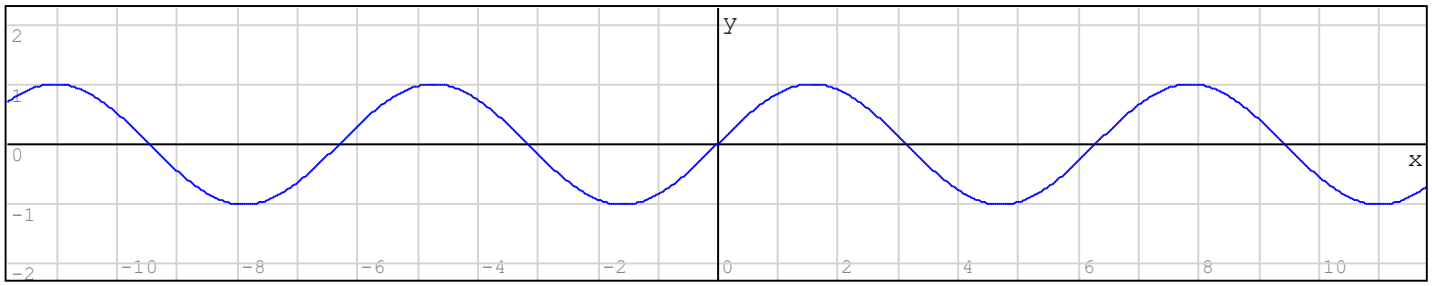
Basics of 2D Graph

Sine function

$$f(x) := \sin(x)$$

Graph of Sine Function

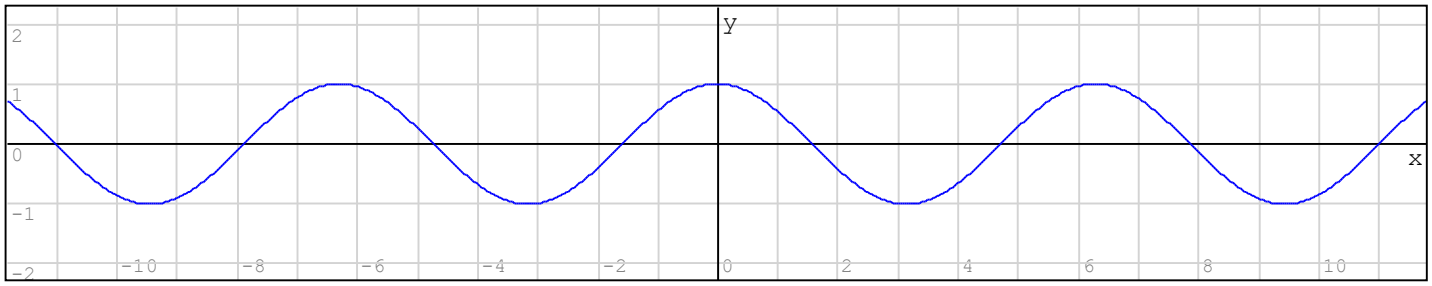


$f(x)$

Cosine function

$$g(x) := \cos(x)$$

Graph of Cosine Function

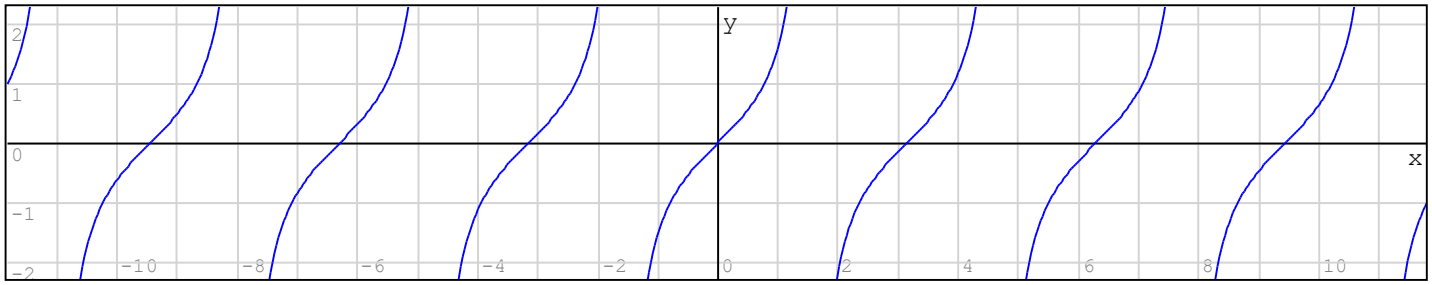


$g(x)$

