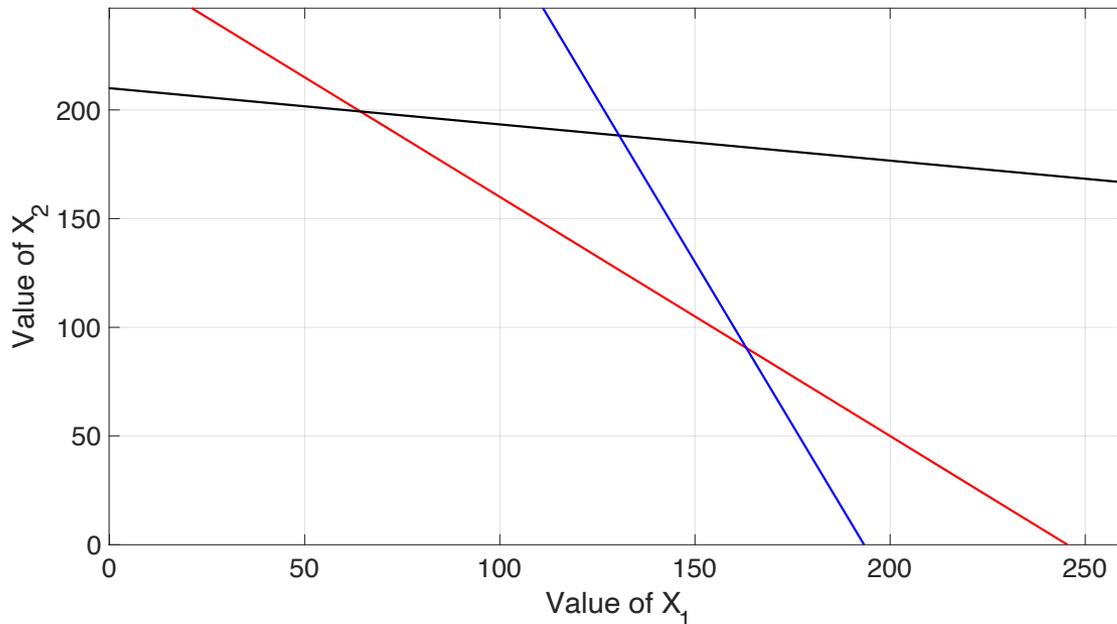




# Plotting Equations and Finding Intersection Points in Matlab



Dr. Antonio A. Trani  
Professor of Civil Engineering  
Virginia Tech  
Spring 2026



## Solving a System of Equations in LP Problems

The objective is to plot and find the intersection points for a system of equations (look at the typical constraint equations in LP problems)

$$Z = 340x_1 + 326x_2$$

$$1.1x_1 + x_2 \leq 270$$

$$x_1 + 6x_2 \leq 1260$$

$$3x_1 + x_2 \leq 580$$



# Plot the Equations Using Matlab

Define the equations as a function of one variable (say  $x_2$ )

```

1  % Solve a system of equations
2  % Programmer: A. Trani
3
4  x2=0:1:250;    % Create a vector for x2
5  % Write the three equations solving for x1 as a function of x2 (defined
6  % above)
7
8  x1_1 = (270 - x2)/1.1;
9  x1_2 = (1260 - 6 * x2);
10 x1_3 = (580 - x2)/3;
11
12 % Plot the equations
13
14 plot(x1_1,x2,'-r',x1_2,x2,'-k',x1_3,x2,'-b')
15     xlabel('Value of X1')
16     ylabel('Value of X2')
17     grid

