

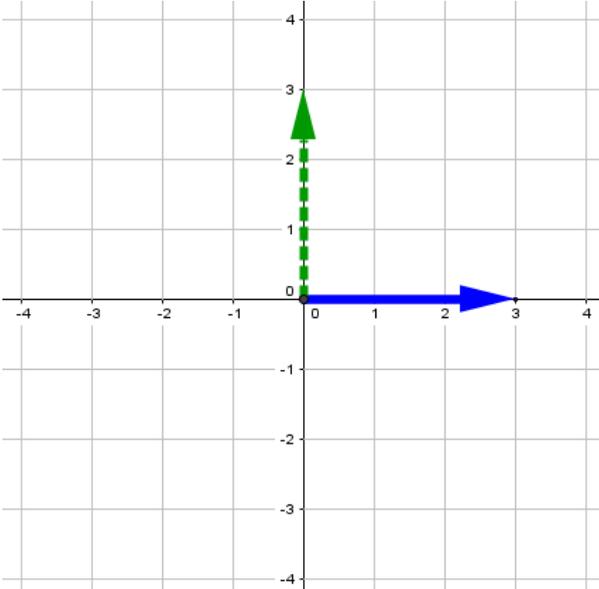
Rotation

Once you have completed this booklet you should be able to:

- Understand how 90° , 180° and 270° rotation affects horizontal and vertical lines
- Rotate a vertical or horizontal arrow 90° , 180° or 270° clockwise or anti-clockwise
- Rotate an arrow in any direction around its base by 90° , 180° or 270°
- Rotate a shape around one of its corners by 90° , 180° or 270° in either direction

Section A: Describing rotations

1. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

_____ $^\circ$ **clockwise/anti-clockwise**

around its base to give the green arrow.

The original (blue) arrow was pointing:

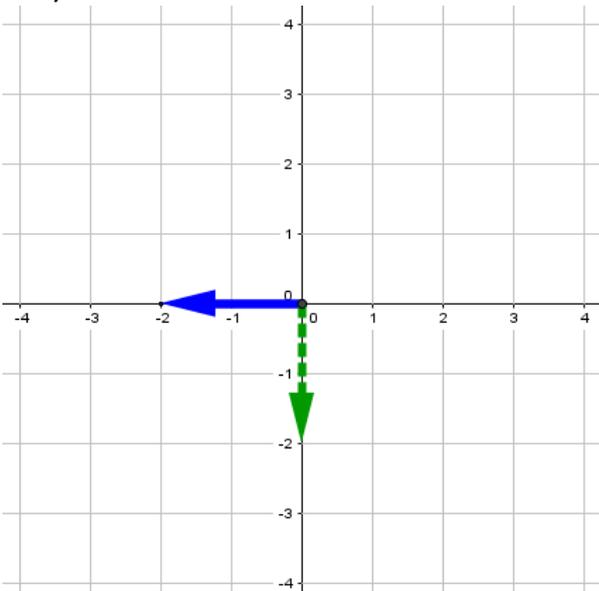
up / down / left / right

The new (green) arrow is pointing:

up / down / left / right

b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

2. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

_____ $^\circ$ **clockwise/anti-clockwise**

around its base to give the green arrow.

The original (blue) arrow was pointing:

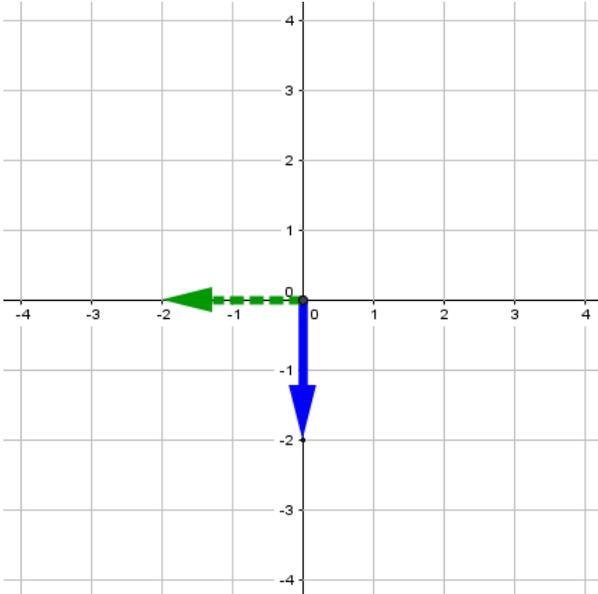
up / down / left / right

The new (green) arrow is pointing:

up / down / left / right

b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

3. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

_____ ° **clockwise/anti-clockwise**
around its base to give the green arrow.

The original (blue) arrow was pointing:

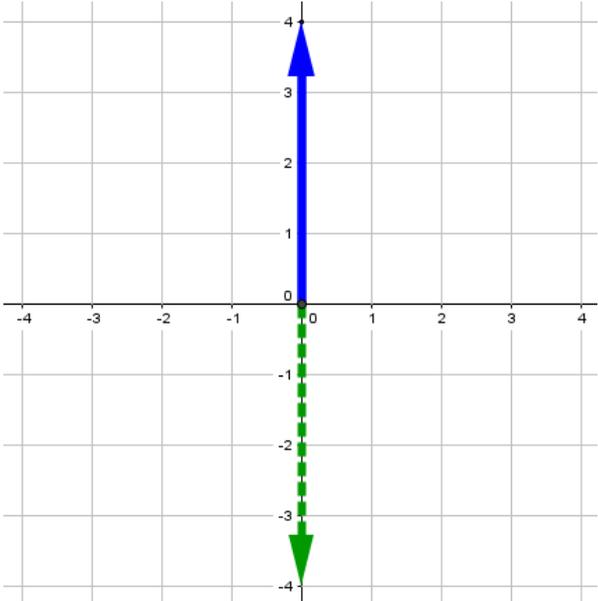
up / down / left / right

The new (green) arrow is pointing:

up / down / left / right

b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

4. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

_____ ° **clockwise/anti-clockwise**
around its base to give the green arrow.

The original (blue) arrow was pointing:

up / down / left / right

The new (green) arrow is pointing:

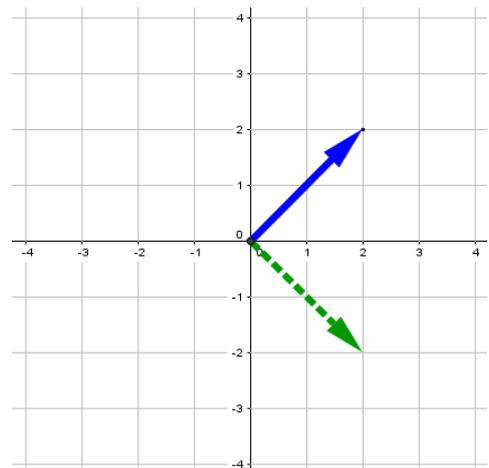
up / down / left / right

b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

5. The blue arrow in the diagram has been rotated **270° anti-clockwise** to give the green dotted arrow.

Describe the *same* rotation using *different* instructions:

_____ ° **clockwise/anti-clockwise**

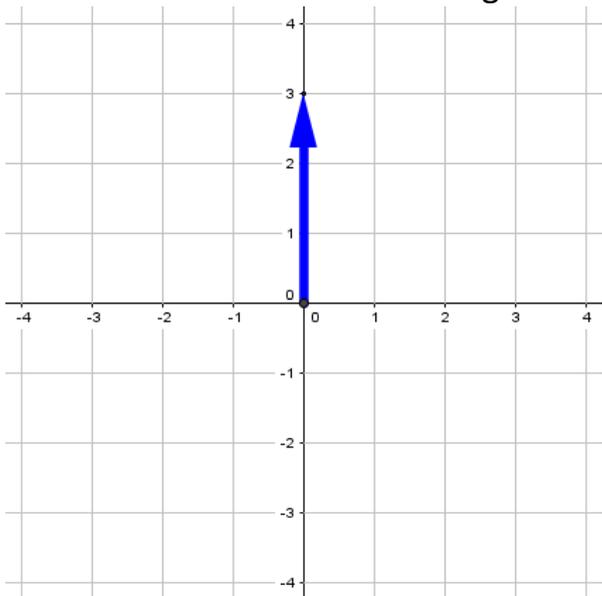


Section B: Rotating horizontal and vertical arrows

For now, all rotations will be turning around the point (0,0) (known as the 'origin').

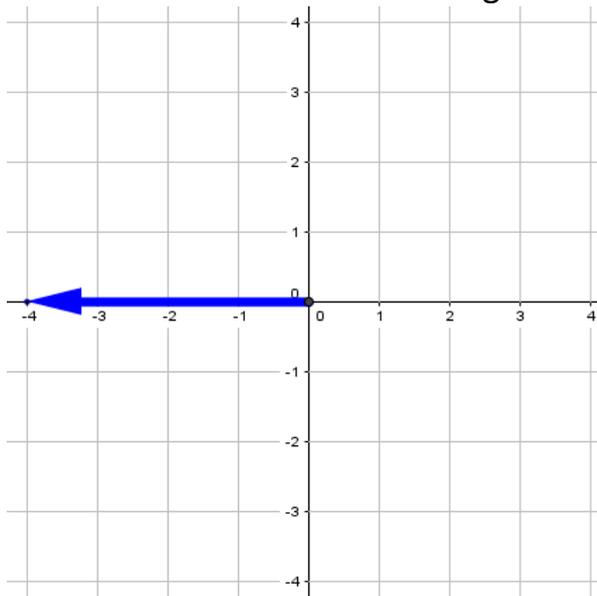
1. Rotate the blue arrow **90° clockwise**.

Draw the new arrow on the diagram:



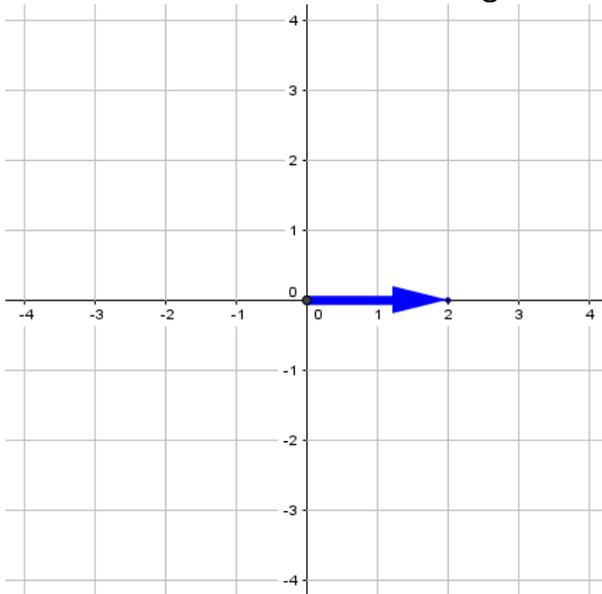
2. Rotate the blue arrow **90° anti-clockwise**.

