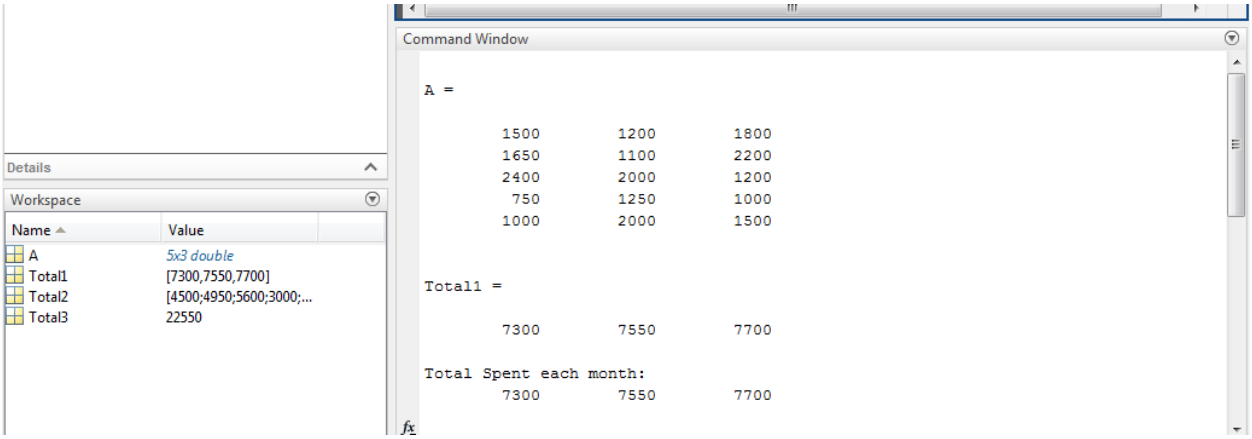
		Quantity purchased (tons)		
Material	**Price ($/ton)**	**May**	**June**	**July**
1	300	5	4	6
2	550	3	2	4
3	400	6	5	3
4	250	3	5	4
5	500	2	4	3

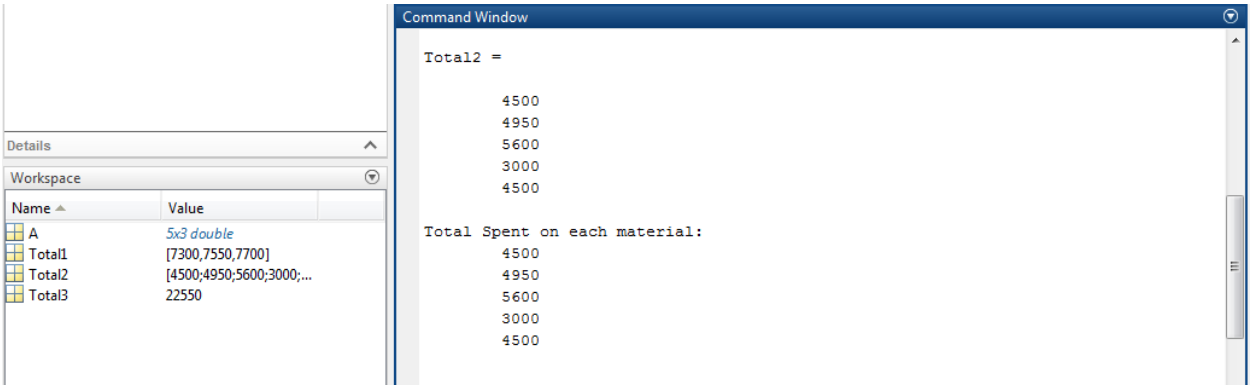
Use MATLAB to answer these questions:

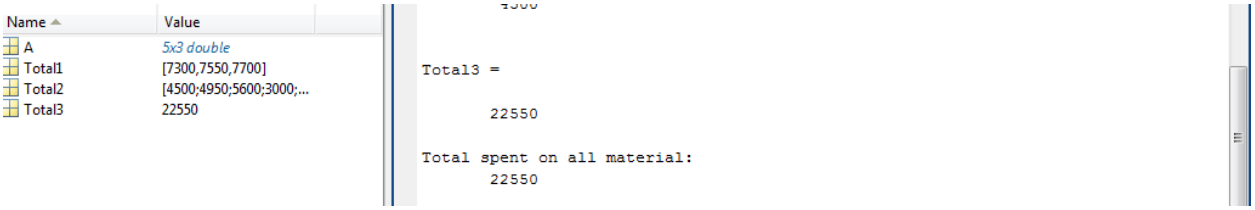
a. Create a 5×3 matrix containing the amounts spent on each item for each month.
b. What is the total spent in May? in June? in July?
c. What is the total spent on each material in the three-month period?
d. What is the total spent on all materials in the three-month period?

