Linear transformations with Matrices lesson 1 - Translation of a point
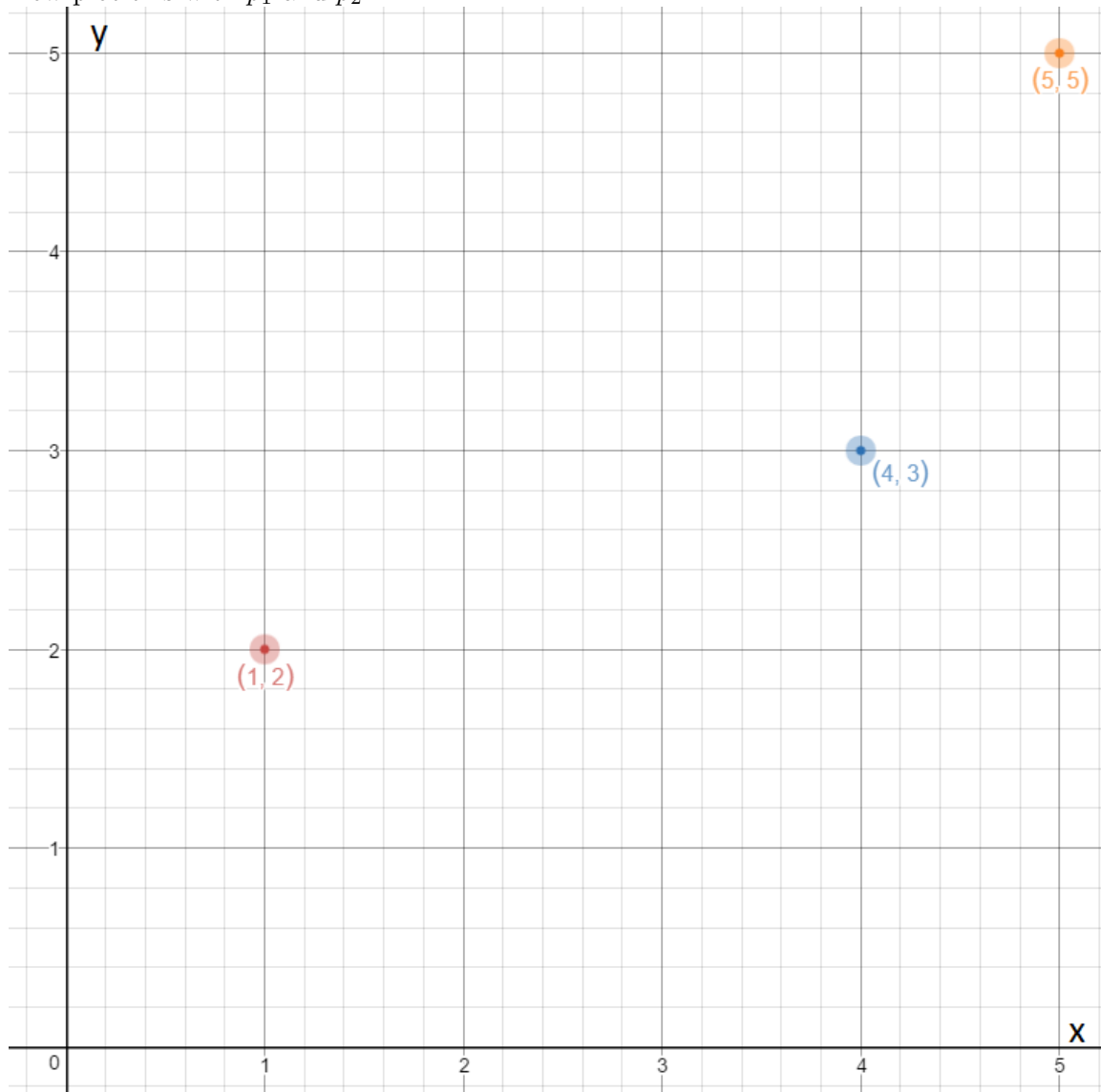
Magic Monk Tutorials

1 Translate the point $p_1 = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ by the point $p_2 = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and plot it in the x-y plane.

Add the two points.

$$\begin{pmatrix} 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 4 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 5 \end{pmatrix}$$

Now plot this with p_1 and p_2.

2 Translate the below triangle with the translation $T = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$ and plot the result in the x-y plane.

Take the corner points in the triangle. We may add our translation to these points, draw these points and our triangle can be made by joining them together. This is because the translation only moves points, not scales them.