Draw the new arrow on the diagram:



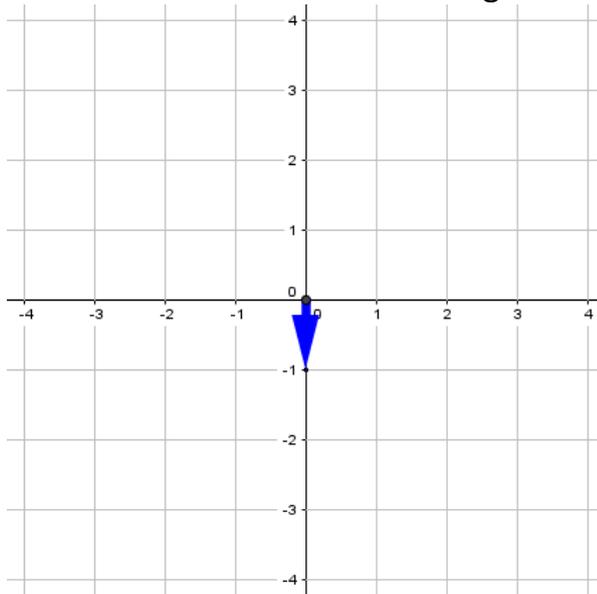
3. Rotate the blue arrow **180° clockwise**.

Draw the new arrow on the diagram:



4. Rotate the blue arrow **270° clockwise**.

Draw the new arrow on the diagram:



5. Complete the sentences below to show the effect of different rotations.

Eg: A **90° clockwise** rotation changes an **up** arrow into a **right** arrow.

A **90° anti-clockwise** rotation changes a **down** arrow into a _____ arrow.

A **180°** rotation changes a **left** arrow into a _____ arrow.

A **270°** _____ rotation changes a _____ arrow into a **down** arrow.

Can you find a *different* (but also correct) way to complete that last one?

A **270°** _____ rotation changes a _____ arrow into a **down** arrow.

6. After a **90° clockwise** rotation:

- a) What direction would an **up** arrow face?
- b) What direction would a **down** arrow face?
- c) What direction would a **left** arrow face?
- d) What direction would a **right** arrow face?

7. After a **90° anti-clockwise** rotation:

- a) What direction would an **up** arrow face?
- b) What direction would a **down** arrow face?
- c) What direction would a **left** arrow face?
- d) What direction would a **right** arrow face?

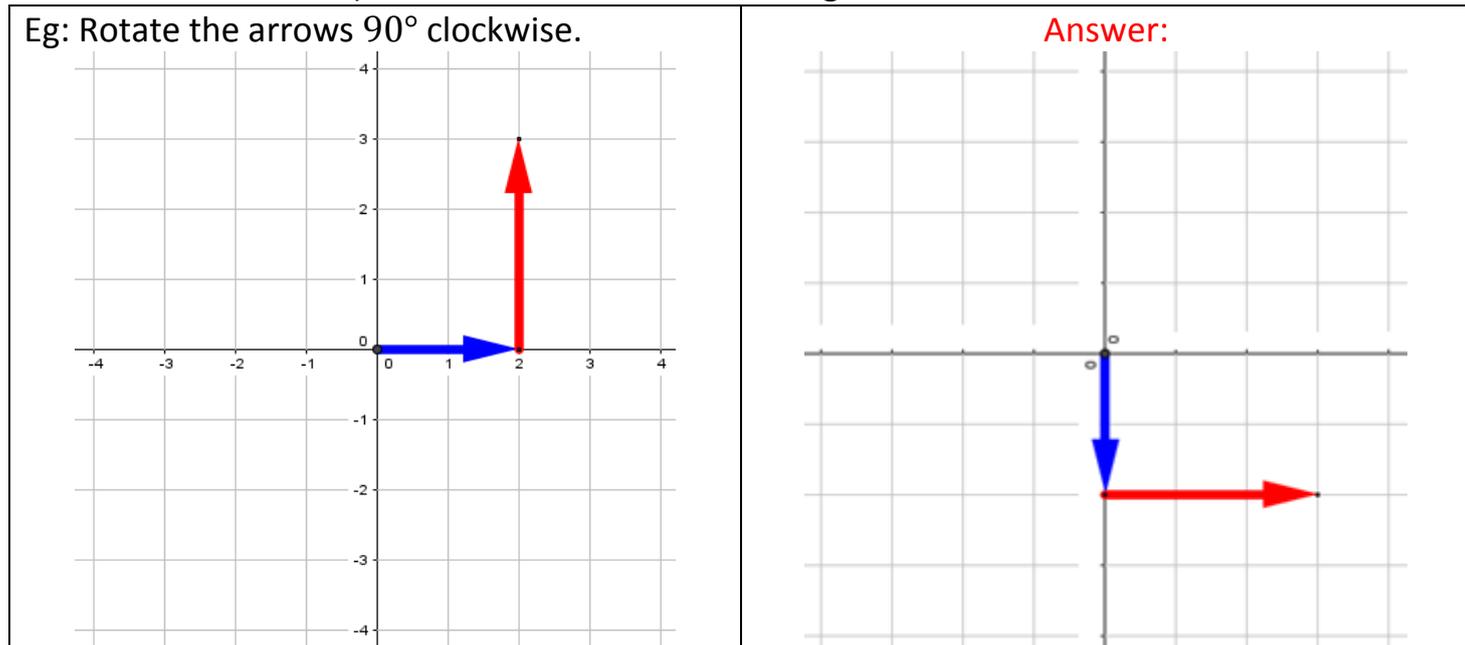
8. After a **180°** rotation (in either direction):

- a) What direction would an **up** arrow face?
- b) What direction would a **down** arrow face?
- c) What direction would a **left** arrow face?
- d) What direction would a **right** arrow face?

9. When an arrow is **rotated**, what happens to the **length** of the arrow?

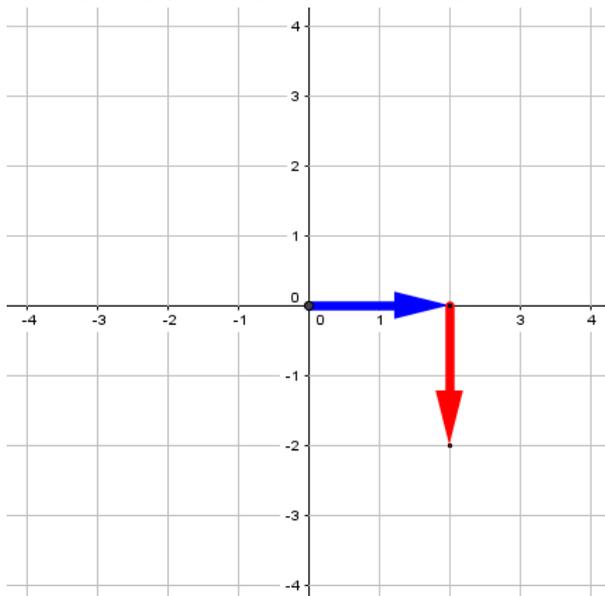
Section C: Rotating any arrow

In the example below, **both** arrows are rotated around the origin (the point $(0,0)$) which is the base of the blue arrow). The result is shown on the right-hand side:

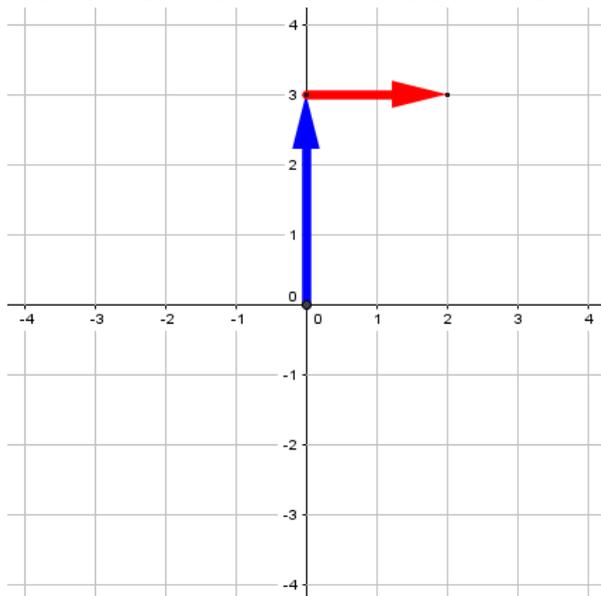


1. On the same diagram, rotate **both** arrows about the origin, following the instructions given:

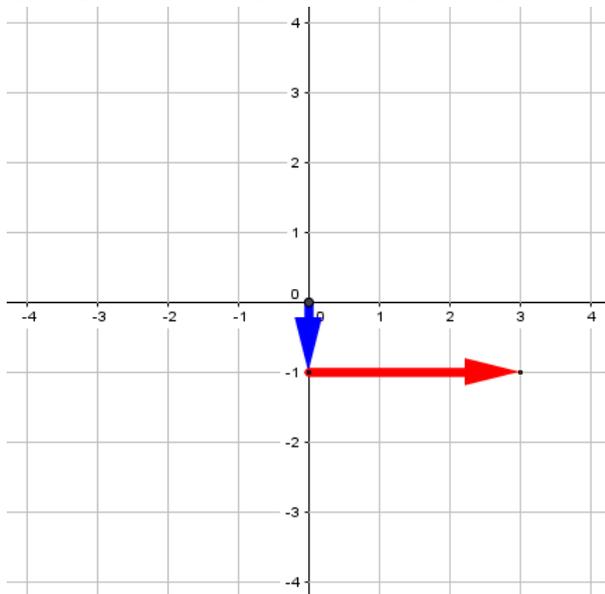
a) Rotate the arrows 90° clockwise.



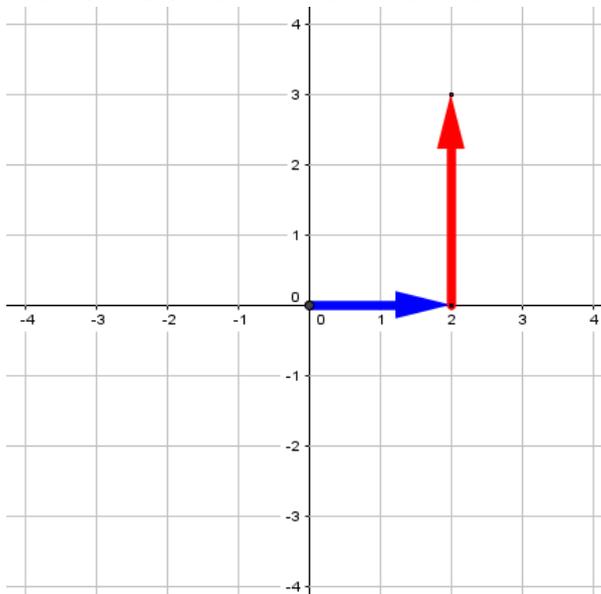
b) Rotate the arrows 90° anticlockwise.



c) Rotate the arrows 180° clockwise.