```

$$1.1x_1 + x_2 \leq 270$$

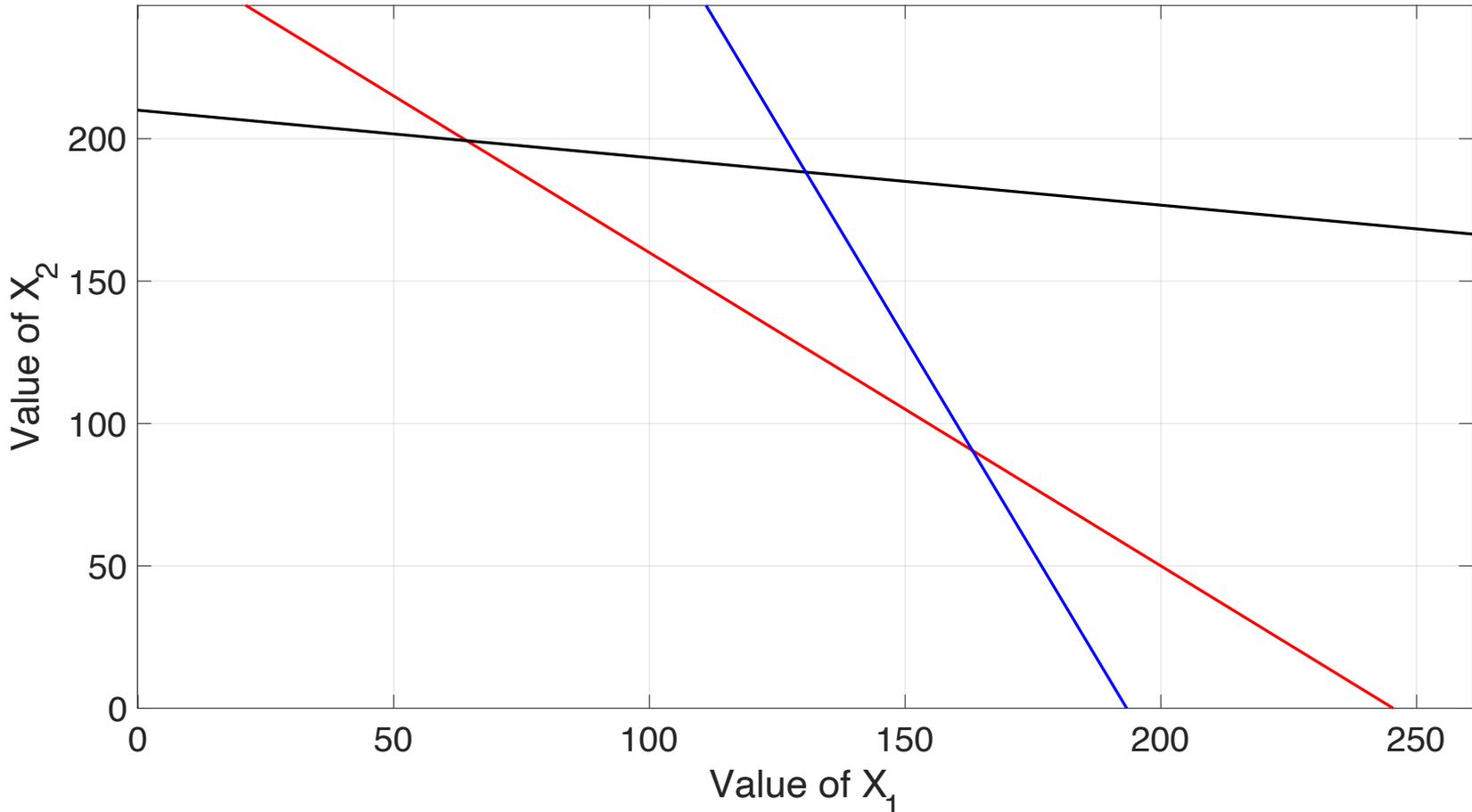
$$x_1 + 6x_2 \leq 1260$$

$$3x_1 + x_2 \leq 580$$



# Plot the Equations Using Matlab

Use the Zoom tool in the figure (plot) to select an area of interest





# Find the Points of Intersection for a Pair of Equations

This step requires the Matlab Mapping Toolbox

If the Mapping toolbox is not available, use the zoom tool to estimate the corner points

```

21      % Supply two vertices of each line
22
23      x2_vertex = [0 200];      % Define two random values for x2
24
25      % Evaluate the vertices for x1
26
27      x1_1_vertices = (270 - x2_vertex)/1.1;
28      x1_2_vertices = (1260 - 6 * x2_vertex);
29      x1_3_vertices = (580 - x2_vertex)/3;
30
31      % Intersection of lines 1 and 2
32      [xi_12,yi_12] = polyxpoly(x1_1_vertices,x2_vertex,x1_2_vertices,x2_vertex);
33      mapshow(xi_12,yi_12,'DisplayType','point','Marker','o')
34
35      % Intersection of lines 1 and 3
36      [xi_13,yi_13] = polyxpoly(x1_1_vertices,x2_vertex,x1_3_vertices,x2_vertex);
37      mapshow(xi_13,yi_13,'DisplayType','point','Marker','o')
  
```



# Find the Points of Intersection for a Pair of Equations

Define two random points on every line (called vertices)