The points are as follows. $p_1 = \begin{pmatrix} 0 \\ 4 \end{pmatrix}, p_2 = \begin{pmatrix} 4 \\ 4 \end{pmatrix}, p_3 = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$. Translate each of these points.

$$p_1 + T = \begin{pmatrix} 0 \\ 4 \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

$$p_2 + T = \begin{pmatrix} 4 \\ 4 \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$$

$$p_3 + T = \begin{pmatrix} 0 \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

Now plot each of these points and join them together, as below.
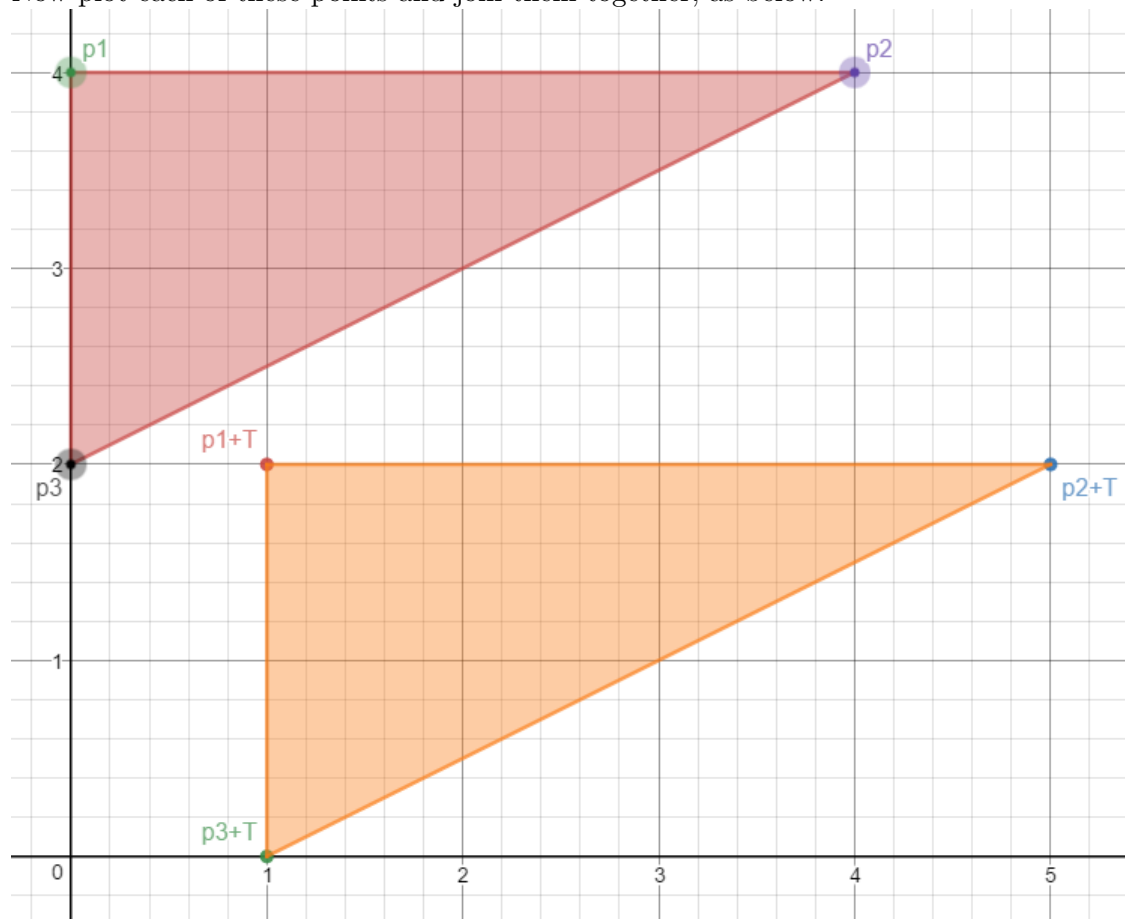
3 Translate the below circle with the translation $T = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ and plot the result in the x-y plane.

Similar to the previous question, take the points on the circle at $\begin{pmatrix} 0 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \begin{pmatrix} -1 \\ 0 \end{pmatrix}, \begin{pmatrix} -1 \\ 0 \end{pmatrix}$.

Now translate each of these points by T. This results in $\begin{pmatrix} 1 \\ 2 \end{pmatrix}, \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \end{pmatrix}$.

Now we may plot this change on the x-y plane as below. Then one may also draw a circle that has these points as 4 points on their circumference. This has also been done below.