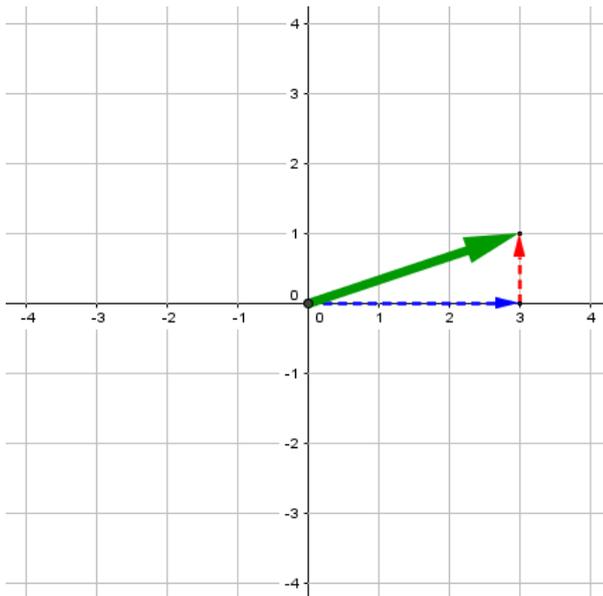


d) Rotate the arrows 270° anticlockwise.

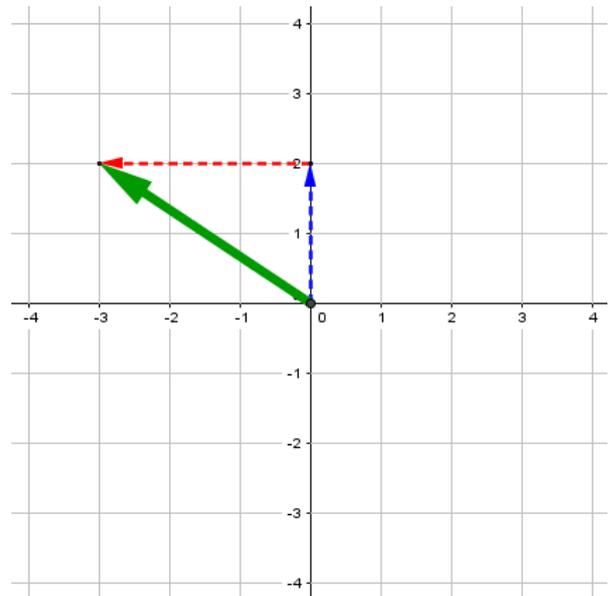


2. Rotate the **green arrow** around the point $(0,0)$, following the instructions given.
The easiest way to do this is to rotate the dotted blue and red arrows at the same time.

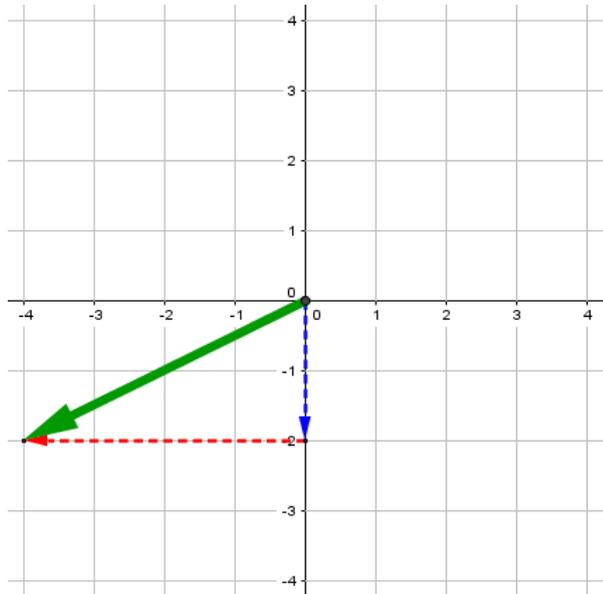
a) Rotate the arrow 90° clockwise.



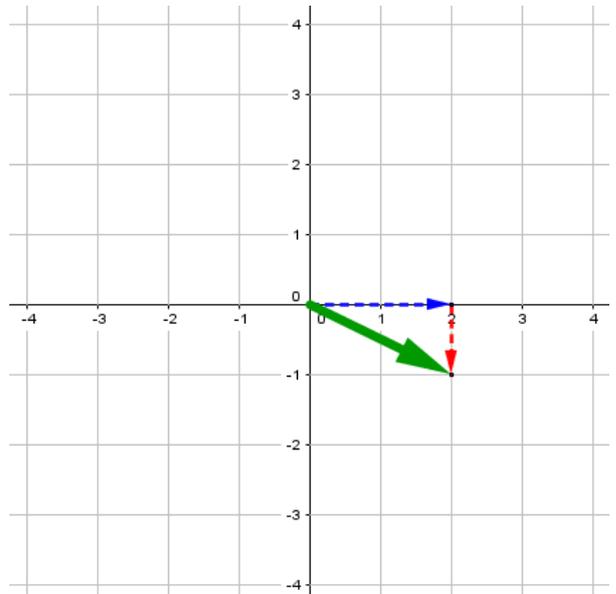
b) Rotate the arrow 90° anticlockwise.



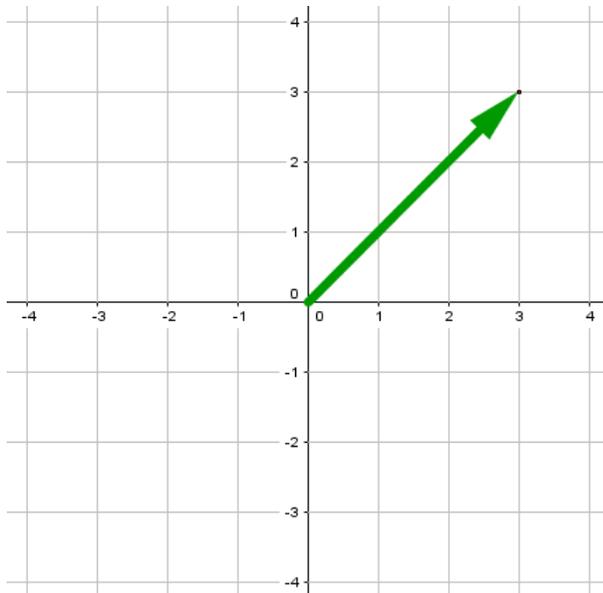
c) Rotate the arrow 180° clockwise.



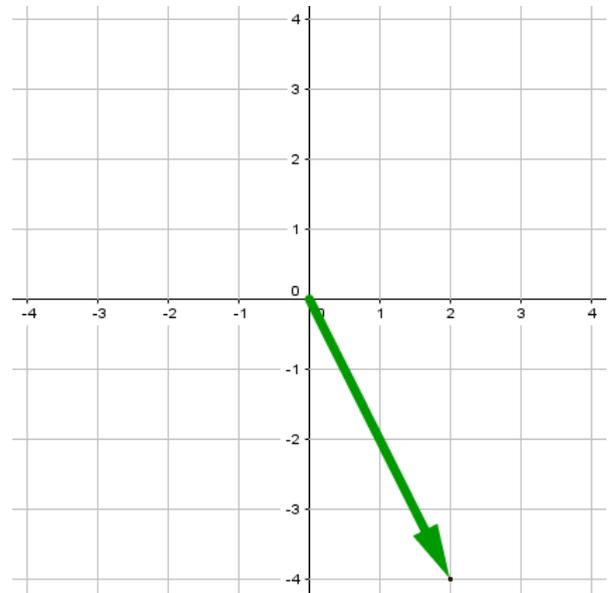
d) Rotate the arrow 270° anticlockwise.



e) Rotate the arrow 90° clockwise.



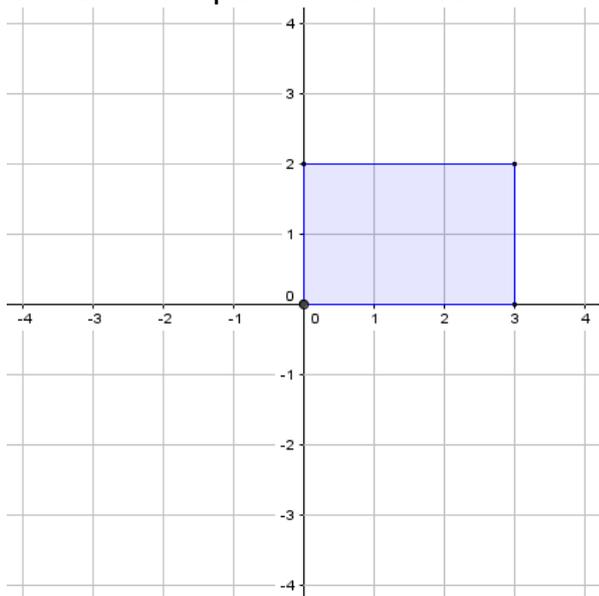
f) Rotate the arrow 270° clockwise.



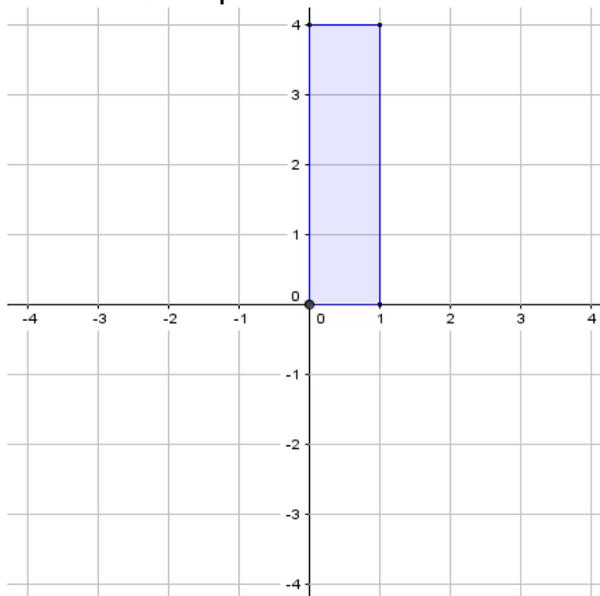
Section D: Rotating Shapes

1. Draw arrows to help you rotate these shapes around (0,0), following the instructions given:

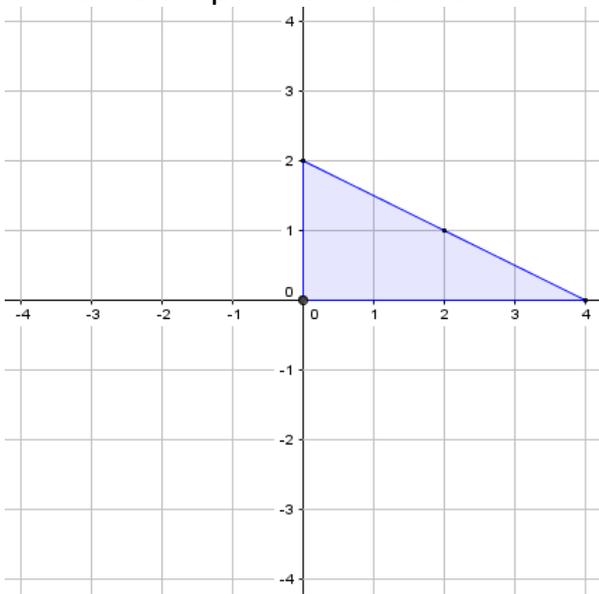
a) Rotate the shape 90° clockwise.



