

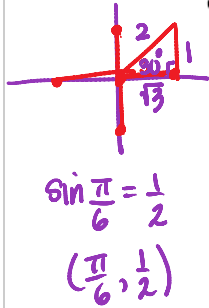
# L1 - Base Graphs

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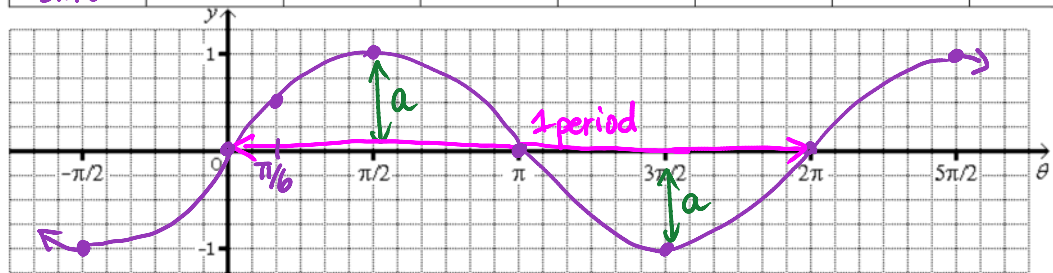
## Unit 10: Trigonometric Functions

### Lesson 1 Base Graphs of Trigonometric Functions

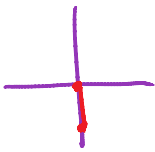
- Ex1. Consider the function  $f(\theta) = \sin \theta = \frac{\text{opp}(y)}{\text{hyp}(r)}$
- Complete the table without using a calculator.
  - Plot the above points on the grid below. Do not join the points yet.
  - Evaluate  $f(\theta)$  for each special angle in the domain  $0 < \theta < 2\pi$  and plot them all.
  - Join all points to obtain the sine graph. Check with your graphing calculator.



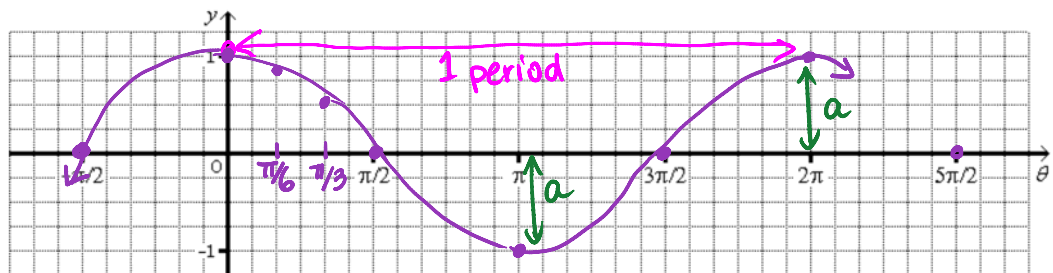
$\theta$	$-\frac{\pi}{2}$	0	$\frac{\pi}{2}$	$\pi$	$\frac{3\pi}{2}$	$2\pi$	$\frac{5\pi}{2}$
$f(\theta) = \sin \theta$	-1	0	1	0	-1	0	1



- Ex2. Consider the function  $h(\theta) = \cos \theta = \frac{\text{adj}(x)}{\text{hyp}(r)}$
- Complete the table without using a calculator.
  - Plot the above points on the grid below. Do not join the points yet.
  - Evaluate  $h(\theta)$  for each special angle in the domain  $0 < \theta < 2\pi$  and plot them all.
  - Join all points to obtain the sine graph. Check with your graphing calculator.



$\theta$	$-\frac{\pi}{2}$	0	$\frac{\pi}{2}$	$\pi$	$\frac{3\pi}{2}$	$2\pi$	$\frac{5\pi}{2}$
$f(\theta)$	0	1	0	-1	0	1	0