Tangent Function

$$h(x) := \tan(x)$$

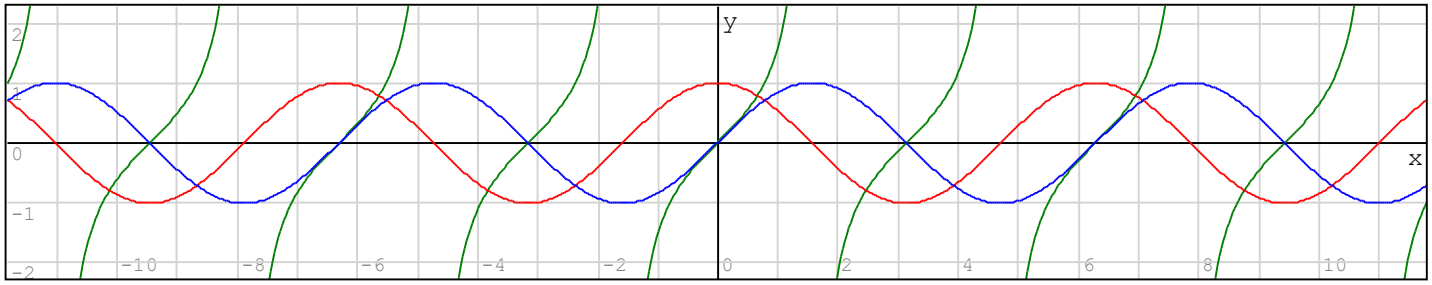
Graph of Tangent Function



$h(x)$

Merging of various graphs

Graph of Sine, Cosine, Tangent Function



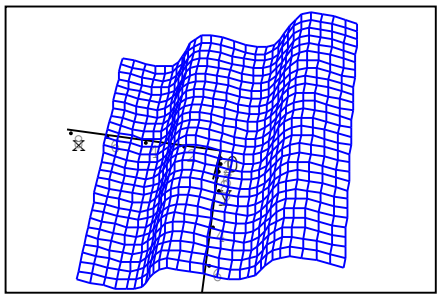
$$\begin{cases} f(x) \\ g(x) \\ h(x) \end{cases}$$

