

**SECTION 3.3 GRAPHING SINE  
COSINE AND TANGENT  
FUNCTIONS**

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I) WHAT IS A PERIODIC FUNCTION?

- A function that repeats
- The range of input values within a cycle is
- There are many examples of periodic functions in our world
  - Ocean waves and ocean currents
  - Solar system
  - Finance and Market trends
  - Sound waves, light transmission, radiation
  - Wave propagation: earthquakes,
  - Heart beat



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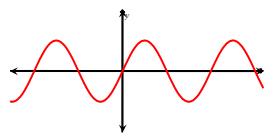
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II) COMPONENTS OF A PERIODIC FUNCTION:



Crest:  
Trough:  
Amplitude:  
Period:



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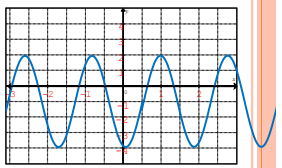
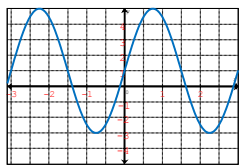
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Ex: Given each graph, indicate the period and amplitude




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Ex: If high tide occurred at 7:30am and low tide was at 1:30pm, what time will the next high tide be?

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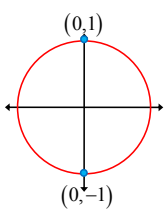
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III) SINE FUNCTION IN AN UNIT CIRCLES:

- o **Sinθ** in an unit circle is equal to
- o The highest y-coordinate is at
- o The value of **Sinθ** changes
- o If we graph the sine function, we are comparing




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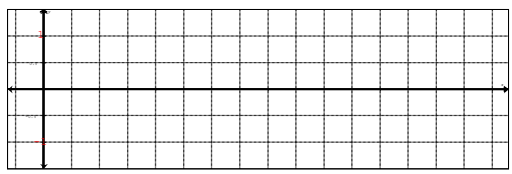
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IV) GRAPHING THE SINE FUNCTION:



- X-axis:
- Y-axis:




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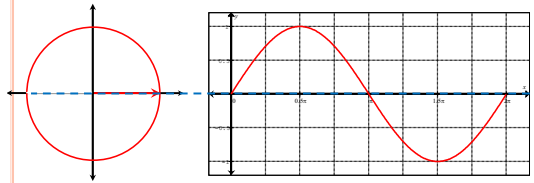
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SINE FUNCTION:



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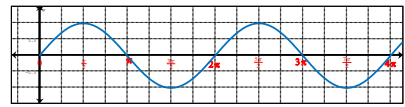
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Ex: Find the following for the sine function:

- a) Period & amplitude
- b) Y intercept
- c) X intercept and a general formula
- d) Domain and Range




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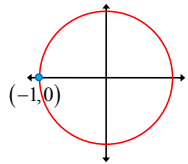
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V) COSINE FUNCTION IN AN UNIT CIRCLES:

- o **Cosθ** in an unit circle is equal to
- o The lowest x-coordinate is
- o The value of **Cosθ** changes
  
- o If we graph the Cosine function, we are comparing




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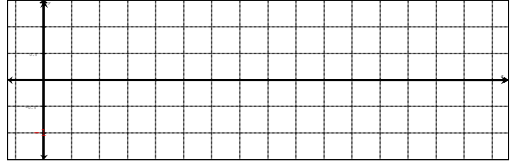
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VI) GRAPHING THE COSINE FUNCTION:



- o X-axis: value of the central angle in radians
- o Y-axis: value of cosθ, x-coordinate point "P"
  - Highest (1) and lowest (-1)

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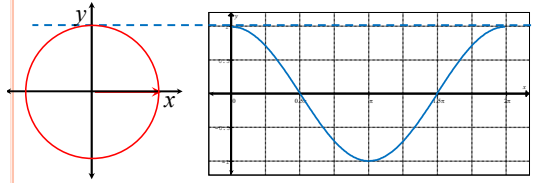
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COSINE FUNCTION:




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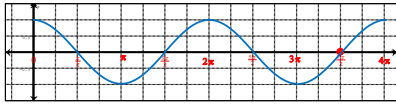
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Ex: Find the following for the cosine function:

- a) Period & amplitude
- b) Y intercept
- c) X intercept and a general formula
- d) Domain and Range




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VII) SUMMARY FOR GRAPHING COSINE/SINE FUNCTIONS

- When graphing a Sine & Cosine function, there are only 5 points to consider: Beginning, Middle, End, Quarter way, and 3 Quarters way of the period
- Sine Function:
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  -
- Cosine Function
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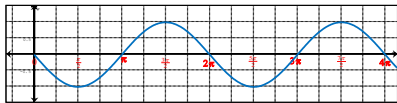
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Ex: What is the equation for the following graph?