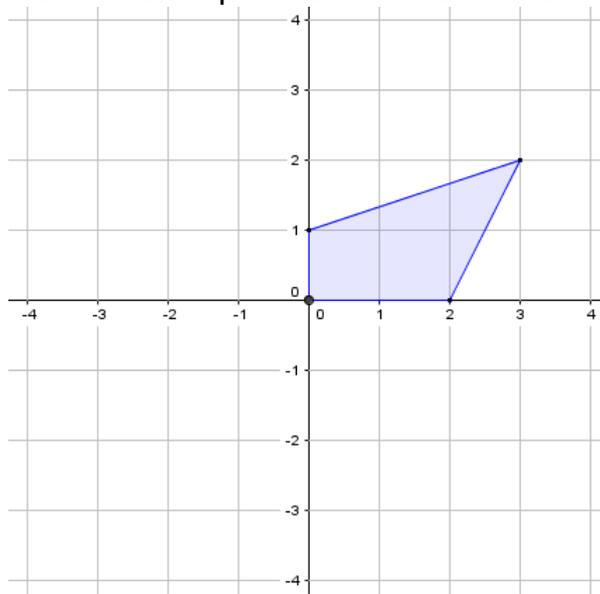
b) Rotate the shape 90° anticlockwise.



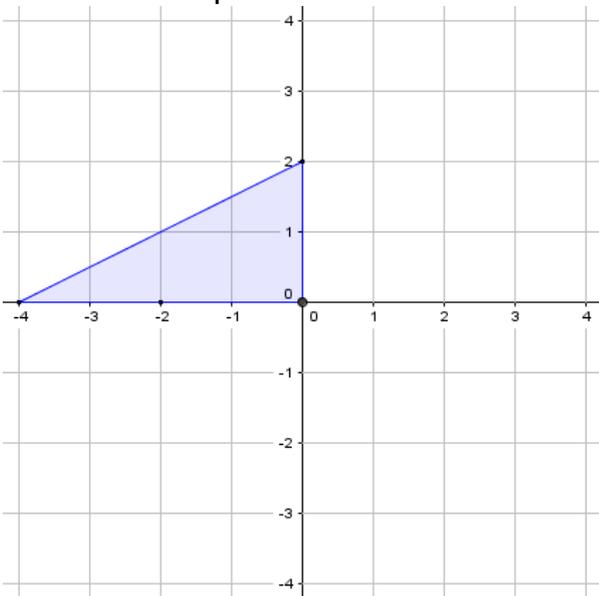
c) Rotate the shape 180° clockwise.



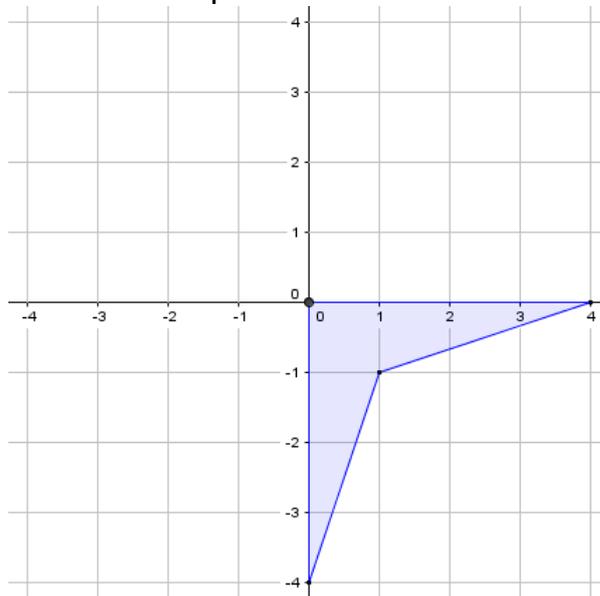
d) Rotate the shape 270° anticlockwise.



e) Rotate the shape 90° clockwise.

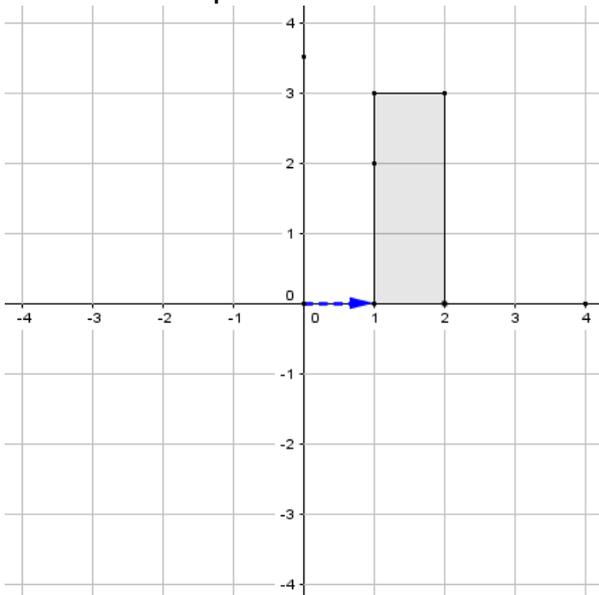


f) Rotate the shape 270° clockwise.

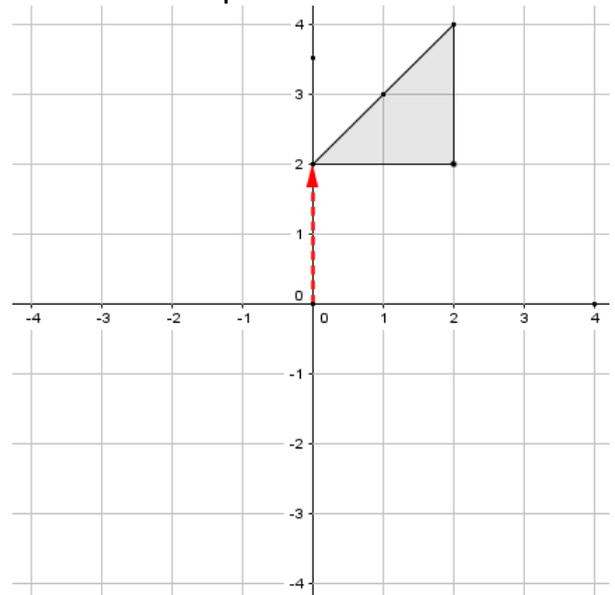


2. Use the arrows to help you rotate the shapes around (0,0), following the instructions given:

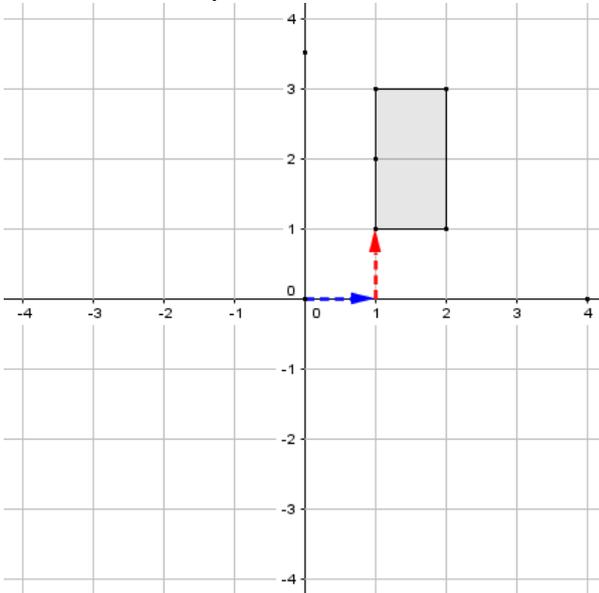
a) Rotate the shape 90° clockwise.



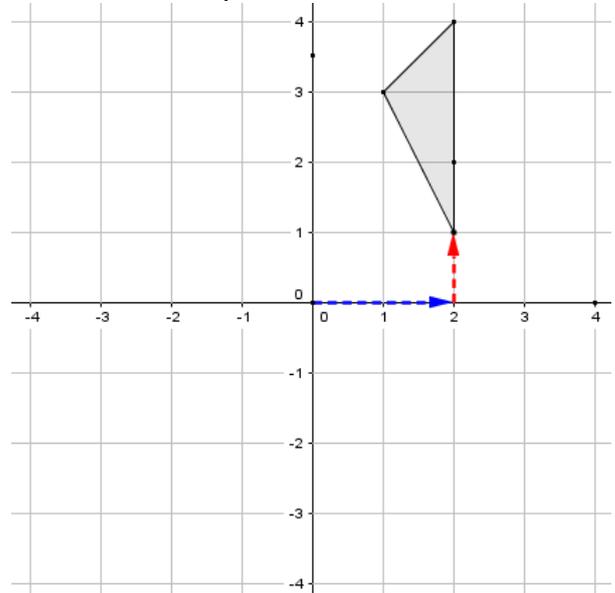
b) Rotate the shape 90° anticlockwise.



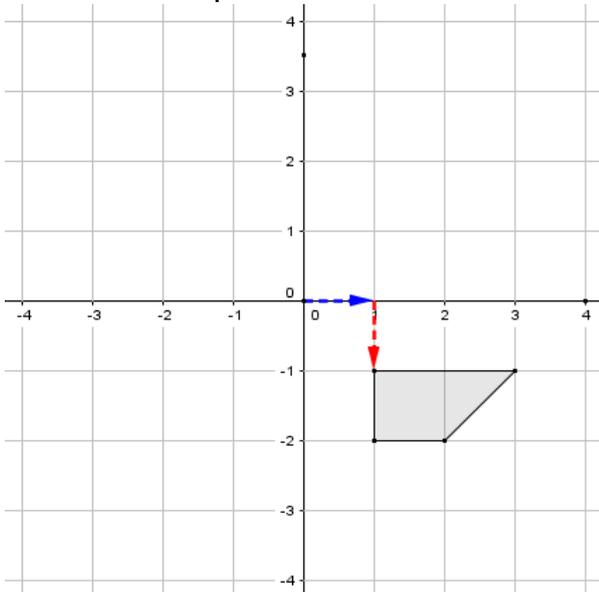
c) Rotate the shape 180° clockwise.



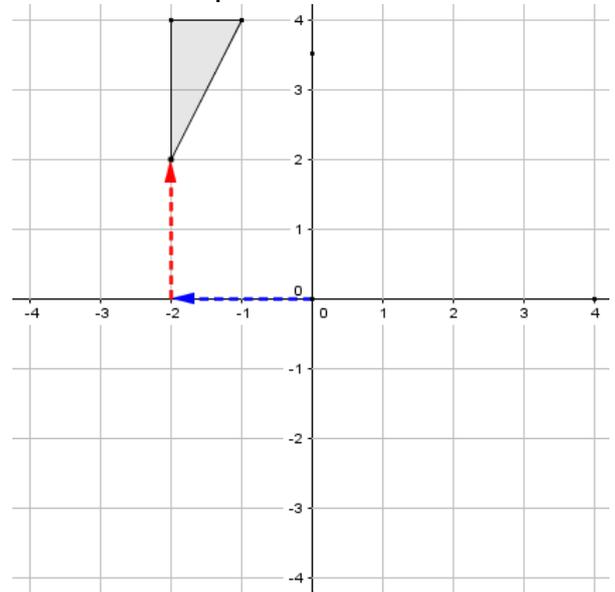
d) Rotate the shape 270° anticlockwise.



e) Rotate the shape 90° clockwise.



f) Rotate the shape 270° clockwise.