Solution:







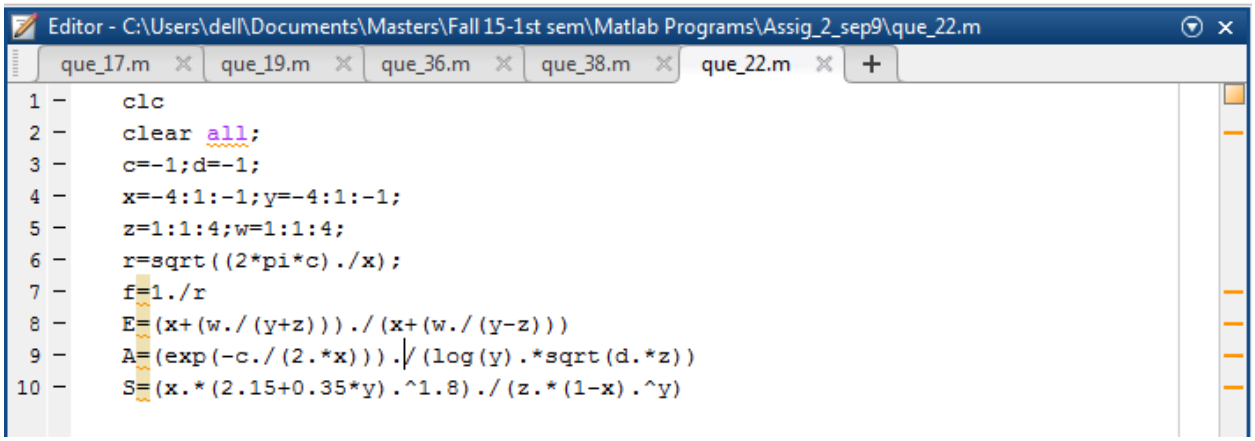


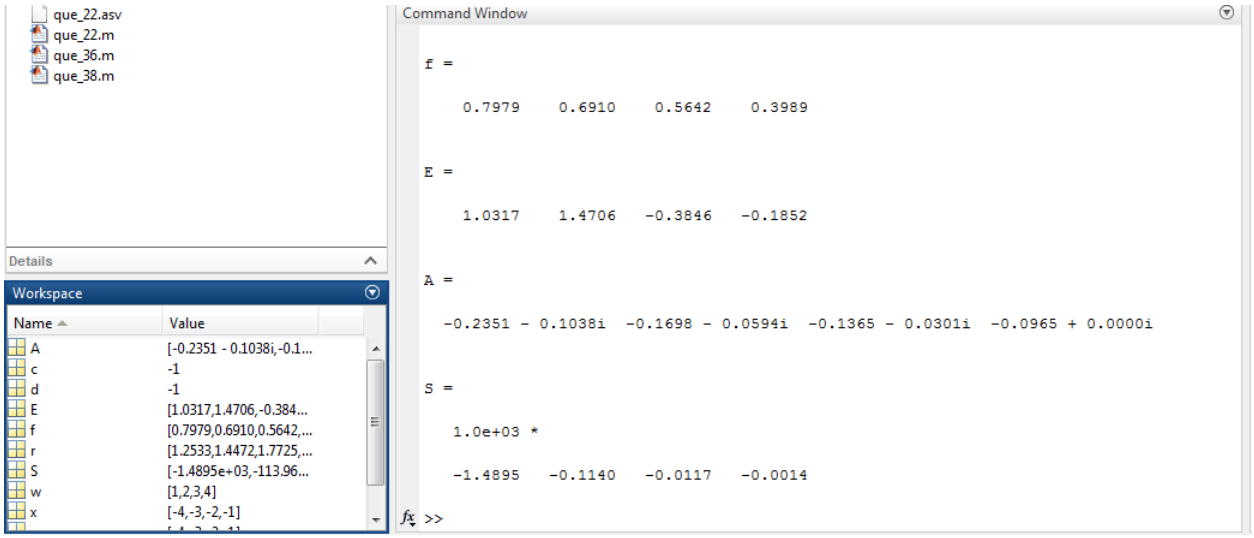
22. Write a MATLAB assignment statement for each of the following functions, assuming that w, x, y, and z are row vectors of equal length and that c and d are scalars.