Basic of 3D graphs

Sine function

$$f(x) := \sin(x)$$

3D Graph of Sine Function

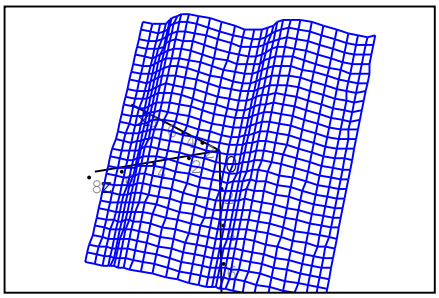


$f(x)$

Cosine function

$$g(x) := \cos(x)$$

3D Graph of Cosine Function

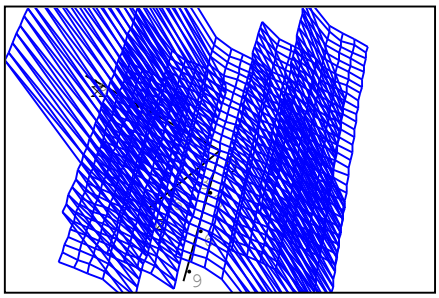


$g(x)$

Tangent Function

$$h(x) := \tan(x)$$

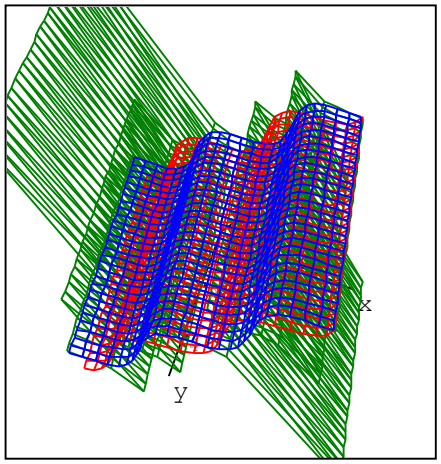
3D Graph of Tangent Function



$h(x)$

Merging of 3D Graphs

3D Graph of Sine, Cosine and Tangent function



$$\begin{cases} f(x) \\ g(x) \\ h(x) \end{cases}$$

Graph of Data Set Points

Using Matrix to consolidate data