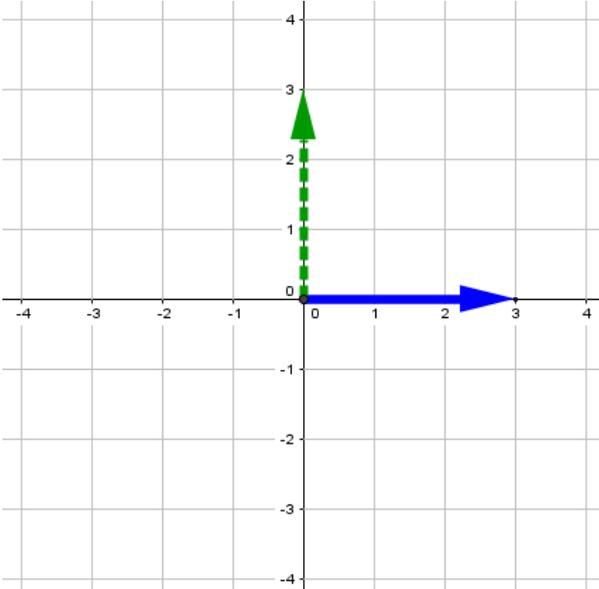
Rotation SOLUTIONS

Once you have completed this booklet you should be able to:

- Understand how 90° , 180° and 270° rotation affects horizontal and vertical lines
- Rotate a vertical or horizontal arrow 90° , 180° or 270° clockwise or anti-clockwise
- Rotate an arrow in any direction around its base by 90° , 180° or 270°
- Rotate a shape around one of its corners by 90° , 180° or 270° in either direction

Section A: Describing rotations

1. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

90° ~~clockwise~~/anti-clockwise

around its base to give the green arrow.
(or 270° clockwise)

The original (blue) arrow was pointing:

~~up~~ / ~~down~~ / ~~left~~ / right

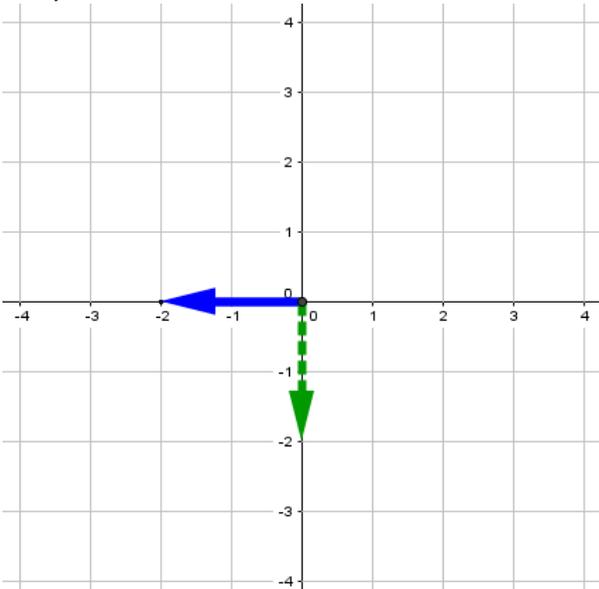
The new (green) arrow is pointing:

up / ~~down~~ / ~~left~~ / ~~right~~

b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

90° clockwise OR 270° anti-clockwise

2. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

90° ~~clockwise~~/anti-clockwise

around its base to give the green arrow.
(or 270° clockwise)

The original (blue) arrow was pointing:

~~up~~ / ~~down~~ / left / ~~right~~

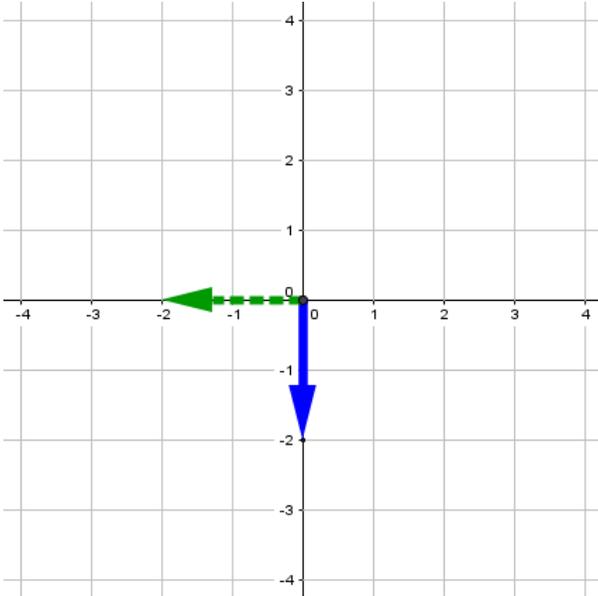
The new (green) arrow is pointing:

~~up~~ / down / ~~left~~ / ~~right~~

b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

90° clockwise OR 270° anti-clockwise

3. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

90° clockwise/~~anti-clockwise~~

around its base to give the green arrow.

(or 270° anti-clockwise)

The original (blue) arrow was pointing:

~~up~~ / down / ~~left~~ / ~~right~~

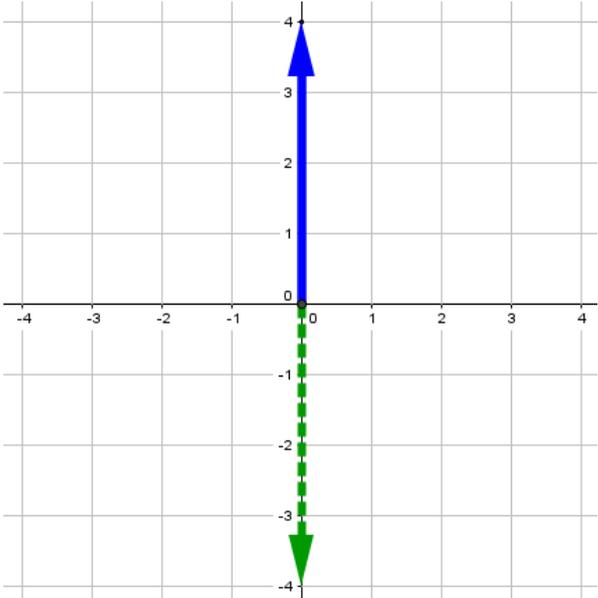
The new (green) arrow is pointing:

~~up~~ / ~~down~~ / left / ~~right~~

b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

90° anti-clockwise OR 270° clockwise

4. a) Describe the rotation that turns the blue arrow into the green dotted arrow:



The blue arrow has been rotated by:

180° clockwise/anti-clockwise

(either, neither or both: the direction doesn't make a difference)

around its base to give the green arrow.

The original (blue) arrow was pointing:

up / ~~down~~ / ~~left~~ / ~~right~~

The new (green) arrow is pointing:

~~up~~ / down / ~~left~~ / ~~right~~

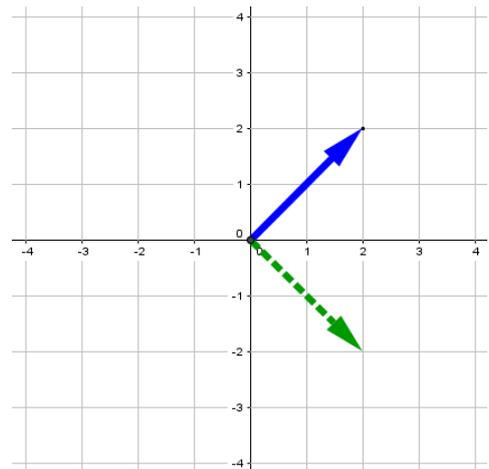
b) Describe the rotation that turns the green dotted arrow above into the blue arrow:

180° (clockwise or anti-clockwise, or not specified)

5. The blue arrow in the diagram has been rotated **270° anti-clockwise** to give the green dotted arrow.

Describe the *same* rotation using *different* instructions:

90° clockwise/anti-clockwise

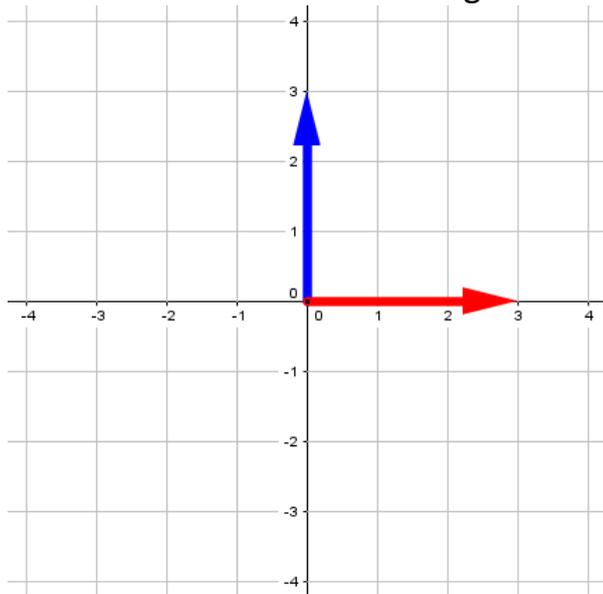


Section B: Rotating horizontal and vertical arrows

For now, all rotations will be turning around the point (0,0) (known as the 'origin').

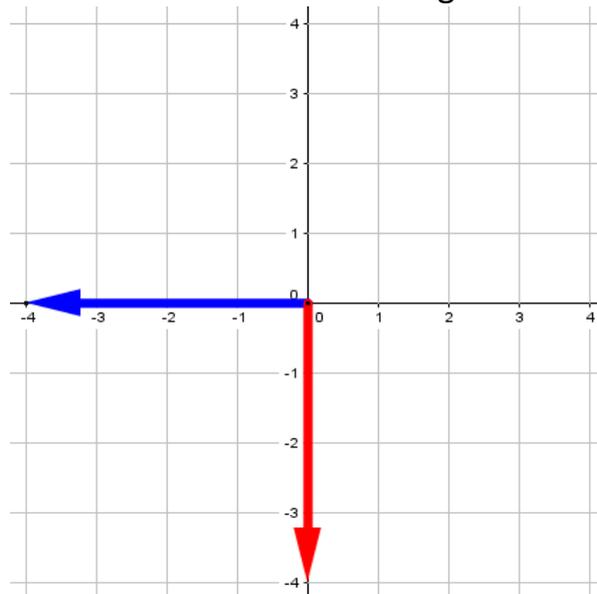
1. Rotate the blue arrow **90° clockwise**.

Draw the new arrow on the diagram:



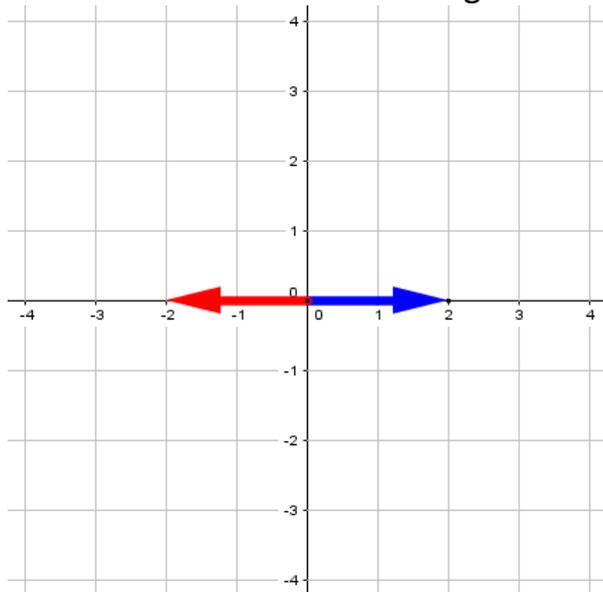
2. Rotate the blue arrow **90° anti-clockwise**.

