Module One - Vectors, Lines, Planes, and Quadratic Surfaces

MAT325: Calculus III: Multivariable Calculus

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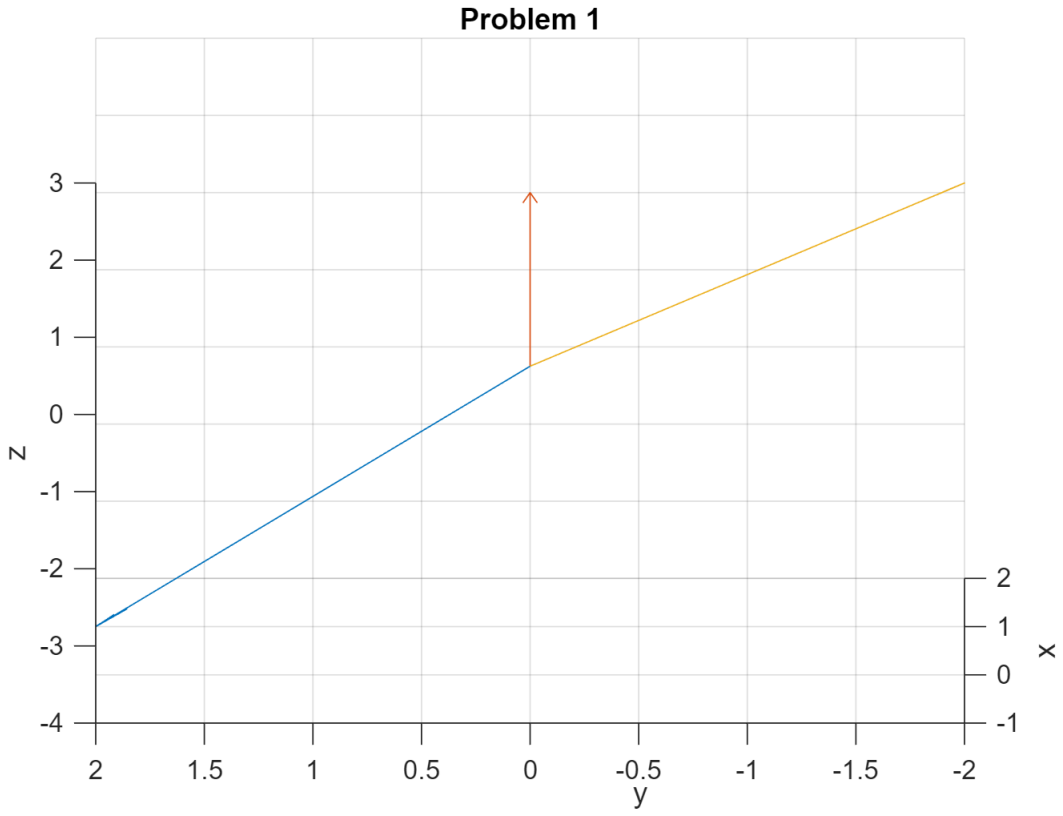
Problems:

Problem 1: Use MATLAB to define the vectors $\mathbf{x}_1 =< 1, 2, -4 >$, $\mathbf{x}_2 =< 2, 0, 1 >$, and $\mathbf{x}_3 =< -1, -2, 3 >$. Use the quiver3() function to plot all vectors on a single figure. Set an appropriate view in your plot, label all axes, and title your figure. Also, compute the dot product between vectors $\mathbf{x}_1$ and $\mathbf{x}_2$, and compute the cross product between vectors $\mathbf{x}_2$ and $\mathbf{x}_3$.

```
% Problem 1 Code Here
x1 = [1 2 -4];
x2 = [2 0 1];
x3 = [-1 -2 3];

figure;
quiver3(0,0,0,x1(1),x1(2),x1(3),'off');
hold on;
quiver3(0,0,0,x2(1),x2(2),x2(3),'off')
quiver3(0,0,0,x3(1),x3(2),x3(3),'off');
xlabel('x');
ylabel('y');
zlabel('z');
title('Problem 1')
grid on;
view([-90 15]);
```




```
dot(x1,x2)
```

```
ans =
-2
```

```
cross(x2,x3)
```