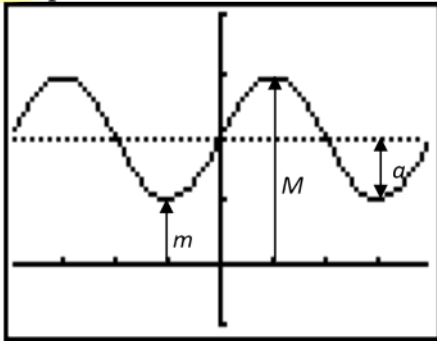


- What is the maximum value of  $\sin \theta$  and  $\cos \theta$ ?  $\frac{1}{-1}$  } why? (hyp & opp/adj)
- What is the minimum value of  $\sin \theta$  and  $\cos \theta$ ?  $\frac{1}{-1}$
- What are the domain and range of  $\sin \theta$  and  $\cos \theta$ ? Domain:  $\theta \in \mathbb{R}$  or  $\theta \in ]-\infty, \infty[$   
Range:  $y \in [-1, 1]$

**Period:** Trigonometric functions are **periodic functions**. The graph of a periodic function repeats in a regular way. The length of the shortest part that repeats, measured along the horizontal axis, is called the **period** of the function.

➤ What is the period of  $\sin \theta$  and  $\cos \theta$ ?  $2\pi$  or  $360^\circ$

**Amplitude:**



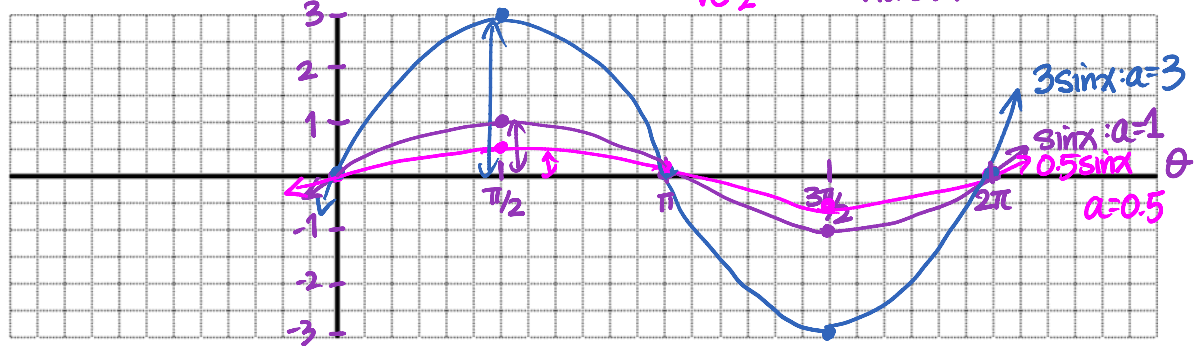
The number  $a$  is the **amplitude** of a trigonometric function. It represents the distance from any maximum or minimum to the mid-line.

$$a = \frac{|M - m|}{2}$$

where  $M$  = maximum value

$a > 0$

Ex.3: a) Graph the functions  $y = \sin x$ ,  $y = 3 \sin x$  and  $y = 0.5 \sin x$ . (Check with GDC)  
 b) State the amplitude of each function.



➤ For the functions of the forms  $y = a \sin b\theta$  and  $y = a \cos b\theta$ , where  $a, b \neq 0$ , the **amplitude** is  $|a|$ , and the **period** is  $\frac{360^\circ}{|b|}$  or  $\frac{2\pi}{|b|}$ .  $p = \frac{2\pi}{b}$

Ex.4: Determine the amplitude and the period in radians of the function  $y = 2 \cos \frac{x}{3}$ . Graph this function to verify your answers.

$a=2$   $b=\frac{1}{3}$

amplitude:  $a=2$

period:  $p = \frac{2\pi}{b} = \frac{2\pi}{\frac{1}{3}} = 2\pi \times \frac{3}{1} = 6\pi$

Ex.5: Write an equation of:

a) sine fct with amplitude 2.8 and period  $60^\circ$

$$y = a \sin b\theta = 2.8 \sin 6\theta$$

$$a = 2.8$$

$$P = \frac{360^\circ}{b} \rightarrow b = \frac{360^\circ}{P} = \frac{360^\circ}{60^\circ} = 6$$

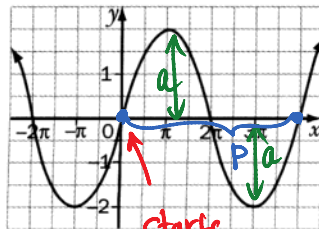
b) cosine fct with amplitude 3, and period  $2\pi$

$$y = a \cos b\theta = 3 \cos \theta$$

$$a = 3$$

$$b = \frac{2\pi}{P} = \frac{2\pi}{2\pi} = 1$$

Ex.6: What is a possible equation of the following function?