$$f = \frac{1}{\sqrt{2\pi c/x}} \qquad E = \frac{x + w/(y + z)}{x + w/(y - z)}$$

$$A = \frac{e^{-c/(2x)}}{(\ln y)\sqrt{dz}} \qquad S = \frac{x(2.15 + 0.35y)^{1.8}}{z(1 - x)^{y}}$$

Solution:





36. Use MATLAB to plot the polynomial $y = 3x^4 - 5x^3 - 28x^2 - 5x + 200$ on the interval $-1 \leq x \leq 1$. Put a grid on the plot and use the `ginput` function to determine the coordinates of the peak of the curve.

Solution:

Editor - que_36.m

que_17.m | que_19.m | que_36.m

```
1 -    clc
2 -    clear all;
3 -    x=-1:0.1:1;
4 -    y=polyval([3,-5,-28,-5,200],x);
5 -    plot(x,y),xlabel('x'),ylabel('y'),grid
6 -    [x,y]=ginput(1)
7 -    disp('Coordinates of Peak of the curve: ')
8 -    disp([x,y])
9
```

Variables - E

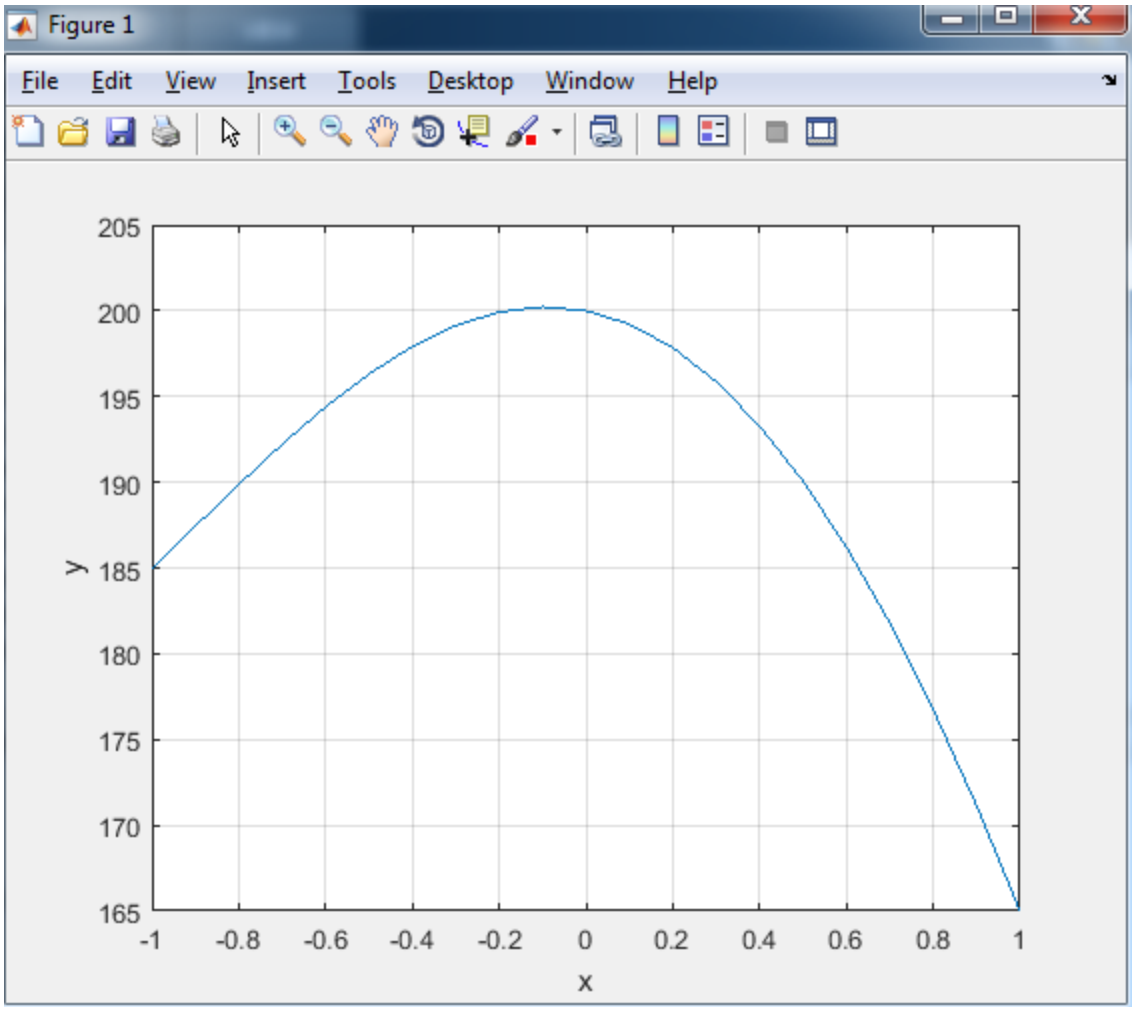
Details

Workspace

Name	Value
x	-0.1037
y	200.1603

Command Window

```
x =

   -0.1037


y =

  200.1603

Coordinates of Peak of the curve:
   -0.1037  200.1603

fx >>
```



38.* Use MATLAB to nd the quotient and remainder of

$$\frac{14x^3 - 6x^2 + 3x + 9}{5x^2 + 7x - 4}$$

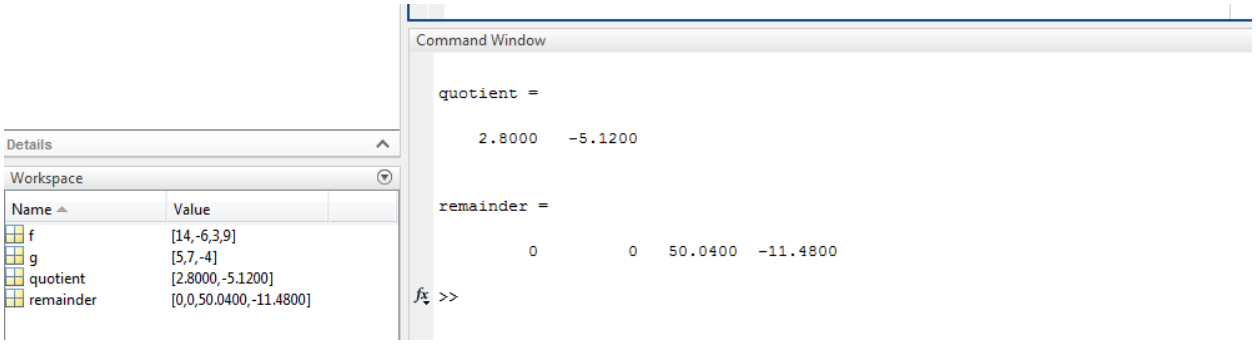
Solution:

Editor - que_38.m

Variables - E

que_17.m | que_19.m | que_36.m | que_38.m

```
1 -    clc
2 -    clear all;
3 -    f=[14,-6,3,9];
4 -    g=[5,7,-4];
5 -    [quotient,remainder]=deconv(f,g)
```



