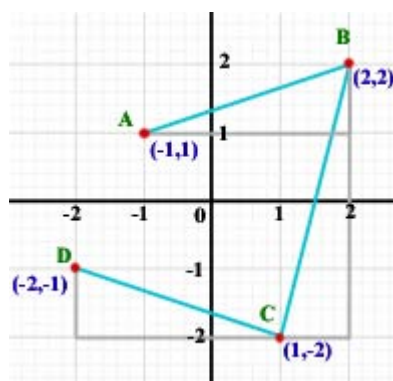


Translation of points

A point  $(x,y)$  can be moved to another position by applying a column matrix vector.

A column matrix vector is just two numbers, one above the other, surrounded by long brackets. The top number adds to the x-coordinate while the bottom number adds to the y-coordinate.

$(x,y)$  transformed by the column vector  $\begin{pmatrix} a \\ b \end{pmatrix}$   
gives the new point  $(x+a, y+b)$

Example

move **right** or **left** = **x** more **positive** or more **negative**  
move **up** or **down** = **y** more **positive** or more **negative**

A(-1,1) to B(2,2) by going to the **right 3** and **up 1** by applying vector  $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$

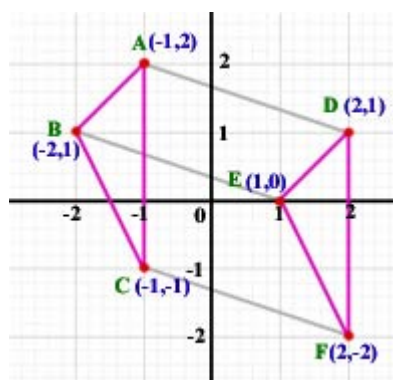
B(2,2) to C(1,-2) by going to the **left 1** and **down 4** by applying vector  $\begin{pmatrix} -1 \\ -4 \end{pmatrix}$

C(1,-2) to D(-2,-1) by going to the **left 3** and **up 1** by applying vector  $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$

Translation of shapes

This is similar to the translation of a point except that the vector column matrix is applied to each point of the shape in turn to move the whole shape to another position.

example Translate the triangle ABC by the vector column matrix  $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$



Each x-coordinate is increased by 3 (moved right 3)

Each y-coordinate is reduced by 1 (moved down 1)

Reflections

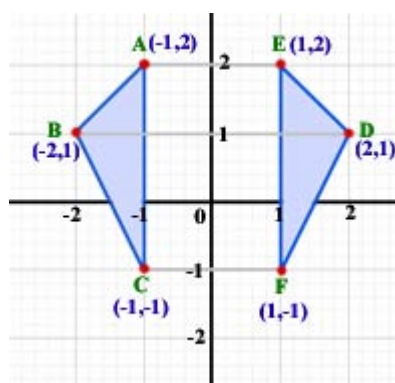
A reflection is a mirror image of the shape about an arbitrary line. This line can be for example  $x=0$ (y-axis),  $y=3$ ,  $y=x$ (diagonal) etc.

Reflected points can be located by remembering that:

**each point is as far in front of the line as the image of the point is behind**

So measure the perpendicular distance of each point on the shape from the mirror line, then measure each distance the other side of the line to locate the points.

Example Draw the reflection of triangle ABC in the y-axis.



Point A is 1 unit in front of the y-axis mirror. Therefore the reflected point(E) is 1 unit the other side of the line.

Similarly, B is 2 units in front. D is 2 units behind. C is 1 unit in front. F is 1 unit behind.

Method for locating mirror images

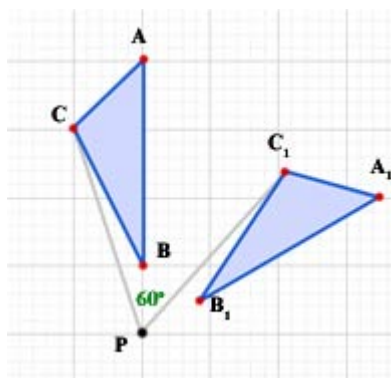
- Use your set-square to draw perpendiculars from the 'mirror line' through each point of the shape
- Measure the point-'mirror line' distance for each point.
- Produce each line **behind** the mirror line the **same distance** to locate the mirrored points.

Rotations

In order to rotate a shape, 3 pieces of information are required:

**the centre of rotation - the direction of rotation - the angle of rotation**

Example - Rotate triangle ABC through 60 deg. in a clockwise direction about point P.

method

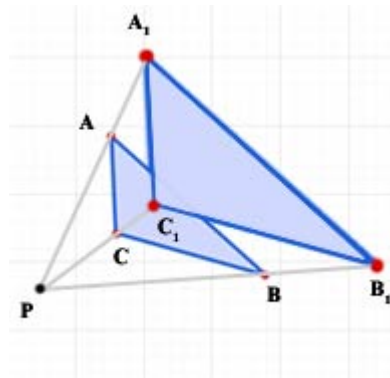
- draw a line PC between P and C
- measure the line PC
- draw a line 60 deg. clockwise from PC, centre P, the same length as PC
- repeat the method for **B** and **A** on the original shape
- finally join up the ends of the lines to make the original shape but rotated through 60 deg.

Enlargements

In order to enlarge a shape, 2 pieces of information are required:

**the centre of enlargement - the scale factor**

Example Enlarge triangle ABC by a scale factor of 1.5 from the point P.

method

- Draw a line through A, measuring 1.5 times PA.
- Draw a line through B, measuring 1.5 times PB.
- Draw a line from P through C, measuring 1.5 times PC.
- Join up the ends of the lines.