

# SHARP

## Introducing Reduction angle formulae

### Grade 11 Maths

1. Calculate the value of each of the following and complete the table.

$\sin 30^\circ =$	$\cos 30^\circ =$	$\tan 30^\circ =$
$\sin 150^\circ =$	$\cos 150^\circ =$	$\tan 150^\circ =$
$\sin 210^\circ =$	$\cos 210^\circ =$	$\tan 210^\circ =$
$\sin 330^\circ =$	$\cos 330^\circ =$	$\tan 330^\circ =$

2. Use your Sharp calculator to complete each of the tables below for each trigonometric ratio and then discuss your findings in relation to the Cartesian Plane and its quadrants.

$\sin \theta =$

$\theta$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$
$\sin \theta$				
$\sin (180 - \theta)$				
$\sin (180^\circ + \theta)$				
$\sin (360^\circ - \theta)$				
$\sin (360^\circ + \theta)$				

$\cos \theta =$

$\theta$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$
$\cos \theta$				
$\cos (180 - \theta)$				
$\cos (180^\circ + \theta)$				
$\cos (360^\circ - \theta)$				
$\cos (360^\circ + \theta)$				

$\tan \theta =$

$\theta$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$
$\tan \theta$				
$\tan (180 - \theta)$				
$\tan (180^\circ + \theta)$				
$\tan (360^\circ - \theta)$				
$\tan (360^\circ + \theta)$				

3. Use your sharp calculator to complete the table below and then discuss your findings in relation to the Cartesian Plane. Note that now we are dealing with **negative angles**.

$\theta$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$
$\sin(-\theta)$				
$\cos(-\theta)$				
$\tan(-\theta)$				
$\sin(-180^\circ + \theta)$				
$\cos(-180^\circ + \theta)$				
$\tan(-180^\circ + \theta)$				

$\sin(-180^\circ - \theta)$				
$\cos(-180^\circ - \theta)$				
$\tan(-180^\circ - \theta)$				

4. What happens if you add or subtract  $360^\circ$ ?

$$\sin(\theta \pm 360^\circ) = \qquad \sin(-\theta \pm 360^\circ) =$$

$$\cos(\theta \pm 360^\circ) = \qquad \cos(-\theta \pm 360^\circ) =$$

$$\tan(\theta \pm 360^\circ) = \qquad \tan(-\theta \pm 360^\circ) =$$

5. Now, answer the following questions based on what you have found in number 1, 2, and 3.

- What do you notice about answers?
- What is the relationship between your answers?
- What causes the sign to change in some of the values?
- Can you think of other cases like this?
- What is your conclusion after you have engaged to this activity?

6. Follow these instructions carefully in your workbook:

- Draw four different Cartesian Planes
- In each Cartesian Plane draw a terminal arm that lies in one quadrant. E.g., 1<sup>st</sup> Cartesian Plane, terminal arm lies in the first quadrant, 2<sup>nd</sup> Cartesian Plane, terminal arm lies in the second quadrant and so on...
- Construct a line from any point of your terminal arm to the x-axis and the line must be perpendicular to the x-axis. Do this on each Cartesian Plane.
- Label all angles between terminal arm and x-axis  $\theta$
- Label all sides using y-axis and x-axis accordingly.
- Remember to label terminal arm  $r$

Now, complete the following table:

Trig function	1 <sup>st</sup> quadrant	2 <sup>nd</sup> quadrant	3 <sup>rd</sup> quadrant	4 <sup>th</sup> quadrant
$\sin \theta$				
$\sin(90^\circ - \theta)$				
$\cos \theta$				
$\cos(90^\circ - \theta)$				

- Through observing the findings recorded on the table above, what conclusion you can make?

7. How could you prove  $\sin(90^\circ + \theta) = \cos \theta$  and  $\cos(90^\circ + \theta) = -\sin \theta$ ?