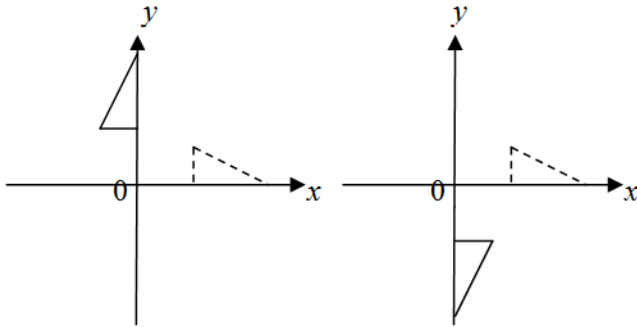


Math Lesson (Suitable for Years 8 to 12)

Transformations of 2D figures © itute 2018

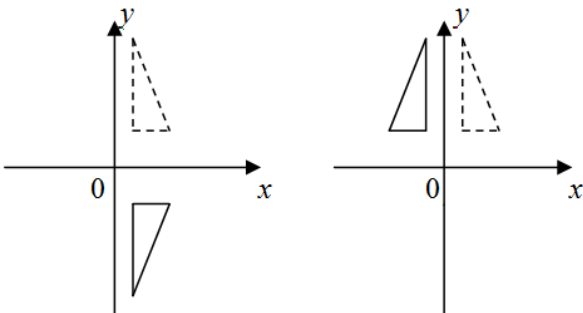
(i) *Rotation about the origin*



In the first diagram the triangle is rotated about the origin by an angle of $+90^\circ$. The positive sign indicates that the rotation is anticlockwise.

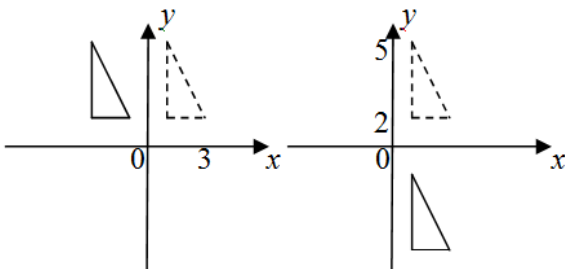
Clockwise rotation is represented by a negative angle. In the second example the angle of rotation is -90° (Note: It can also be considered as $+270^\circ$).

(ii) *Reflections in the x-axis and in the y-axis*



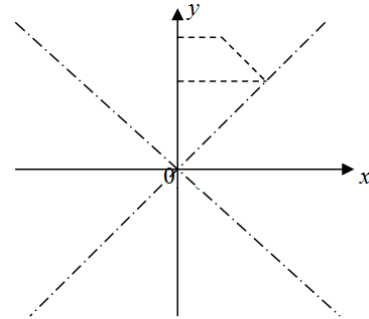
(Reflection in the x-axis) (Reflection in the y-axis)

(iii) *Horizontal and vertical translations*

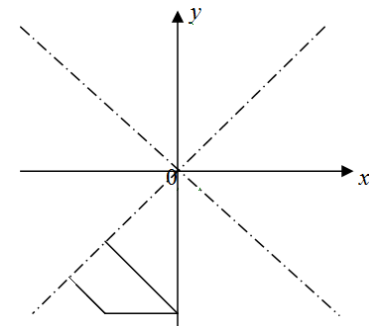


The first diagram shows the horizontal translation of the triangle to the left by 4 units. In the second diagram the triangle is translated vertically downwards by 9 units.

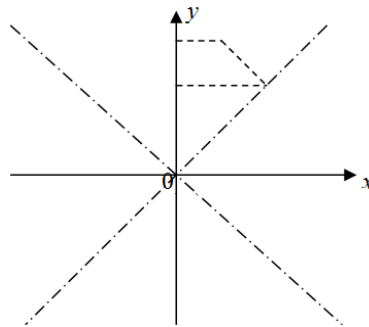
Example 1 Carry out the following transformations on the trapezium: Rotation about the origin by -135° and then a reflection in the y-axis.



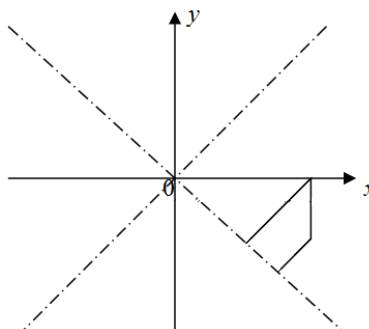
Solution:



Example 2 Carry out the following transformations on the trapezium in example 1: Reflection in the y-axis and then rotation about the origin by -135° .



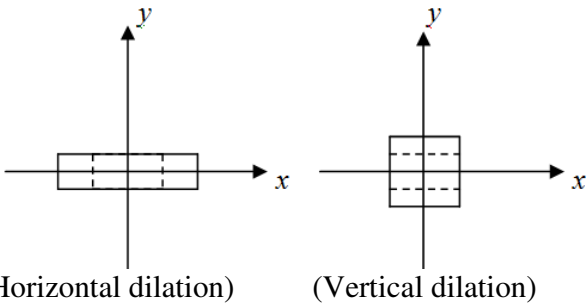
Solution:



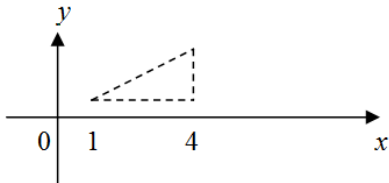
Does it matter which transformation is carried out first?

