ENGR 133, LAB-03

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Exercise #1...Problem 5.1

Problem Presentation:

We are asked to construct a breakeven plot for producing and selling a chemical product. We are given values for fixed cost (FC), variable cost (VC), quantity, (Q), and unit selling price (P). We want to know the breakeven point, the range of profitable production, and the quantity of product that produces maximum profit.

Pseudocode:

Initialize Variables

Perform Calculations

Evaluate Results

Display Results

Problem Solution:

Initialize Variables

```
clc,clear,close all
FC = 3e6; % fixed cost in dollars per year. ($/yr)
VC = 0.025; % variable cost in dollars per gallon produced. ($/gal)
P = 0.055; % selling price in dollars per gallon sold. ($/gal)
Q = [0:200]*1e+6; % quantity produced/sold in millions of gallons per year.
(gal/yr)
```

Perform Calculations

```
TC = FC+Q*VC; % returns total cost (TC) per year in $M.
TR = Q*P; % returns total revenue (TR) per year in $M.
TP = TR-TC; % returns profit per year in $M.
```

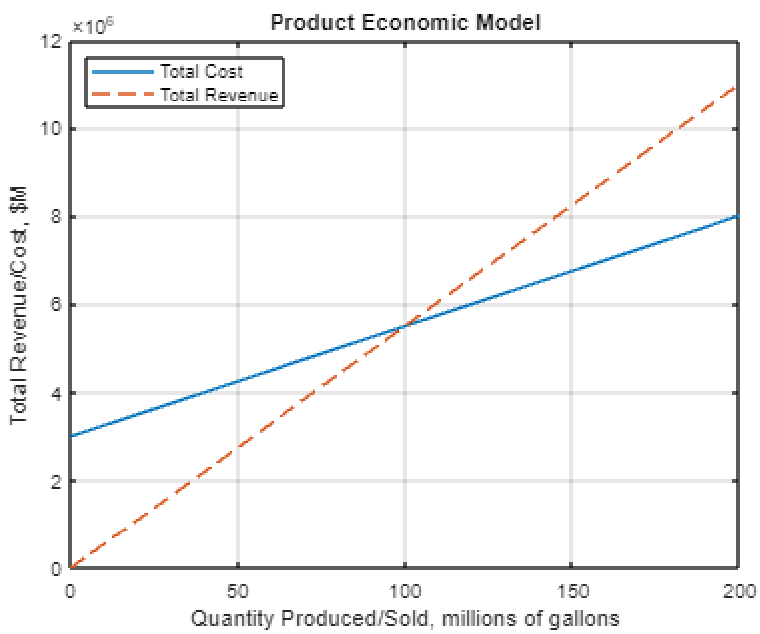
Evaluate Results

```
idx = find(TP>0); % finding all possible indexes where TP is positive
```

```
minQ_idx = min(idx); % findinf first index where TP is positive
BEP = Q(minQ_idx); % return breakeven point in millions of gallons per year.
```

Display Results

```
plot(Q*1e-6,TC,Q*1e-6,TR,'--')
title('Product Economic Model')
xlabel('Quantity Produced/Sold, millions of gallons')
ylabel('Total Revenue/Cost, $M')
legend('Total Cost','Total Revenue', 'location','northwest')
grid on
```




```
fprintf('The breakeven point occurs at %3.0f million gallons. \n\n', BEP*1e-6)
```

```
The breakeven point occurs at 101 million gallons.
```

```
fprintf('Operations are profitable above this point.\n\n')
```

```
Operations are profitable above this point.
```

```
fprintf('There is no upper limit on profitability.\n\n')
```

```
There is no upper limit on profitability.
```

Exercise #2...Subplots

Problem Presentation:

We are asked to construct a 2 by 2 grid of plots showing sin(x), cos(x), e^x, and both sin(x) and cos(x) on one subplot. We must include elements to create proper plots

Pseudocode:

initialize variable

Display Results

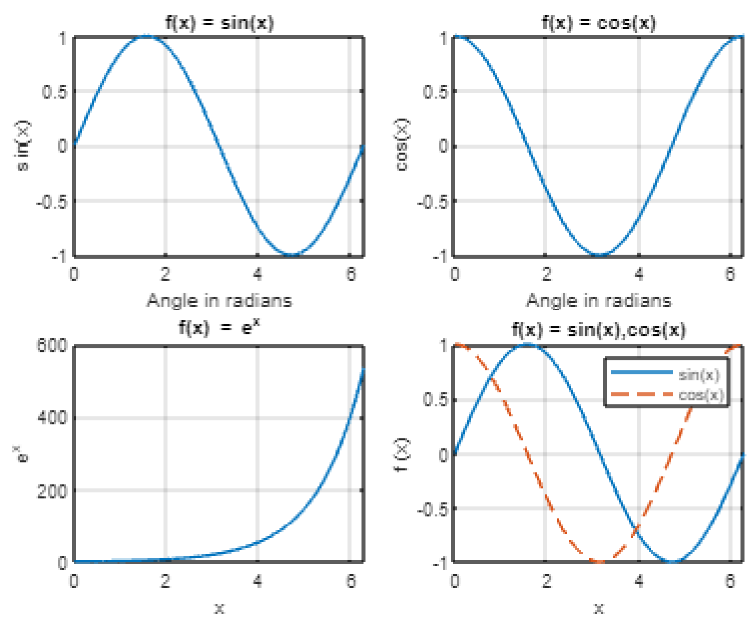
Problem Solution:

initialize variable

```
clc,clear,close all
x =  linspace(0,2*pi,1000); % creating an array of 1000 equally spaced points.
sin_x = sin(x); % creating an array of sine values.
cos_x = cos(x); % creating an array of cosine values.
exp_x = exp(x); % creating an array of exponential values.
```