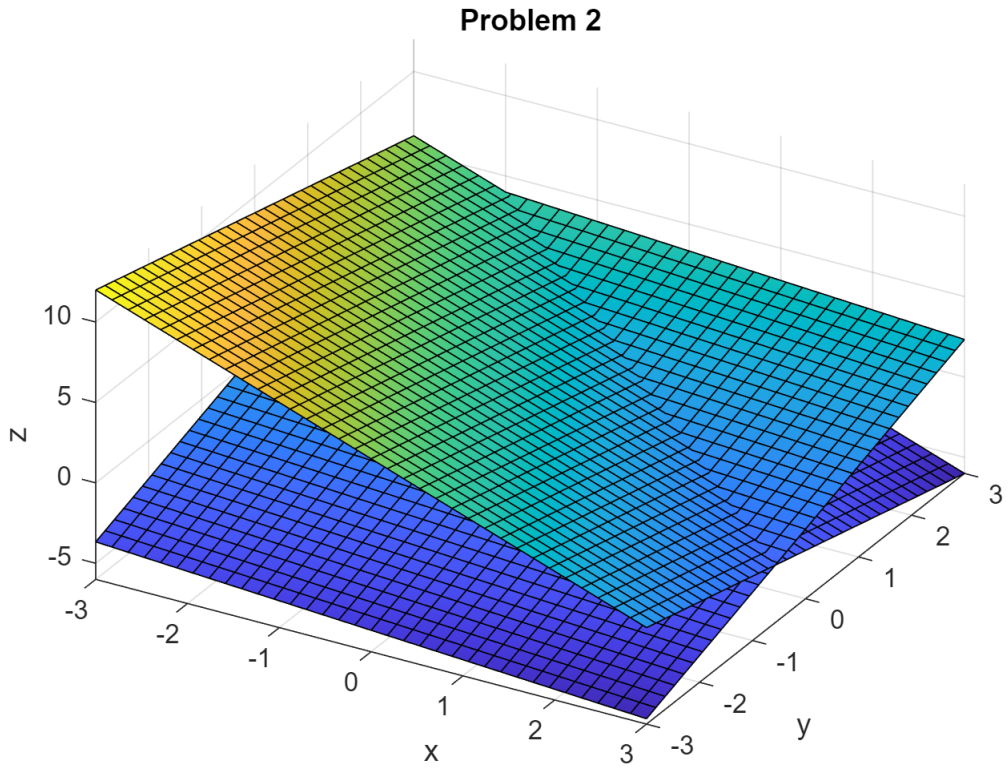
```
ans = 1×3
     2    -7    -4
```

Problem 2: Consider the two planes defined by the equations $2x + y + z = 3$ and $x - 4y + 3z = 2$. Use MATLAB and the surf() or fsurf() function to plot the two planes in the same figure for the interval $x \in [-3, 3]$ and $y \in [-3, 3]$. Define normal vectors for each plane and compute the angle (in degrees) between the two planes.

```
% Problem 2 Code Here
clear all;
syms x y;

z = -2*x-y+3;
z1 = (-x+4*y-2)/3;
```

```
figure;
fsurf(z,[-3,3,-3,3]);
hold on;
fsurf(z1,[-3,3,-3,3]);
xlabel('x');
ylabel('y');
zlabel('z');
title('Problem 2')
grid on;
view([30 45])
```



Problem 3: Consider the quadratic surface defined by the equation $z = \frac{x^2}{9} - \frac{y^2}{16}$.

Use MATLAB and the surf() or fsurf() function to plot the surface over the interval $x \in [-4, 4]$, $y \in [-3, 3]$. Choose an appropriate view to best visualize the surface and label axes appropriately.

```
% Problem 3 Code Here
clear all;

x = linspace(-4,4,100);
y = linspace(-3,3,100);

[X,Y] = meshgrid(x,y);
```

```
Z = ((X.^2)./9 - (Y.^2)./16);

figure;
surf(X,Y,Z);
xlabel('x');
ylabel('y');
zlabel('z');
title('Problem 3');
grid on;
```