Quotient:2.8x-5.12

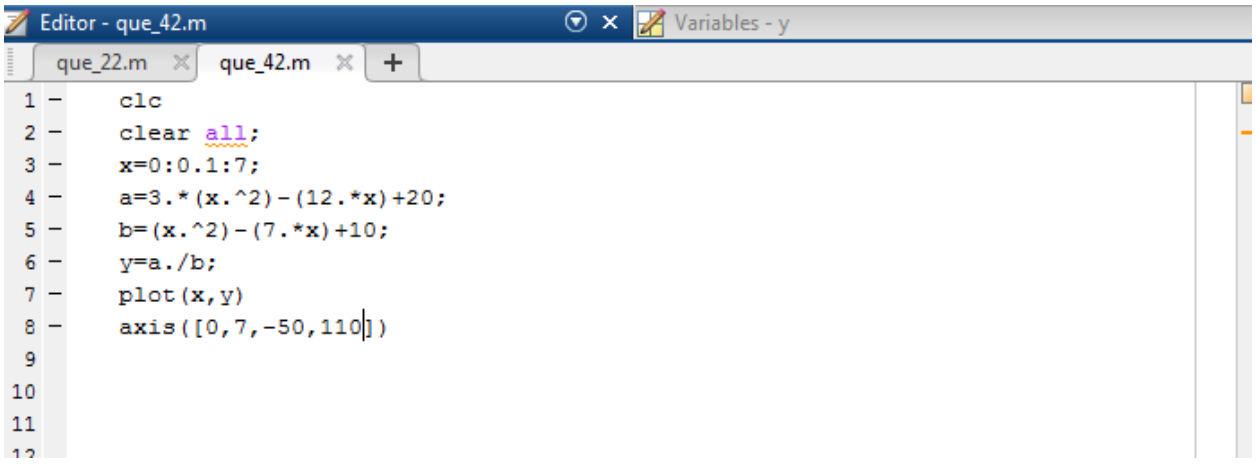
Remainder: 50.04x-11.48

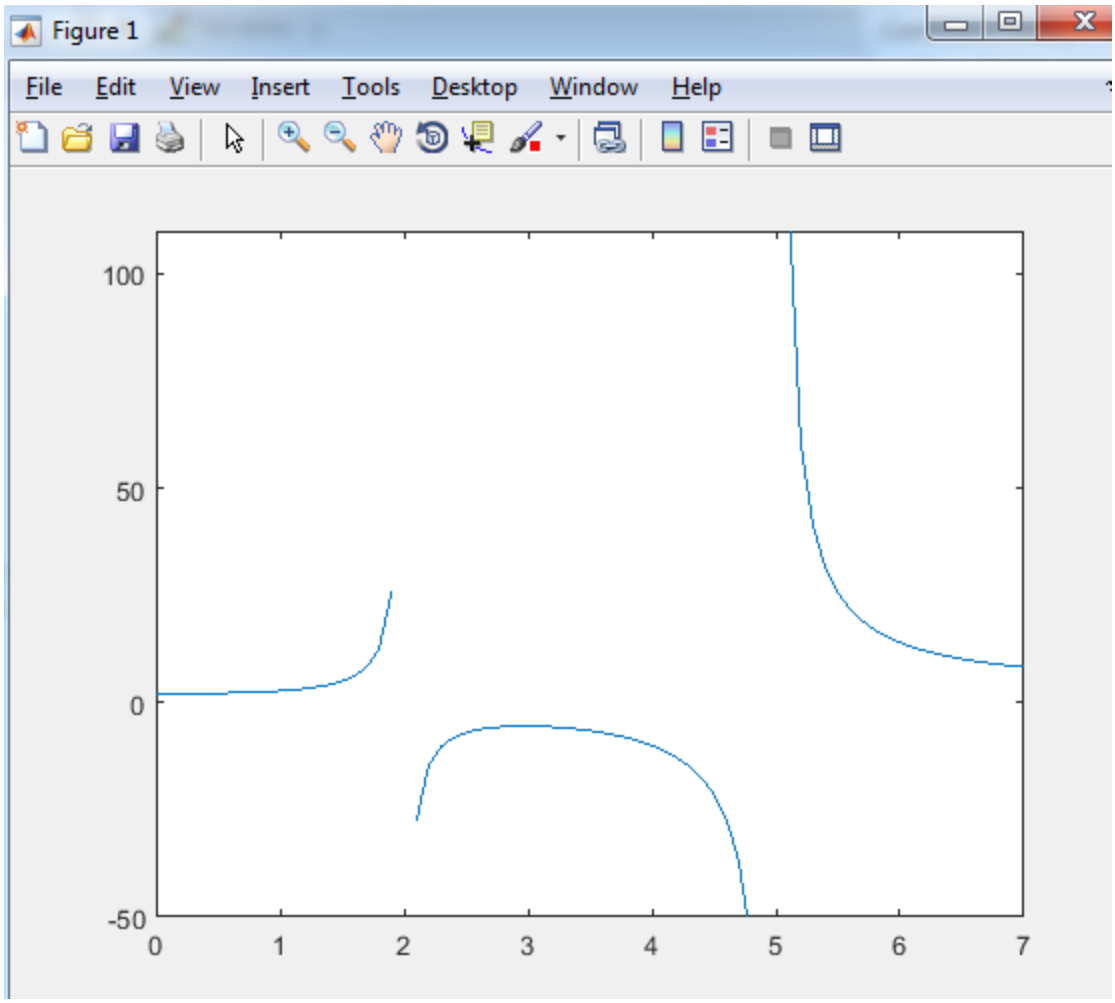
42. The function

$$y = \frac{3x^2 - 12x + 20}{x^2 - 7x + 10}$$

approaches ∞ as $x \to 2$ and as $x \to 5$. Plot this function over the range $0 \leq x \leq 7$. Choose an appropriate range for the y axis.