$$Legends := \begin{bmatrix} 8 & 1.3 & \text{"Sine"} & 10 & \text{"Blue"} \\ 10 & 1.3 & \text{"Cosine"} & 10 & \text{"Red"} \\ 3 & 3 & \text{"X"} & 10 & \text{"Green"} \end{bmatrix}$$

Vectorize First Function

$$f(x) := \overrightarrow{\sin(x)}$$

Augment for x, y values of f(x)

$$FF := \text{augment}(x, f(x))$$

VectorizeSecond Function

$$g(x) := \overrightarrow{\cos(x)}^{2}$$

Augment for x,y values of g(x)

$$GG := \text{augment}(x, g(x))$$

VectorizeThird Function

$$h(x) := \vec{x}$$

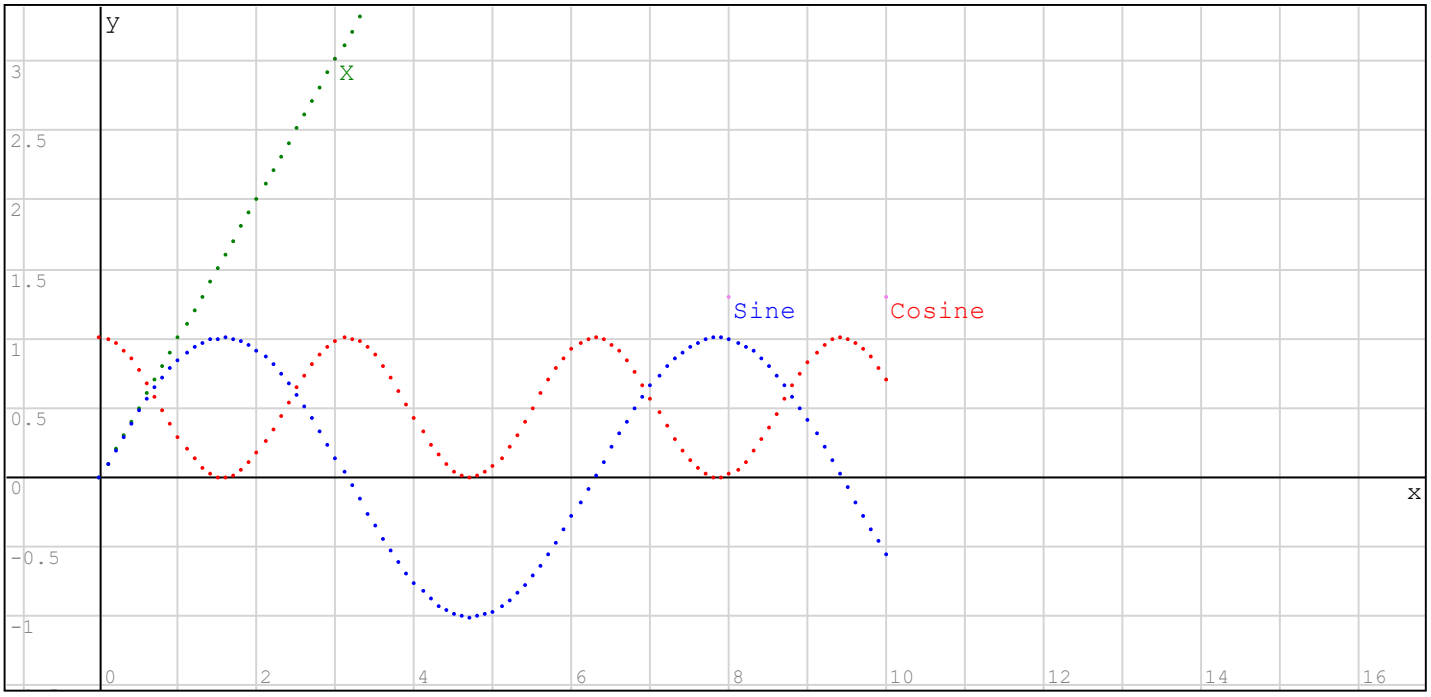
Augement for x,y values of h(x)