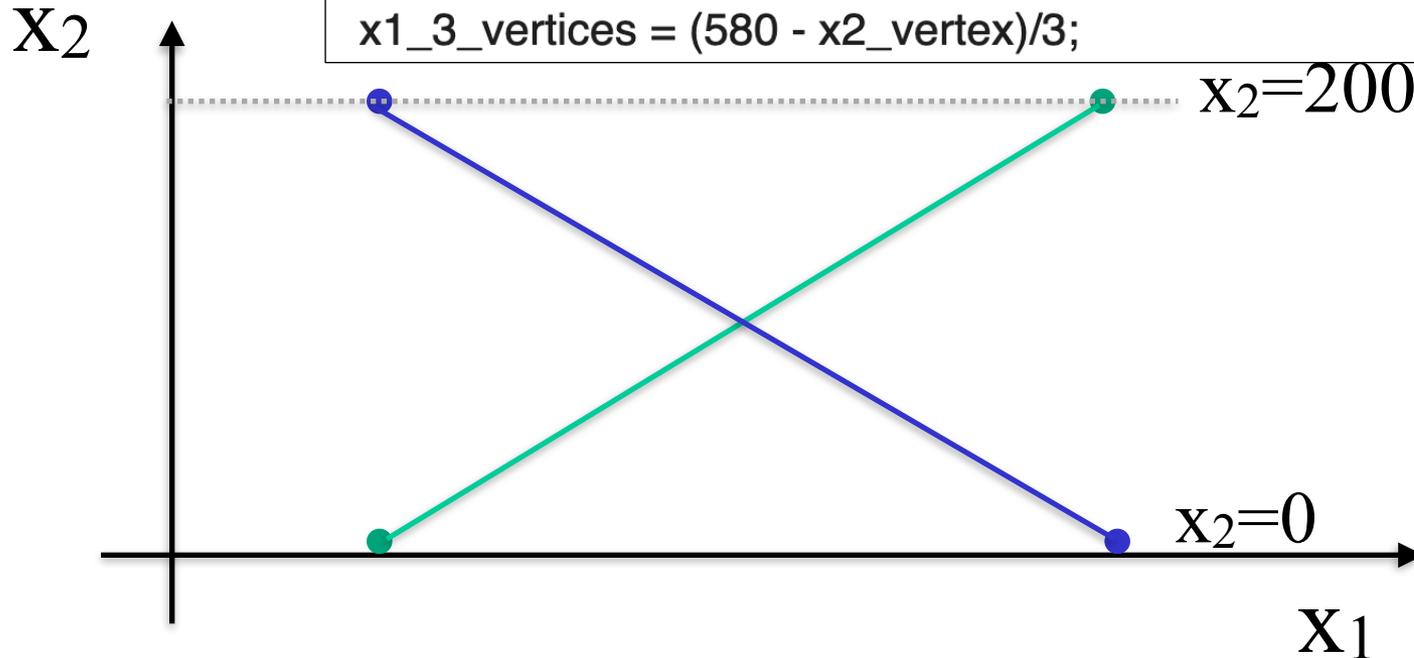
```
x2_vertex = [0 200];           % Define two random values for x2
```

```
% Evaluate the vertices for x1
```

```
x1_1_vertices = (270 - x2_vertex)/1.1;
```

```
x1_2_vertices = (1260 - 6 * x2_vertex);
```

```
x1_3_vertices = (580 - x2_vertex)/3;
```

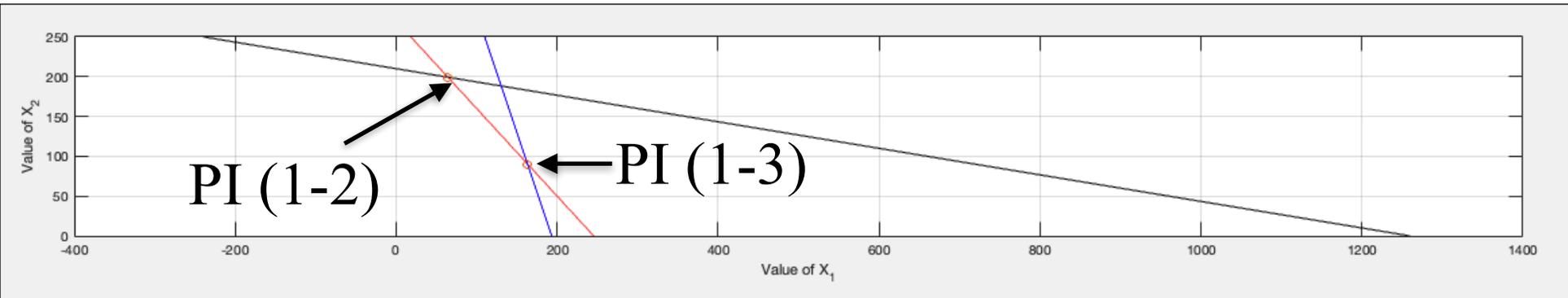




## Points of Intersection: Equations 1 and 2

```

31 % Intersection of lines 1 and 2
32 [xi_12,yi_12] = polyxpoly(x1_1_vertices,x2_vertex,x1_2_vertices,x2_vertex);
33 mapshow(xi_12,yi_12,'DisplayType','point','Marker','o')
    
```