Solution:





8. Given the matrix

$$\mathbf{A} = \begin{bmatrix} 3 & 7 & -4 & 12 \\ -5 & 9 & 10 & 2 \\ 6 & 13 & 8 & 11 \\ 15 & 5 & 4 & 1 \end{bmatrix}$$

a. Find the maximum and minimum values in each column.
b. Find the maximum and minimum values in each row.

Solution:

Editor - C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab Programs\Assig_2_sep9\que_8.m

que_19.m | que_36.m | que_38.m | que_22.m | que_42.m | que_8.m

```
1 -    clc
2 -    clear all;
3 -    A=[3,7,-4,12;-5,9,10,2;6,13,8,11;15,5,4,1]
4      %max in each column
5 -    B=max(A)
6 -    C=min(A)
7 -    D=max(A,[],2)
8 -    E=min(A,[],2)
```

Command Window

```
A =

     3     7    -4    12
    -5     9    10     2
     6    13     8    11
    15     5     4     1


B =

    15    13    10    12


C =

    -5     5    -4     1
```

```
D =

    12
    10
    13
    15


E =

    -4
    -5
     6
     1
```

10. Consider the following arrays.

$$\mathbf{A} = \begin{bmatrix} 1 & 4 & 2 \\ 2 & 4 & 100 \\ 7 & 9 & 7 \\ 3 & \pi & 42 \end{bmatrix} \qquad \mathbf{B} = \ln(\mathbf{A})$$

Write MATLAB expressions to do the following.

a. Select just the second row of **B**.
b. Evaluate the sum of the second row of **B**.
c. Multiply the second column of **B** and the rst column of **A** element by element.
d. Evaluate the maximum value in the vector resulting from element-by-element multiplication of the second column of **B** with the rst column of **A.**
e. Use element-by-element division to divide the rst row of **A** by the rst three elements of the third column of **B**. Evaluate the sum of the elements of the resulting vector.

Solution:

Editor - que_10.m

Variables - x

que_19.m | que_36.m | que_38.m | que_22.m | que_42.m | que_8.m | que_10.m

```
1 -    clc
2 -    clear all
3 -    A=[1,4,2;2,4,100;7,9,7;3,pi,42];
4 -    B=log(A)
5      % to choose second row of B
6 -    C=B(2,:)
7      %sum of second row of B
8 -    D=sum(C,2)
9      % second column of B with first column of A
10 -   E=A(:,1).*B(:,2)
11     %max of E
12 -   e1=max(E)
13     %first row of A by third column of B
14 -   F=(A(1,:))'./B([1 2 3],3)
15     %sum of resultant vector
16 -   f1=sum(F)
17
```

Command Window

```
B =

         0    1.3863    0.6931
    0.6931    1.3863    4.6052
    1.9459    2.1972    1.9459
    1.0986    1.1447    3.7377


C =

    0.6931    1.3863    4.6052


D =

    6.6846
```

Command Window

```
E =

    1.3863
    2.7726
   15.3806
    3.4342


e1 =

   15.3806


F =

    1.4427
    0.8686
    1.0278
```

```
f1 =

    3.3391
```

26. Given the matrices

$$\mathbf{A} = \begin{bmatrix} 4 & -2 & 1 \\ 6 & 8 & -5 \\ 7 & 9 & 10 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 6 & 9 & -4 \\ 7 & 5 & 3 \\ -8 & 2 & 1 \end{bmatrix} \qquad \mathbf{C} = \begin{bmatrix} -4 & -5 & 2 \\ 10 & 6 & 1 \\ 3 & -9 & 8 \end{bmatrix}$$