Draw the new arrow on the diagram:



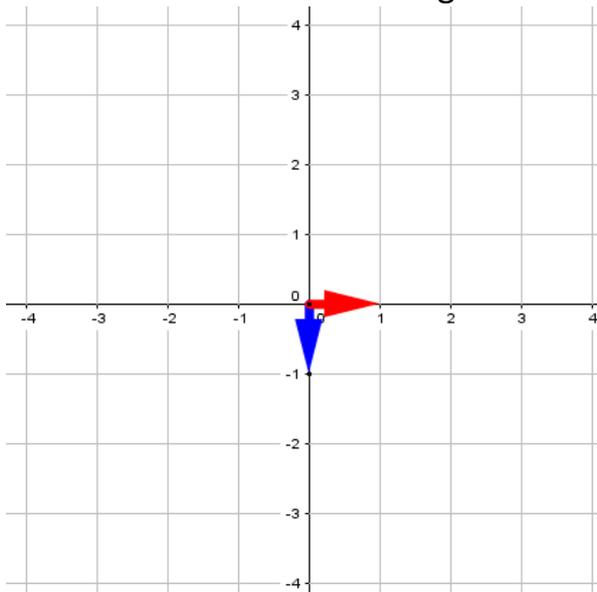
3. Rotate the blue arrow **180° clockwise**.

Draw the new arrow on the diagram:



4. Rotate the blue arrow **270° clockwise**.

Draw the new arrow on the diagram:



5. Complete the sentences below to show the effect of different rotations.

Eg: A **90° clockwise** rotation changes an up arrow into a **right** arrow.

A **90° anti-clockwise** rotation changes a **down** arrow into a right arrow.

A **180°** rotation changes a **left** arrow into a right arrow.

A **270° anti-clockwise** rotation changes a right arrow into a **down** arrow.

Can you find a *different* (but also correct) way to complete that last one?

A **270° clockwise** rotation changes a left arrow into a **down** arrow.

6. After a **90° clockwise** rotation:

- a) What direction would an **up** arrow face?
Right
- b) What direction would a **down** arrow face?
Left
- c) What direction would a **left** arrow face?
Up
- d) What direction would a **right** arrow face?
Down

7. After a **90° anti-clockwise** rotation:

- a) What direction would an **up** arrow face?
Left
- b) What direction would a **down** arrow face?
Right
- c) What direction would a **left** arrow face?
Down
- d) What direction would a **right** arrow face?
Up

8. After a **180°** rotation (in either direction):

- a) What direction would an **up** arrow face?
Down
- b) What direction would a **down** arrow face?
Up
- c) What direction would a **left** arrow face?
Right
- d) What direction would a **right** arrow face?
Left

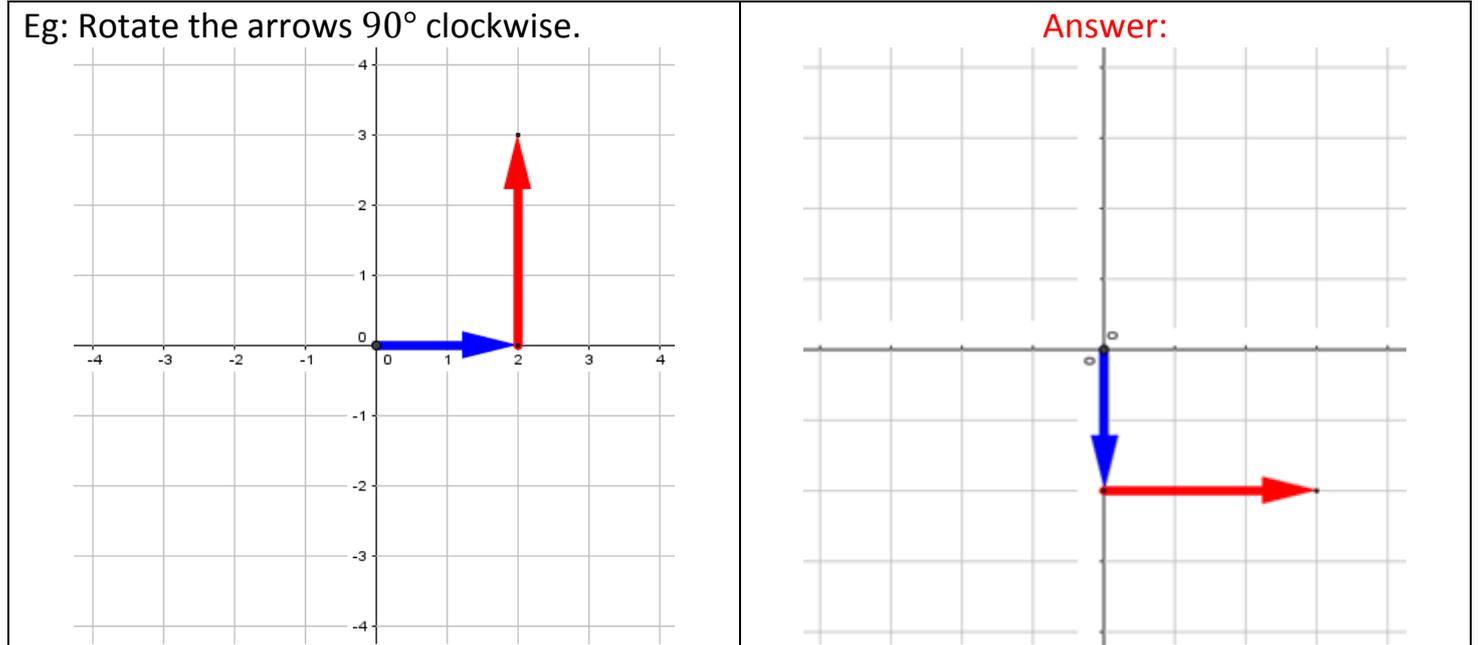
9. When an arrow is **rotated**, what happens to the **length** of the arrow?

Stays the same

Rotation, reflection and translation do not change lengths, only position or orientation.

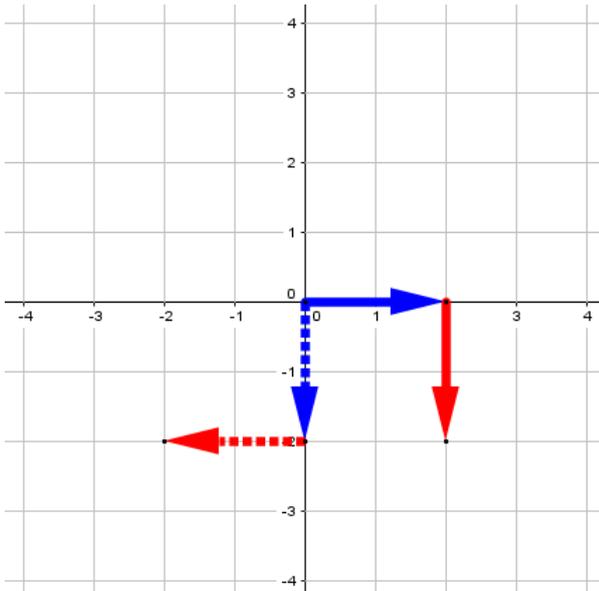
Section C: Rotating any arrow

In the example below, **both** arrows are rotated around the origin (the point $(0,0)$) which is the base of the blue arrow). The result is shown on the right-hand side:

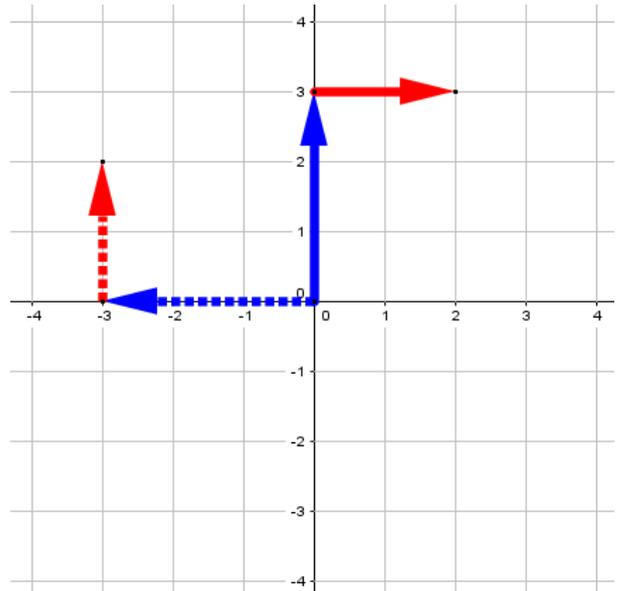


1. On the same diagram, rotate **both** arrows about the origin, following the instructions given:

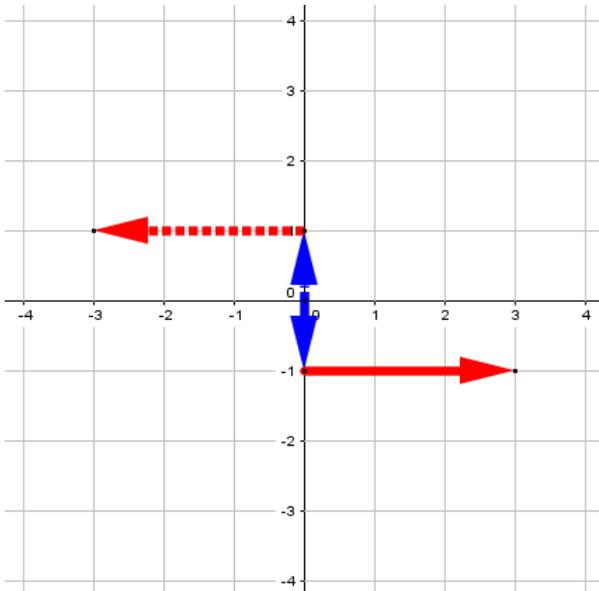
a) Rotate the arrows 90° clockwise.