## Points of Intersection: Equations 1 and 3

```

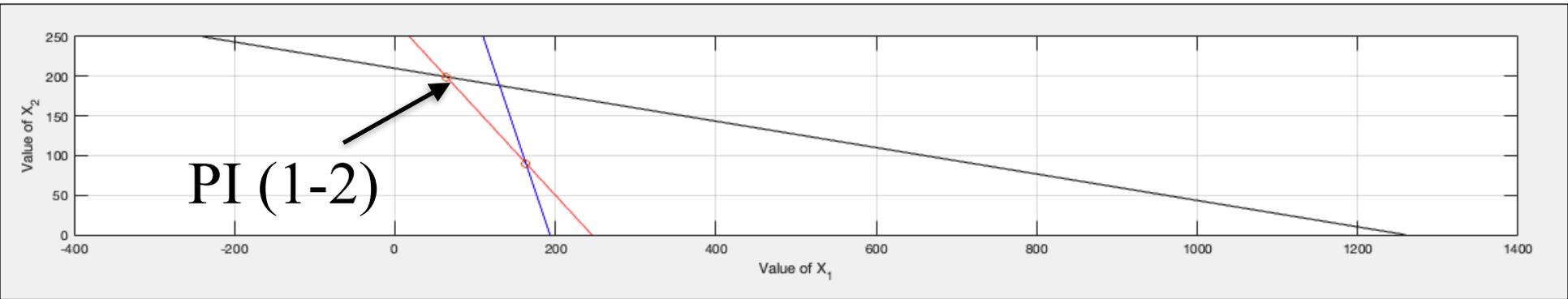
% Intersection of lines 1 and 3
[xi_13,yi_13] = polyxpoly(x1_1_vertices,x2_vertex,x1_3_vertices,x2_vertex);
mapshow(xi_13,yi_13,'DisplayType','point','Marker','o')
    
```



# Points of Intersection: Equations 1 and 2

```

31 % Intersection of lines 1 and 2
32 [xi_12,yi_12] = polyxpoly(x1_1_vertices,x2_vertex,x1_2_vertices,x2_vertex);
33 mapshow(xi_12,yi_12,'DisplayType','point','Marker','o')
    
```



Point of intersection

$$xi\_12 = 64.29$$

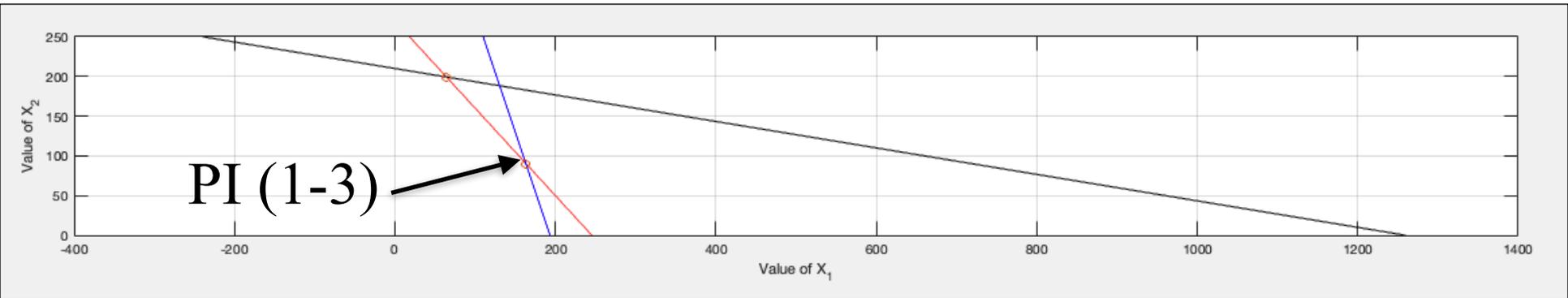
$$yi\_12 = 199.29$$



# Points of Intersection: Equations 1 and 3

% Intersection of lines 1 and 3

```
[xi_13,yi_13] = polyxpoly(x1_1_vertices,x2_vertex,x1_3_vertices,x2_vertex);
mapshow(xi_13,yi_13,'DisplayType','point','Marker','o')
```



Point of intersection

$$xi_{13} = 163.16$$

$$yi_{13} = 90.52$$



# Points of Intersection: Equations 1 and 3