Display Results

```
subplot(2,2,1)
plot(x,sin_x),title('f(x) = sin(x)'), grid on
xlabel('Angle in radians'), ylabel('sin(x)')
subplot(2,2,2)
plot(x,cos_x),title('f(x) = cos(x)'),grid on
xlabel('Angle in radians'),ylabel('cos(x)')
subplot(2,2,3)
plot(x,exp_x),title('f(x) = e^x'),grid on
xlabel('x'),ylabel('e^x')
subplot(2,2,4)
plot(x,sin_x,x,cos_x,'--'),title('f(x) = sin(x),cos(x)'),grid on
xlabel('x'),ylabel('f (x)'),legend('sin(x)','cos(x)')
```



Exercise #3...3-D Plots

Problem Presentation:

Create a plot of the function: z = (x-2)^2 + 2xy + y^2 that shows amesh plot on top, followed by a contour plot and a mesh plot with acontour plot on the bottom.

Pseudocode:

initialize variable

Display Results

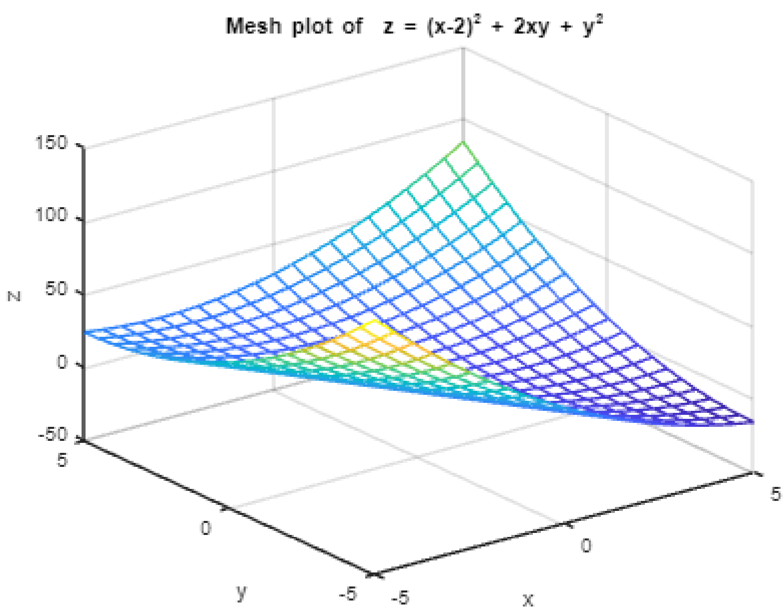
Problem Solution:

initialize variable

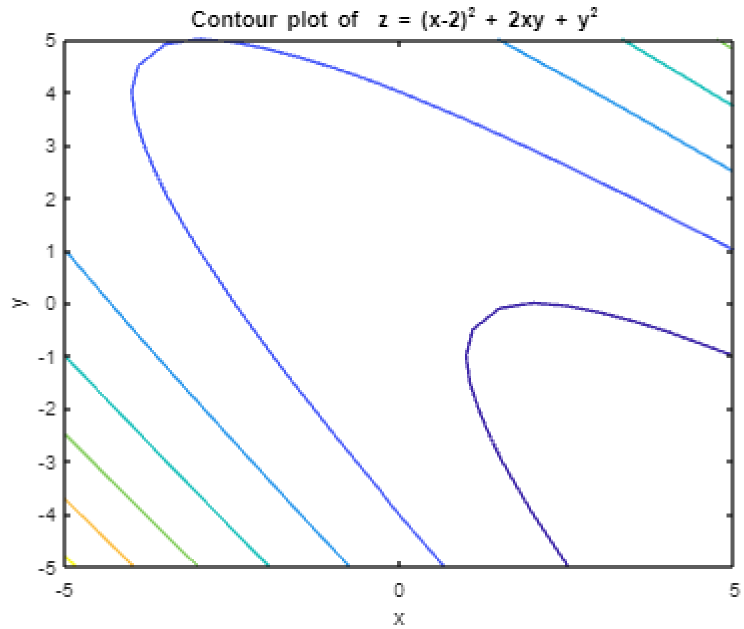
```
clc,clear,close all
[x,y] = meshgrid(-5:0.5:5); % Defining the xy grid of interest
Z = (x-2).^2 + 2*x.*y + y.^2; % Defining the Z = f(x,y) array
```

Display Results

```
mesh(x,y,Z), xlabel('x'),ylabel('y'),zlabel('z')
title('Mesh plot of  z = (x-2)^2 + 2xy + y^2 ')
```




```
figure
contour(x,y,Z), xlabel('x'),ylabel('y'),zlabel('z')
title('Contour plot of  z = (x-2)^2 + 2xy + y^2 ')
```




```
figure
meshc(x,y,Z), xlabel('x'),ylabel('y'),zlabel('z')
title('Mesh plot with contours of  z = (x-2)^2 + 2xy + y^2 ')
```