$$HH := \text{augment}(x, h(x))$$

Creating a list of values

$$x := [0, 0.1 .. 10] = \begin{bmatrix} 0 \\ 0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ 0.5 \\ 0.6 \\ 0.7 \\ 0.8 \\ 0.9 \\ 1 \\ 1.1 \\ 1.2 \\ 1.3 \\ 1.4 \\ 1.5 \\ 1.6 \\ 1.7 \\ 1.8 \\ \vdots \end{bmatrix}$$

Graph of merged data points



$$\begin{Bmatrix} FF \\ GG \\ HH \\ Legends \end{Bmatrix}$$

Chemical Engineering VLE Problem

Properties

Component Name

Name of the most volatile component

$Component_1 := \text{"Benzene"}$

Name of the least volatile component

$Component_2 := \text{"Toluene"}$

Antoine Constants

Enter Antoine's constants for each of the components that make up the binary mixture. In mm Hg and K

Constant "A" of the most volatile component

$A_{EMV} := 15.9007$

Constant "A" of the least volatile component

$A_{emv} := 16.0137$

Constant "B" of the most volatile component

$B_{EMV} := 2788.51$

Constant "B" of the least volatile component

$B_{emv} := 3096.52$

Constant "C" of the most volatile component

$C_{EMV} := -52.36$

Constant "C" of the least volatile component

$C_{emv} := -53.67$

$$CA := \begin{bmatrix} \text{"Data"} & \text{"A"} & \text{"B"} & \text{"C"} \\ Component_1 & A_{EMV} & B_{EMV} & C_{EMV} \\ Component_2 & A_{emv} & B_{emv} & C_{emv} \end{bmatrix}$$

Generan Table to display output

Antoine Constants			
Data	A	B	C
Benzene	15.9007	2788.5100	-52.3600
Toluene	16.0137	3096.5200	-53.6700
NOTE: Units in mmHg and K			