(iv) *Horizontal and vertical dilations*

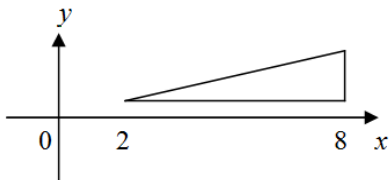
Dilation stretches or compresses a figure. It can be done horizontally or vertically. The extent of dilation is given by a dilation factor. If the horizontal dilation factor is 2, the figure is stretched so that its horizontal measurement is doubled. If the dilation factor is $\frac{1}{2}$, the figure is compressed to half of the original size. The same applies to a vertical dilation.



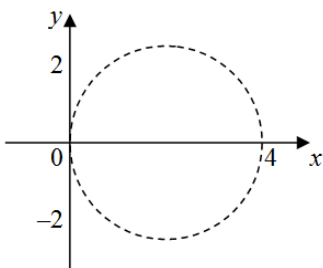
Example 1 Dilate the triangle horizontally by a factor of 2.



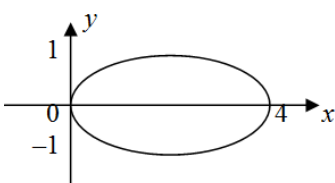
Solution:



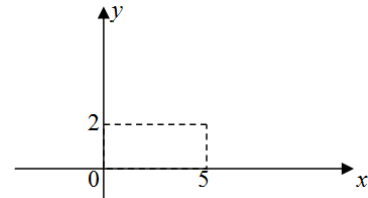
Example 2 Dilate the circle vert. by a factor of $\frac{1}{2}$.



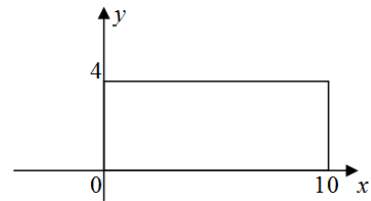
Solution:



Example 3 Dilate the rectangle horizontally by a factor of 2 and vertically by a factor of 3. By what factor does the area increase?

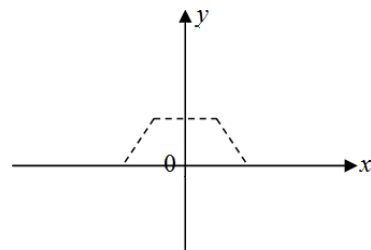


Solution:



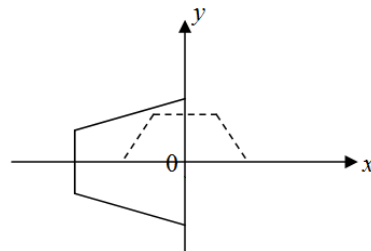
The area increases by a factor of $2 \times 3 = 6$.

Example 4 (a) Dilate the trapezium vertically by a factor of 2 and then rotate through an angle of $+90^\circ$ about the origin. (b) Repeat the transformations in reverse order on the original trapezium.

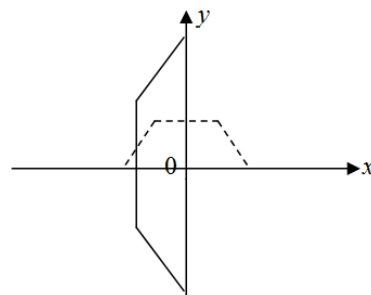


Solutions:

(a)



(b)

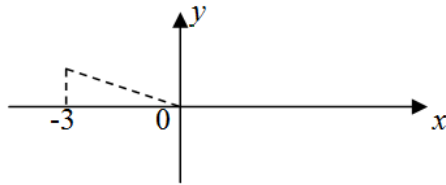


Are the two results the same?

Practice

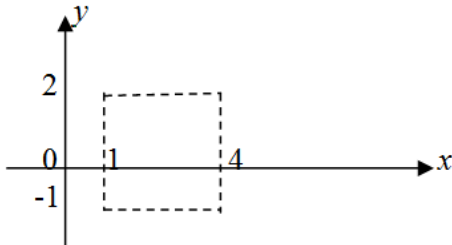
1. Carry out the following transformations on the triangle: Reflection in the y -axis and then a horizontal translation of 2 units to the right.

Repeat with the transformations in reverse order.

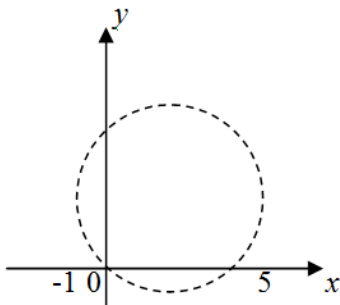


Are the two results the same?

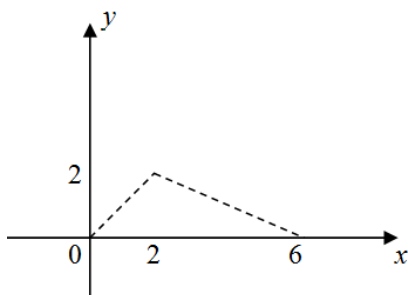
2. Dilate the square vertically by a factor of 2.



3. Dilate the circle horizontally by a factor of $\frac{1}{2}$.



4. Dilate the triangle horizontally by a factor of $\frac{1}{2}$ and vertically by a factor of 4. By what factor does the area increase?



5. Dilate the diamond vertically by a factor of 2 and then rotate through an angle of -90° about the origin. Repeat the transformations in reverse order on the original trapezium. Are the two results the same?