Use MATLAB to

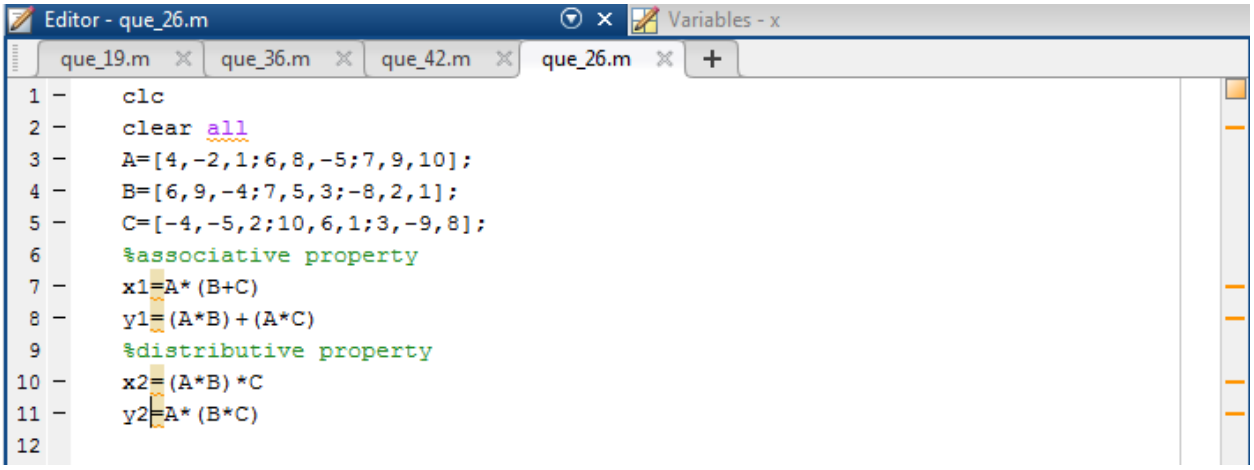
a. Verify the associative property

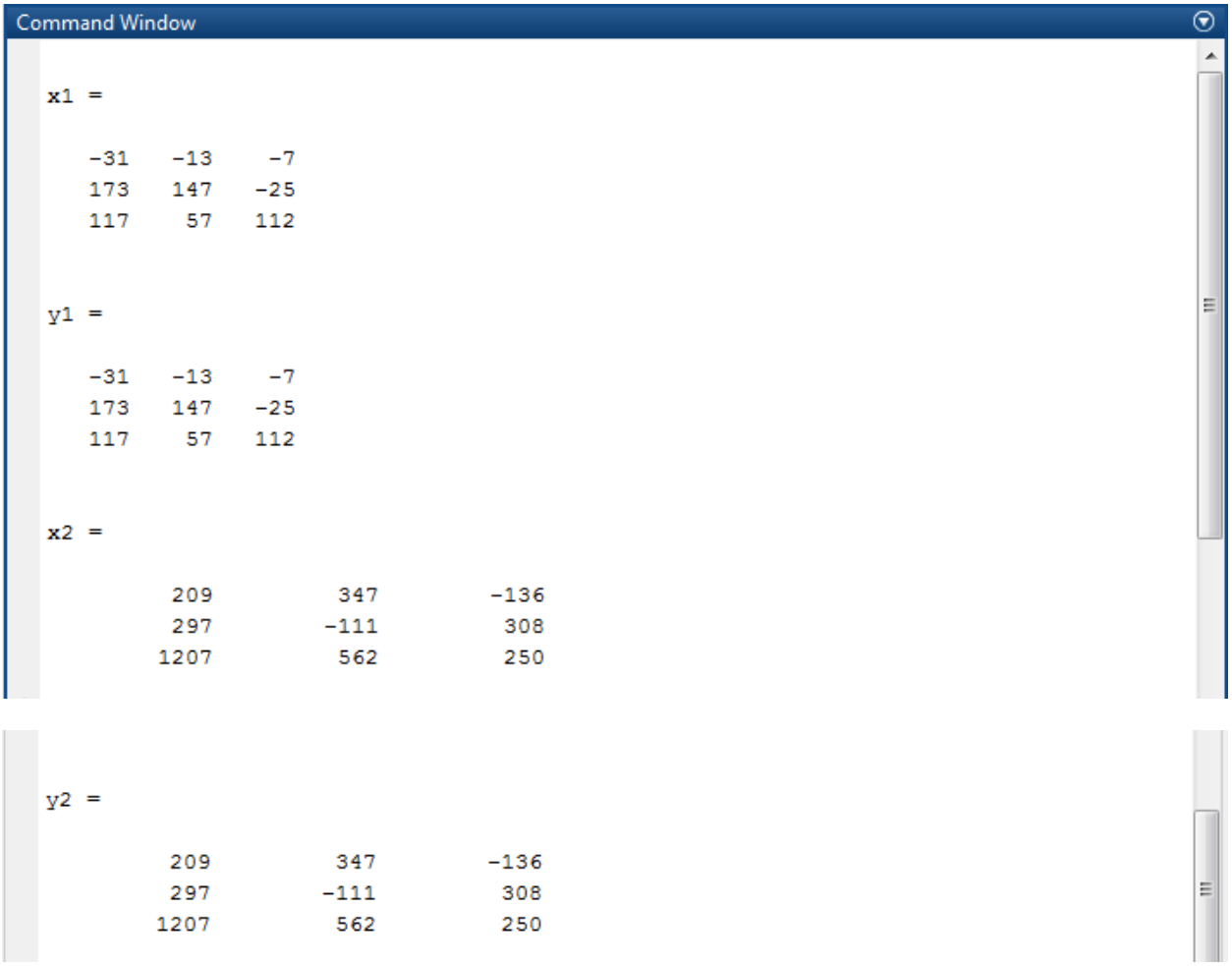
$$\mathbf{A(B + C) = AB + AC}$$

b. Verify the distributive property

$$\mathbf{(AB)C = A(BC)}$$

Solution:





32. Verify the identity

$$\mathbf{A} \times (\mathbf{B} \times \mathbf{C}) = \mathbf{B}(\mathbf{A} \cdot \mathbf{C}) - \mathbf{C}(\mathbf{A} \cdot \mathbf{B})$$

for the vectors $\mathbf{A} = 7\mathbf{i} - 3\mathbf{j} + 7\mathbf{k}$, $\mathbf{B} = -6\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$, and $\mathbf{C} = 2\mathbf{i} + 8\mathbf{j} - 8\mathbf{k}$.

Solution:

Editor - que_32.m

que_19.m | que_36.m | que_42.m | que_32.m

```
clc
clear all
A=[7,-3,7];
B=[-6,2,3];
C=[2,8,-8];
d=cross(B,C);
d1=cross(A,d)
x=dot(A,C);
x1=B*x
y=dot(A,B);
y1=C*y
z=x1-y1
```

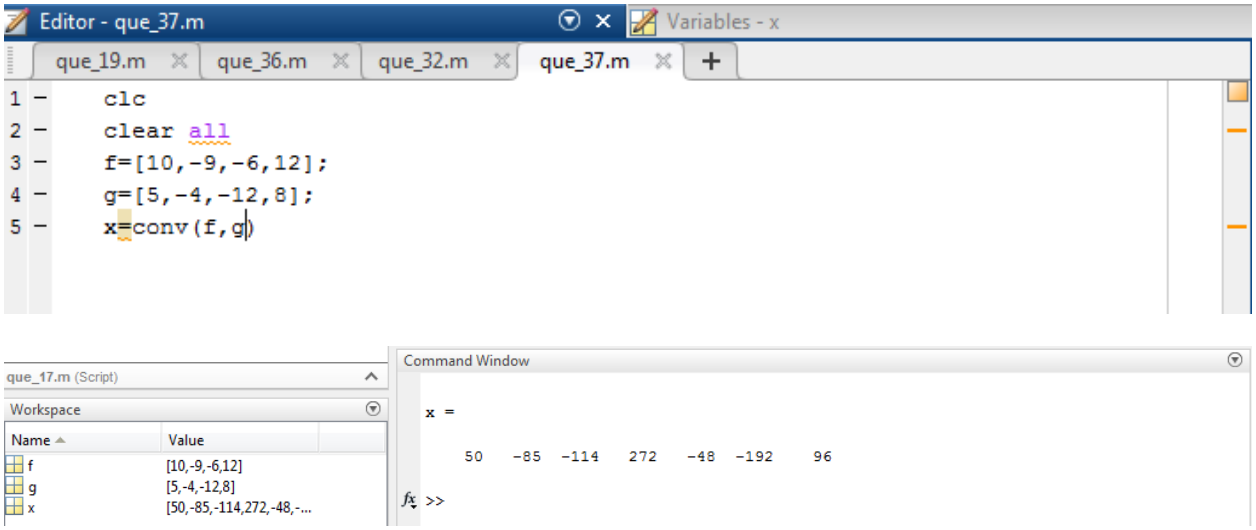
Command Window

```
d1 =

   450    84  -414


x1 =

   396  -132  -198


y1 =

   -54  -216   216


z =

   450    84  -414
```

37. Use MATLAB to find the following product:

$$(10x^3 - 9x^2 - 6x + 12)(5x^3 - 4x^2 - 12x + 8)$$

Solution:


Editor - que_37.m
Variables - x
que_19.m
que_36.m
que_32.m
que_37.m
1 clc
2 clear all
3 f=[10,-9,-6,12];
4 g=[5,-4,-12,8];
5 x=conv(f,g)
que_17.m (Script)
Workspace
Name
Value
f
[10,-9,-6,12]
g
[5,-4,-12,8]
x
[50,-85,-114,272,-48,-...
Command Window
x =
50 -85 -114 272 -48 -192 96
>>