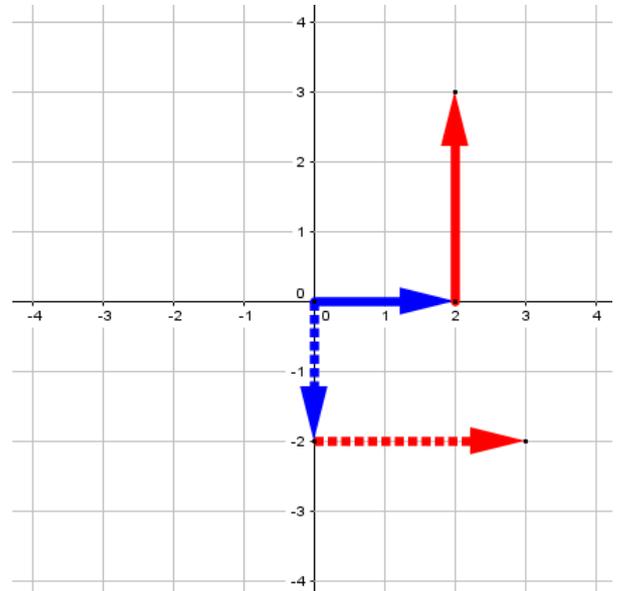
b) Rotate the arrows 90° anticlockwise.



c) Rotate the arrows 180° clockwise.

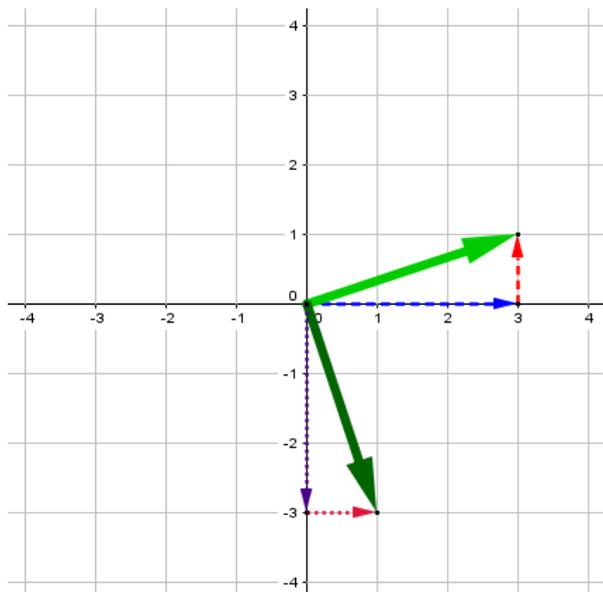


d) Rotate the arrows 270° anticlockwise.

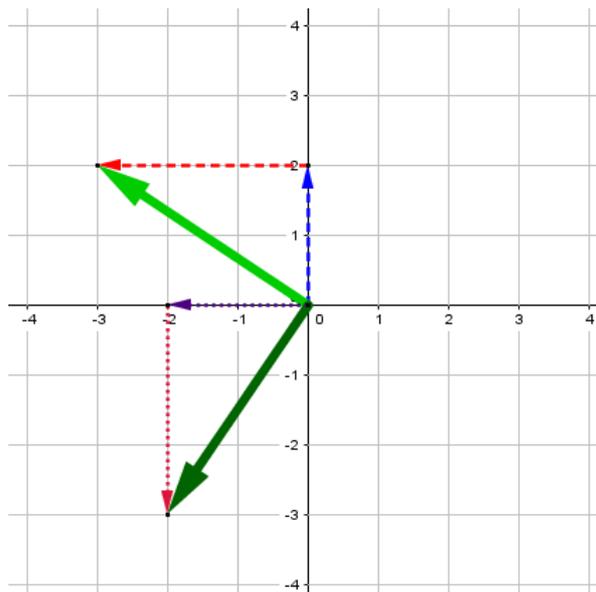


2. Rotate the **green arrow** around the point (0,0), following the instructions given.
The easiest way to do this is to rotate the dotted blue and red arrows at the same time.

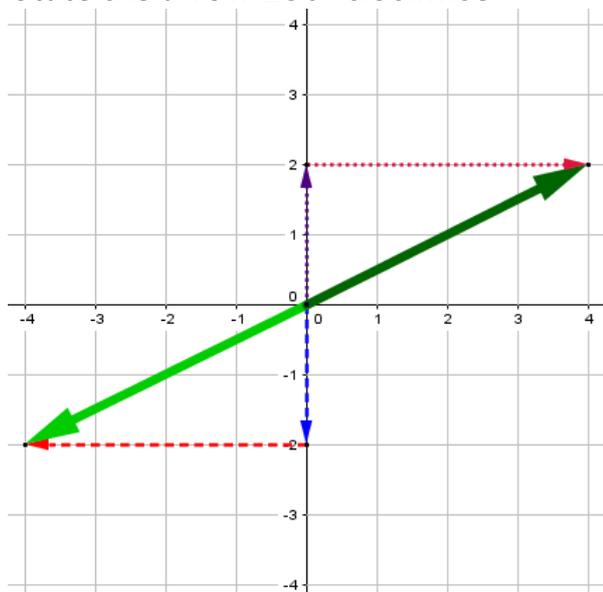
a) Rotate the arrow 90° clockwise.



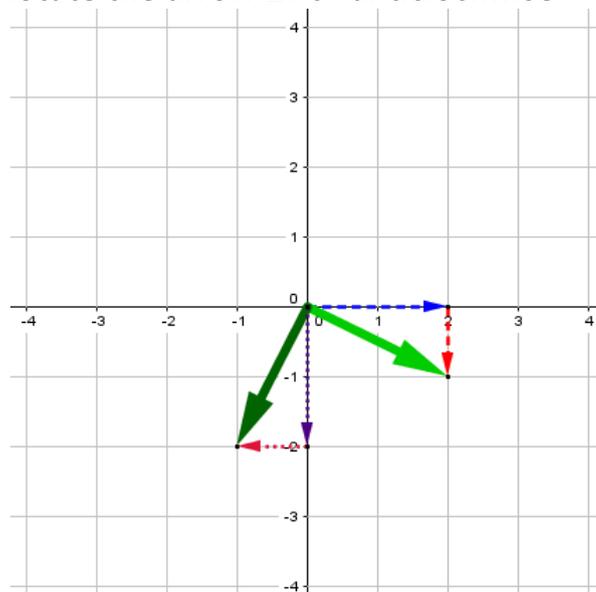
b) Rotate the arrow 90° anticlockwise.



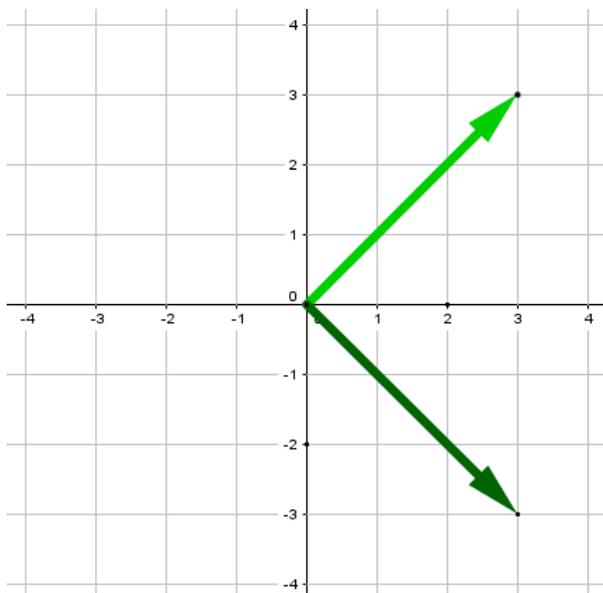
c) Rotate the arrow 180° clockwise.



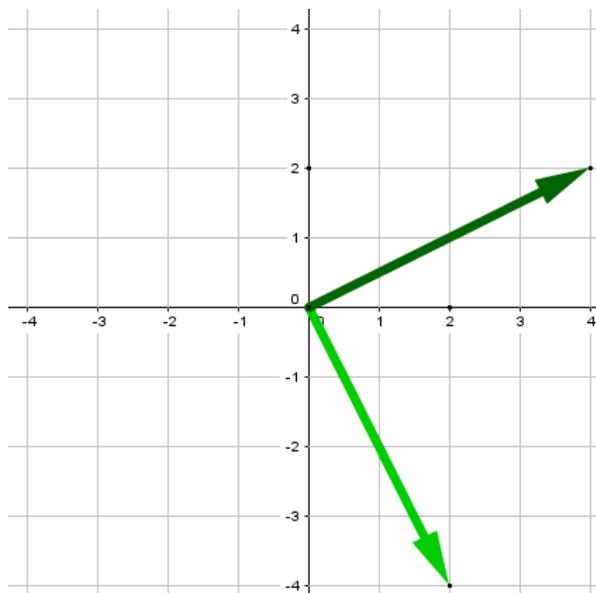
d) Rotate the arrow 270° anticlockwise.



e) Rotate the arrow 90° clockwise.



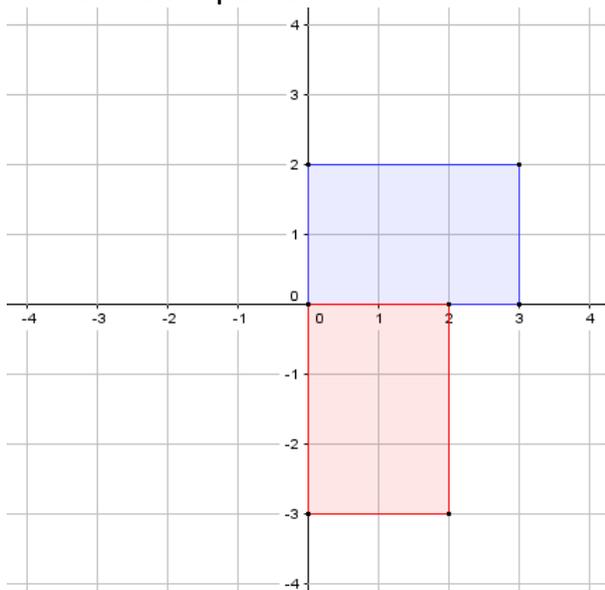
f) Rotate the arrow 270° clockwise.



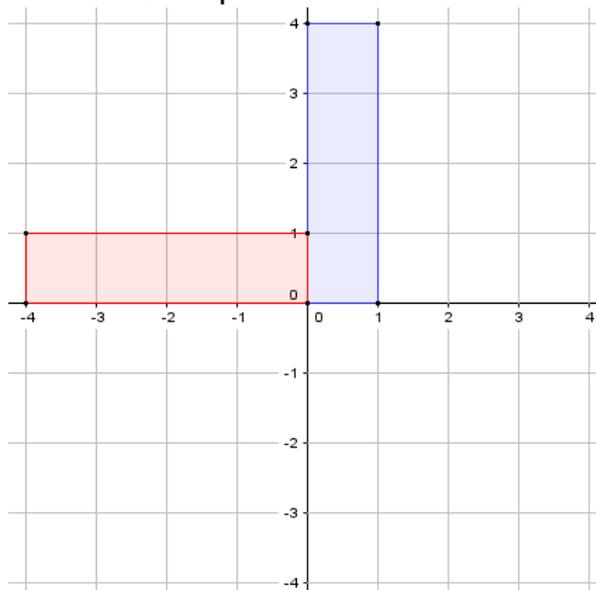
Section D: Rotating Shapes

1. Draw arrows to help you rotate these shapes around (0,0), following the instructions given:

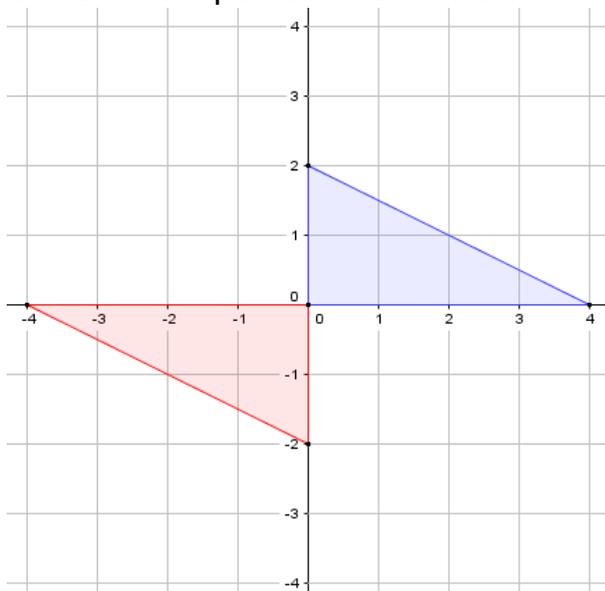
a) Rotate the shape 90° clockwise.



