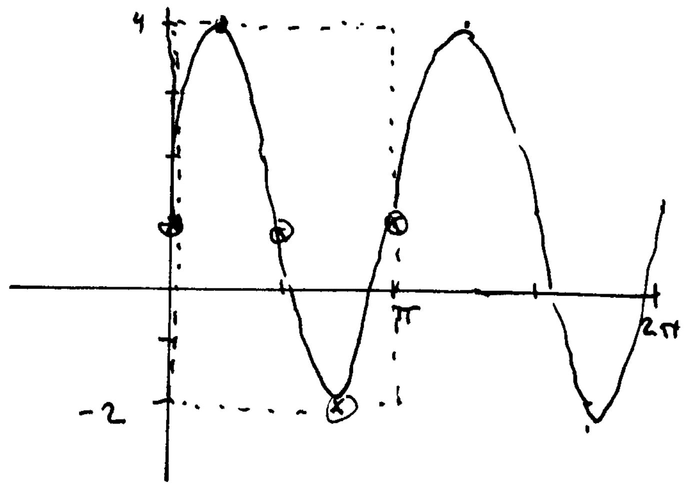
Math 170 Thu 23 Mar 2017

Warmup question



Features of graph:

amplitude = 3

mean value = 1

period = π

phase shift = ?

It depends

Equation: $y = c + a \sin b(x-d)$

or $y = c + a \cos b(x-d)$

Work Toward one answer: Pick a window to contain one cycle so that the window begins at $x=0$, ends at $x=\pi$.

Then we have a sine function and a is positive.

So, $a = +\text{amplitude} = 3$

$b = \frac{2\pi}{\text{period}} = \frac{2\pi}{\pi} = 2$

Recall: $\boxed{\text{period} = \frac{2\pi}{b}}$ so $b = \frac{2\pi}{\text{period}}$

$c = \text{mean value} = \text{vertical shift} = 1$

$d = \text{phase shift} = 0$

one answer: $\boxed{y = 1 + 3 \sin 2x} = 1 + 3 \sin 2(x-0)$

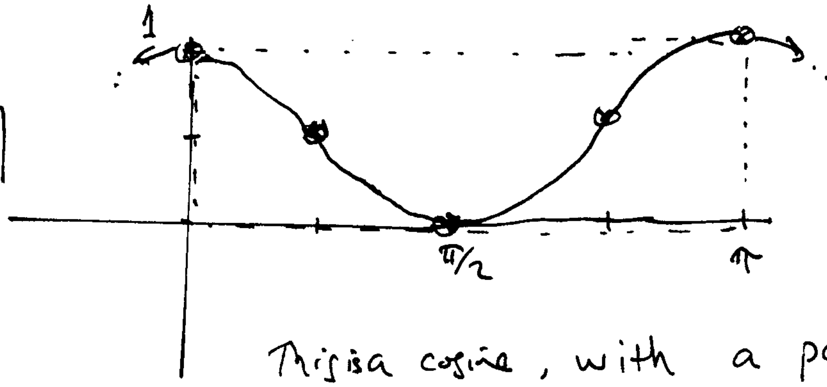
Another answer, expressed as a cosine. What changes? $d = \pi/4$

$$y = 1 + 3 \cos 2(x - \pi/4)$$

Yet another:

$$y = 1 - 3 \sin 2\left(x - \frac{\pi}{2}\right)$$

<u>ex</u>: Find an equation for this graph:



$\boxed{y = \cos^2 x}$

<u>Also</u>: $\boxed{y = \frac{1}{2} + \frac{1}{2}\cos 2x}$

This is a cosine, with a positive.

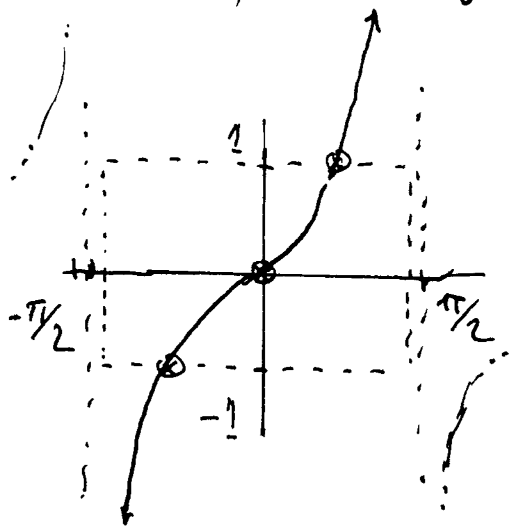
amplitude $= 1/2$ $\Rightarrow$ $a = 1/2$
period $= \pi$ $\Rightarrow$ $b = \frac{2\pi}{\pi} = 2$
mean value $= 1/2$ $\Rightarrow$ $c = 1/2$
phase shift $= 0$ $\Rightarrow$ $d = 0$

This anticipates an identity that we will eventually prove, namely

$$\boxed{\cos^2 x = \frac{1}{2} + \frac{1}{2}\cos 2x}$$

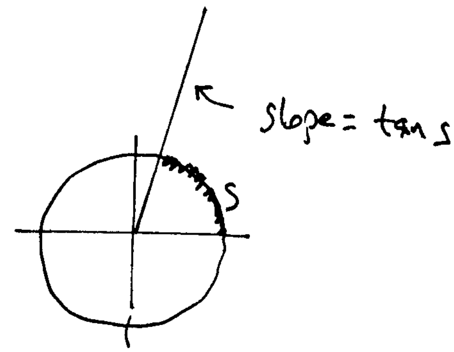
"power-reducing identity"

4.3 Graph of tangent and cotangent



y = tangent function

$y = \tan x$



period = π (not 2π)

domain = all reals <u>except</u> odd multiples of $\pi/2$

range = $(-\infty, \infty)$

$\tan x$ is an <u>odd</u> function, that is $\tan(-x) = -\tan x$

So the graph is symmetric about the origin.