System Pressure

Matrix of A Constant

$$A := \begin{bmatrix} A_{EMV} \\ A_{emv} \end{bmatrix}$$

Matrix of B constant

$$B := \begin{bmatrix} B_{EMV} \\ B_{emv} \end{bmatrix}$$

Matrix of C constant

$$C := \begin{bmatrix} C_{EMV} \\ C_{emv} \end{bmatrix}$$

Enter pressure in mmHg

$P := 760$

Saturation temperatures

Vectorize Temperature Function

$$T_K := \overrightarrow{\frac{B}{A - \ln(P)} - C}$$

Defining Unit

$Temp := T_K \text{ K}$

Saturation Temperature 1 in K

$Temp_1 = 353.2551\ K$

Saturation Temperature 1 in C

$Temp_1 = 80.1051\ °C$

Saturation Temperature 2 in K

$Temp_2 = 383.776\ K$

Saturation Temperature 1 in C

$Temp_2 = 110.626\ °C$

$$Temperature := \begin{bmatrix} T_{K_2} \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 1 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 2 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 3 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 4 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 5 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 6 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 7 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 8 \right) \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 9 \right) \\ T_{K_1} \end{bmatrix} = \begin{bmatrix} 383.776 \\ 380.7239 \\ 377.6718 \\ 374.6197 \\ 371.5676 \\ 368.5156 \\ 365.4635 \\ 362.4114 \\ 359.3593 \\ 356.3072 \\ 353.2551 \end{bmatrix}$$

Generalizing Temperature

$T := Temperature$

Vectorize P1 Pressure

$$P_1 := \overrightarrow{e^{\left(A_{EMV} - \frac{B_{EMV}}{Temperature + C_{EMV}}\right)}}$$

Vectorize P2 Pressure

$$P_2 := \overrightarrow{e^{\left(A_{emv} - \frac{B_{emv}}{Temperature + C_{emv}}\right)}}$$

Vectorize Composition of X

$$X := \overrightarrow{\frac{P - P_2}{P_1 - P_2}}$$

Vectorize Compostion of Y

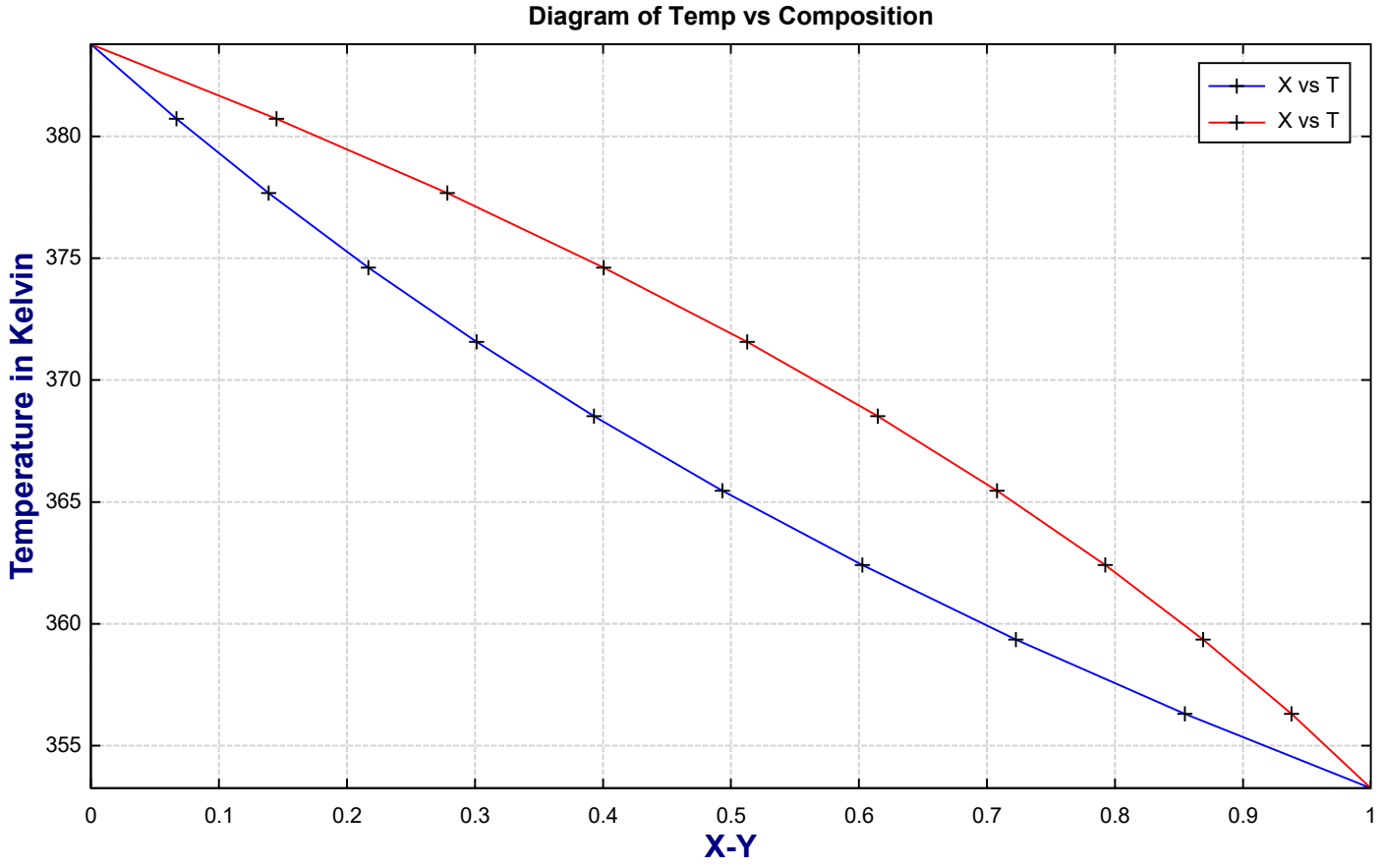
$$Y := \overrightarrow{\frac{X \cdot P_1}{P}}$$