Starts  
@ (0,0)

Amplitude = 2

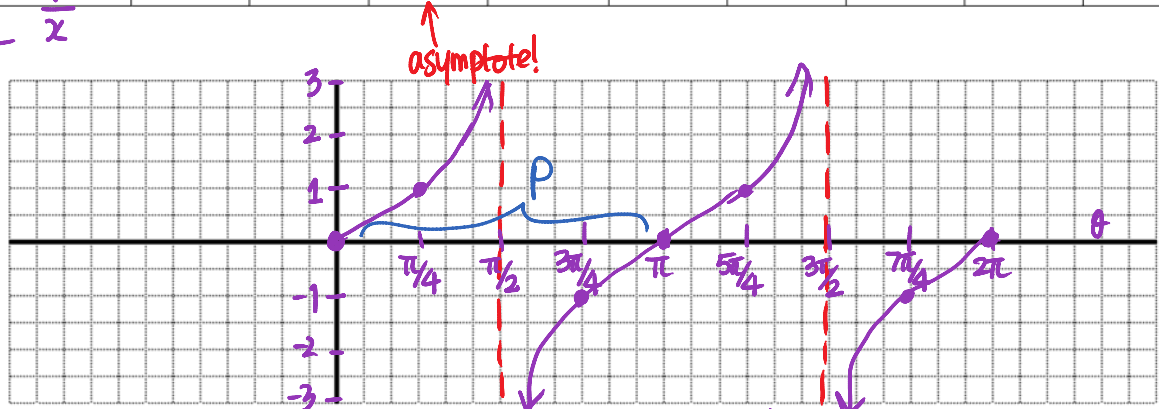
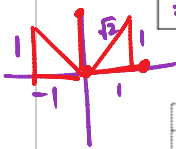
$$\text{period} = 4\pi : b = \frac{2\pi}{P} = \frac{2\pi}{4\pi} = \frac{1}{2}$$

Sine or cosine?

$$y = 2 \sin \frac{1}{2}\theta$$

Ex.7: Complete the following table for the function  $y = \tan \theta$ . Then graph it.

$\theta$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	$\pi$	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	$2\pi$
$y = \tan \theta$ $= \frac{y}{x}$	0	1	undef.	-1	0	1	undef.	-1	0



period =  $\pi$   
amplitude = ?? ( $\infty$ )

Practice: Worksheet L1

## Worksheet L1: Base Trigonometric Functions

→ Please use graph paper available . (Solutions posted on the website)

- Sketch the graph of  $y = 4 \sin x$  for  $x \in \mathbb{R}$ .
  - State the range of the function.
  - What is the period of the function in radians?
  - State the amplitude.
- Sketch the graph of  $y = -\frac{1}{4} \cos \theta$  for  $\theta \in \mathbb{R}$ .
  - State the coordinates of the  $y$ -intercept.
  - State the range of the function.
  - State the amplitude.
- Sketch the graph of  $y = \sin 3x$  for  $0^\circ \leq x \leq 360^\circ$ . Clearly plot the key points.
  - What is the period of the function, in degrees?
  - What is the range of this function?
  - State the amplitude.
- Sketch the graph of  $y = \cos \frac{1}{2}x$ , in radians. Show one complete cycle.
  - State the coordinates of the  $y$ -intercept.
  - What is the period of this function?
  - State the amplitude.
- For each function, state the amplitude. Then, state the period in degrees and radians.
  - $y = 4 \sin 2x$
  - $y = -3 \cos \frac{1}{5}x$
  - $y = \frac{2}{3} \sin \frac{2}{3}x$
  - $y = -\frac{1}{4} \cos (-3x)$
- Using the language of transformations, describe how each function's graph is related to the graph of  $y = \cos x$ .
  - $y = 2 \cos 4x$
  - $y = -\cos \frac{1}{5}x$
  - $y = -3 \cos \frac{5}{2}x$
  - $y = 5 \cos (-x)$
- For each of the following sinusoidal functions, determine the amplitude and period. State a possible equation.