- a)  $y = \sin \theta$
- b)  $y = \cos \theta$
- c)  $y = -\sin \theta$
- d)  $y = -\cos \theta$

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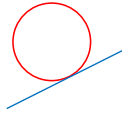
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REVIEW: TANGENT FUNCTION & TANGENT LINES

- SOH-CAH-TOA
- Using the ratio of opposite over adjacent, we can show that the tangent function is

$$\tan \theta = \frac{\text{opp}}{\text{adj}} \quad \tan \theta = \frac{\text{opp}}{\text{adj}}$$

- A tangent line is a line that crosses a circle at only one point




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VIII) TANGENT FUNCTIONS AND UNIT CIRCLES

- There are two ways to relate the tangent function with an unit circle

1<sup>st</sup> Method

- The tangent function can be defined as



2<sup>nd</sup> Method

- The tangent function can be defined as

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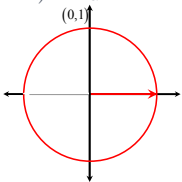
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IX) TANGENT = Y-COORDINATE / X-COORDINATE



- at  $\theta = 0$
- at  $\theta = 30^\circ$
- at  $\theta = 45^\circ$
- at  $\theta = 60^\circ$
- at  $\theta = 90^\circ$

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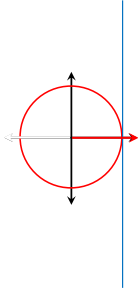
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X) TANGENT AS THE Y-COORDINATE ON THE VERTICAL TANGENT LINE

- The tangent function can be defined as the y-coordinate of the extension of the terminal arm on a vertical tangent line




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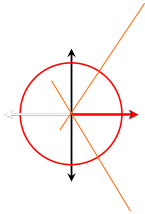
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- As the terminal arm rotates around the circle, it will cross the tangent line above the X-axis (+ve) or below the X-axis (-ve)
- I.e: when the terminal arm is in Q1, it crosses the tangent line above the X-axis, so  $\tan\theta$  is positive




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XI) TANGENT FUNCTION AS A RECIPROCAL

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

- The Tangent function is
- At points where  $\cos\theta = 0$ , you will get a
- At points where  $\sin\theta = 0$ , you will
- At points where  $\sin\theta = \cos\theta$ , the value of  $\tan\theta$  will be



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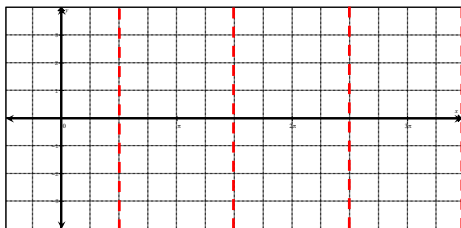
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TANGENT FUNCTION  $y = \tan x$




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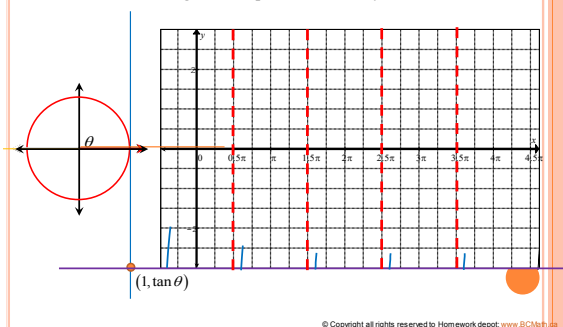
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- The tangent function can be defined as the y-coordinate of the extension of the terminal arm on a vertical tangent line
- As the angle changes and increase, the value of  $\tan\theta$  will fluctuate from negative to positive infinity




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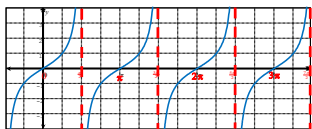
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Ex: Indicate the following for the tangent function:  $y = \tan \theta$

- a) Domain & Range
- b) X-intercepts and the general formula
- c) Period and amplitude




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XII) VERTICAL ASYMPTOTE AND GENERAL FORMULA:

- Since  $\tan\theta = (\sin\theta/\cos\theta)$ , the vertical asymptotes will all appear when  $\cos\theta=0$  (Denominator is equal to zero)
- The general formula for all the vertical asymptotes in a tangent function will be:

$x =$

("n" is an integer)

$x =$

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Ex: Given that  $0 < \theta < 2\pi$ ,  $\tan\theta > 0$  and  $\sin\theta < 0$ , what quadrant is the angle in?

- a) *Quadrant 1*
- b) *Quadrant 2*
- c) *Quadrant 3*
- d) *Quadrant 4*

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