Matrix to consolidate data for plotting

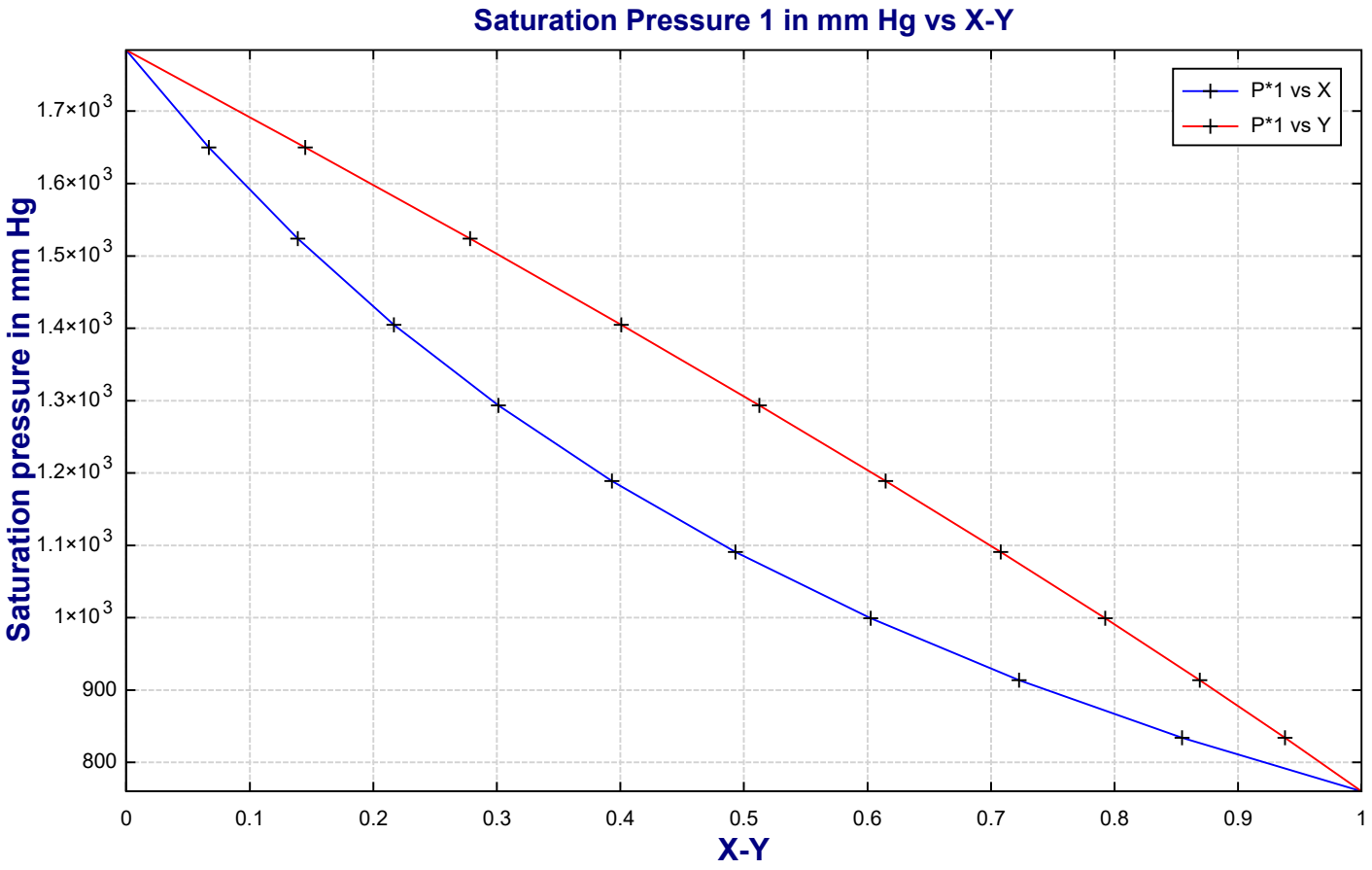
$$RSB := \begin{bmatrix} \text{"Temperature"} & \text{"P1 mm Hg"} & \text{"P2 mm Hg"} & \text{"X"} & \text{"Y"} \\ T_{K_2} & P_{1_1} & P_{2_1} & X_1 & Y_1 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 1\right) & P_{1_2} & P_{2_2} & X_2 & Y_2 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 2\right) & P_{1_3} & P_{2_3} & X_3 & Y_3 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 3\right) & P_{1_4} & P_{2_4} & X_4 & Y_4 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 4\right) & P_{1_5} & P_{2_5} & X_5 & Y_5 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 5\right) & P_{1_6} & P_{2_6} & X_6 & Y_6 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 6\right) & P_{1_7} & P_{2_7} & X_7 & Y_7 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 7\right) & P_{1_8} & P_{2_8} & X_8 & Y_8 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 8\right) & P_{1_9} & P_{2_9} & X_9 & Y_9 \\ T_{K_2} - \left(\frac{T_{K_2} - T_{K_1}}{10} \cdot 9\right) & P_{1_{10}} & P_{2_{10}} & X_{10} & Y_{10} \\ T_{K_1} & P_{1_{11}} & P_{2_{11}} & X_{11} & Y_{11} \end{bmatrix}$$

RESULTS OF THE BINARY SYSTEM				
Temperature	P1 mm Hg	P2 mm Hg	X	Y
383.7760	1784.2839	760.0000	0.0000	0.0000
380.7239	1650.0593	696.2997	0.0668	0.1450
377.6718	1523.6942	636.8873	0.1388	0.2783
374.6197	1404.8846	581.5571	0.2167	0.4006
371.5676	1293.3298	530.1077	0.3012	0.5126
368.5156	1188.7326	482.3431	0.3931	0.6148
365.4635	1090.7998	438.0716	0.4932	0.7079
362.4114	999.2422	397.1069	0.6027	0.7924
359.3593	913.7754	359.2679	0.7227	0.8689
356.3072	834.1196	324.3786	0.8546	0.9379
353.2551	760.0000	292.2685	1.0000	1.0000

