Assignment 1 – Answers

1. **Q:** Figure out data coordinates of the dataset, i.e., min & max of each dimension (SATM, SATV, ACT, GPA)

   Ans:

   From the data statistics:

	SATM	SATV	ACT	GPA
count	271.000000	271.000000	271.000000	271.000000
mean	622.952030	614.612546	27.697417	3.352469
std	89.476634	92.838656	4.208100	0.510941
min	370.000000	280.000000	15.000000	1.704000
25%	560.000000	560.000000	25.000000	3.034500
50%	630.000000	630.000000	28.000000	3.475000
75%	690.000000	680.000000	31.000000	3.764500
max	800.000000	800.000000	35.000000	4.000000

   We can know that the coordinates are:

   SATM: [370, 800]

   SATV: [280, 800]

   ACT: [15, 35]

   GPA: [1.704, 4.0]

2. **Q:** Determine view volume coordinates, for SATM and SATV, that are suitable for visualization.

   Ans:

   SATM: [200, 1000]

   SATV: [200, 1000]

3. **Q:** Suppose you would like to map the scores of SATM (x-axis) and SATV (y-axis) onto a viewport of [(100,100), (200,200)], what transformation matrix would you use? Describe how the matrix is derived.

   Ans:

   To transform [(200, 200), (1000, 1000)] to [(100,100), (200,200)], we can use $\vec{Q} = \vec{M}\vec{P} + \vec{T}$,

   so that the scaling coordinates are: (S_x, S_y)

   S_x=S_y=(200-100)/(1000-200)=100/800=1/8

   i.e. $\vec{M}$ =(1/8, 1/8)^T

   Translation coordinates are: (T_x, T_y)

   T_x=T_y=-200*1/8+100=75

   i.e. $\vec{T}$ =(75, 75)^T

So the scaling matrix is $M=\begin{bmatrix} 1/8 & 0 \\ 0 & 1/8 \end{bmatrix}$

The translation matrix is $T=\begin{bmatrix} 75 \\ 75 \end{bmatrix}$

4. **Q:** Figure out position of the first data point (430, 470) in the viewport.
   Ans:

   In this case, $\vec{P}=(430, 470)^T$,

   $$\vec{Q}=\overrightarrow{M}\vec{P}+\vec{T}=\begin{bmatrix} 1/8 & 0 \\ 0 & 1/8 \end{bmatrix}\begin{bmatrix} 430 \\ 470 \end{bmatrix}+\begin{bmatrix} 75 \\ 75 \end{bmatrix}=\begin{bmatrix} 128.75 \\ 133.75 \end{bmatrix}$$

   So the view point of (430, 470) is (128.75, 133.75)