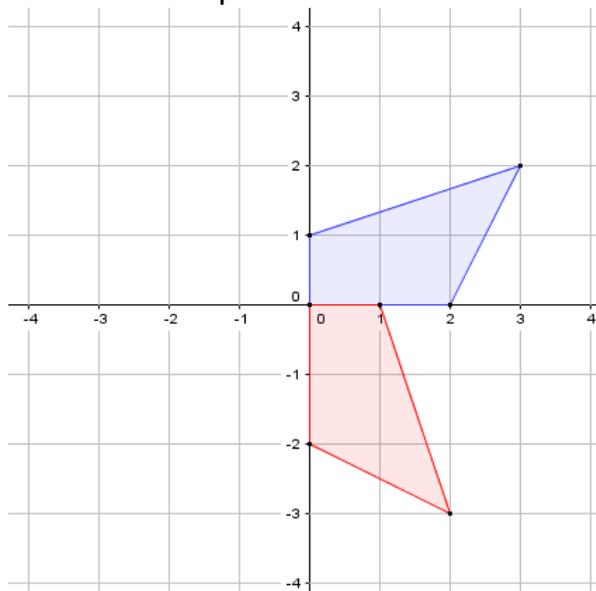
b) Rotate the shape 90° anticlockwise.



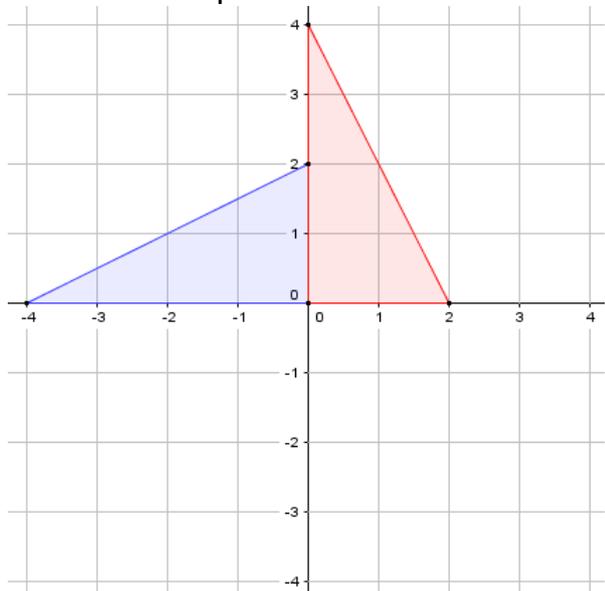
c) Rotate the shape 180° clockwise.



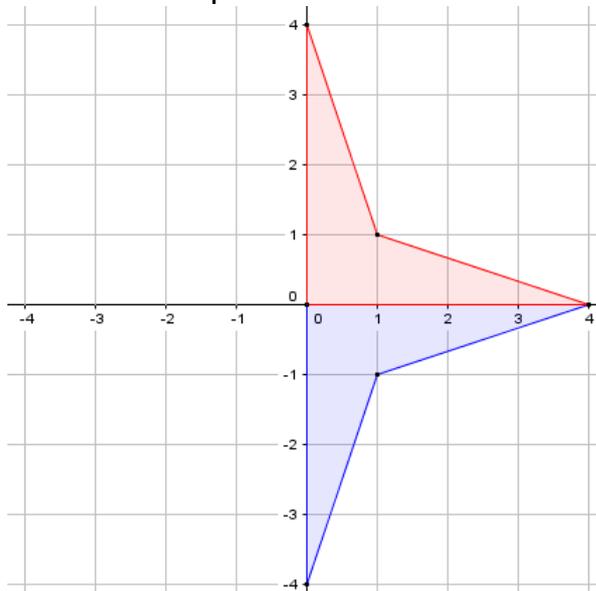
d) Rotate the shape 270° anticlockwise.



e) Rotate the shape 90° clockwise.

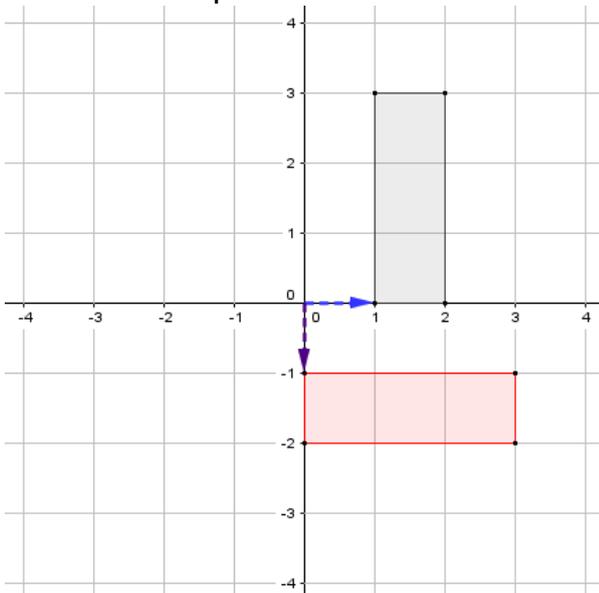


f) Rotate the shape 270° clockwise.

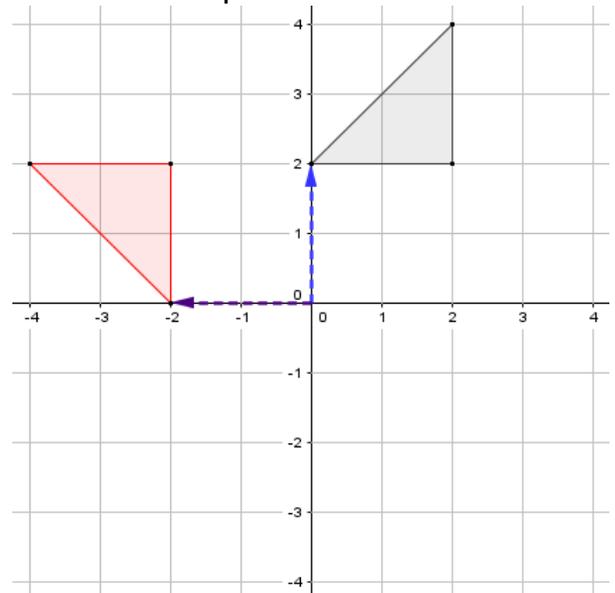


2. Use the arrows to help you rotate the shapes around (0,0), following the instructions given:

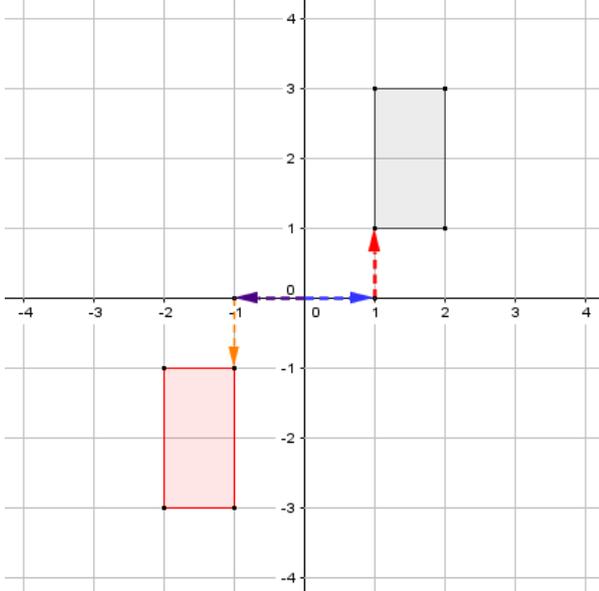
a) Rotate the shape 90° clockwise.



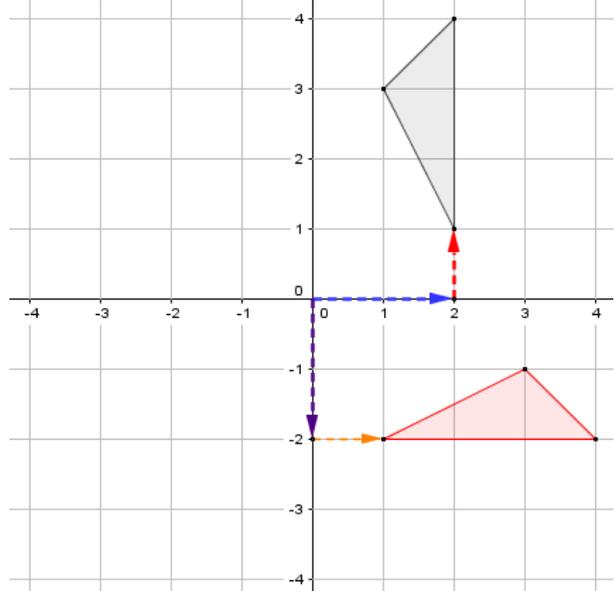
b) Rotate the shape 90° anticlockwise.



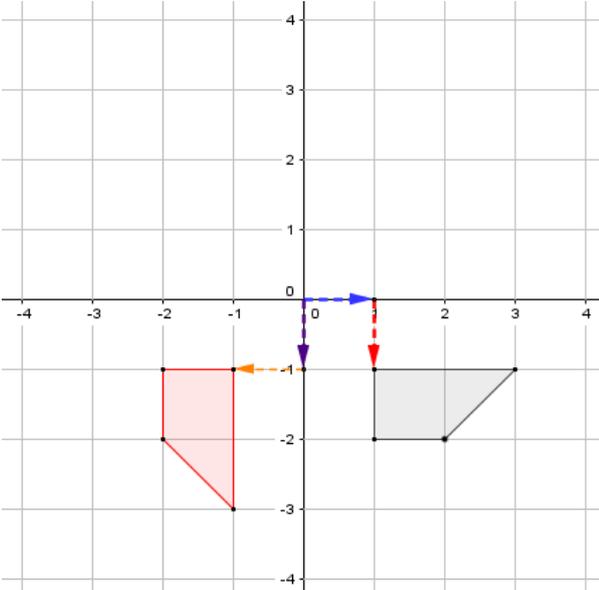
c) Rotate the shape 180° clockwise.



d) Rotate the shape 270° anticlockwise.



e) Rotate the shape 90° clockwise.



f) Rotate the shape 270° clockwise.