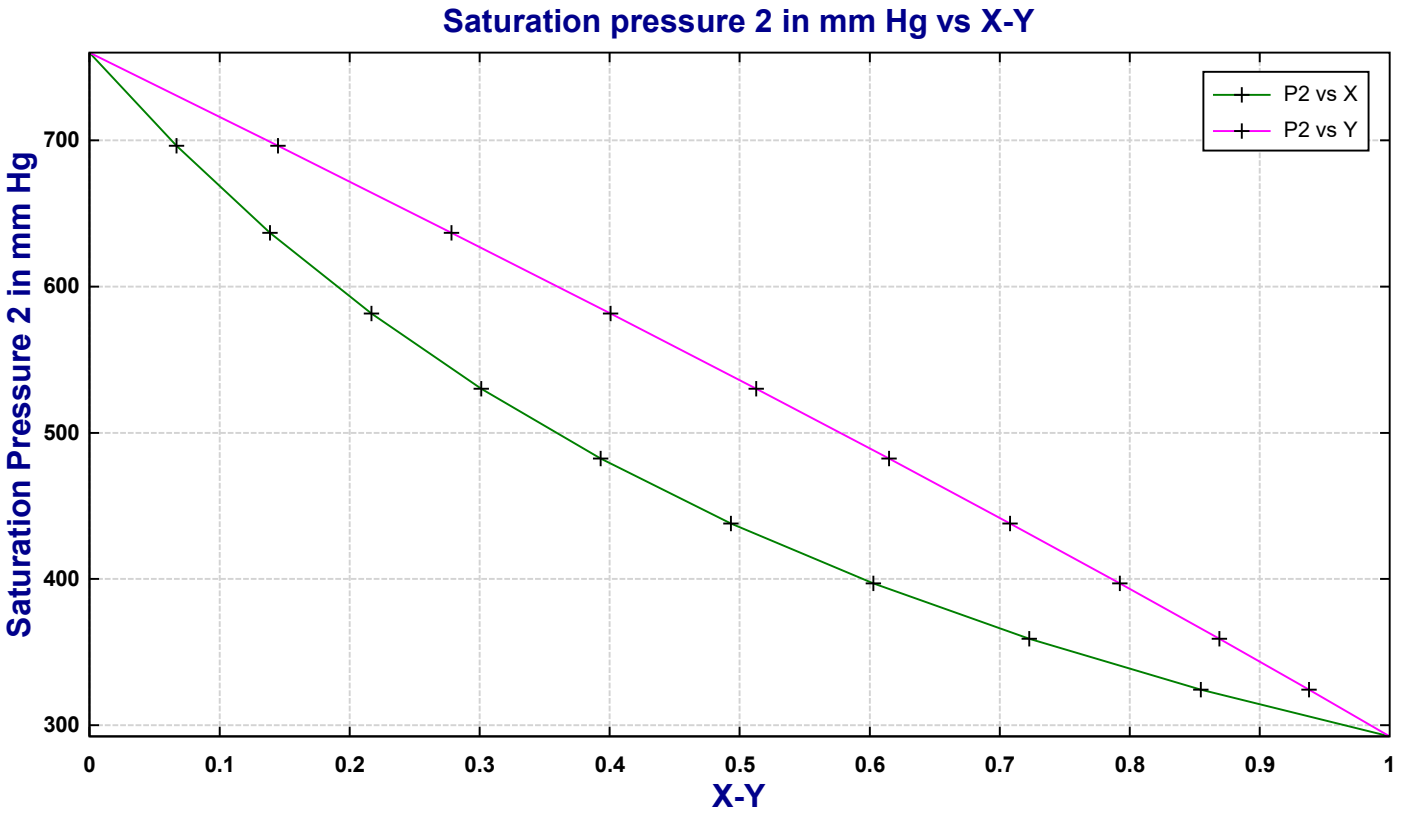
First Graph



Second Graph



Third Graph



Fourth Graph