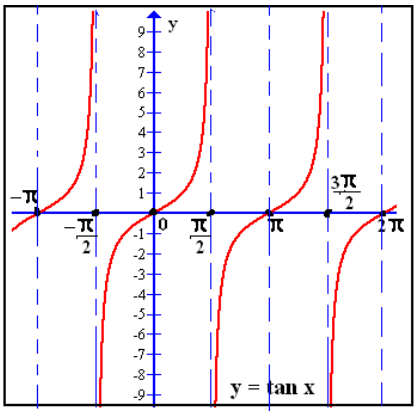
4.6 Graphs of Tangent, Cotangent, Secant, and Cosecant,

Tangent:

Characteristics of the graph of y=tan(x):



- There are *vertical asymptotes* wherever tangent is undefined [wherever cos(x) = 0 since tan(x) = sin(x)/cos(x)] ← graph will never touch/cross these asymptotes (for the parent function, these asymptotes occur at $x = \frac{\pi}{2}$ and $x = -\frac{\pi}{2}$) they can be found at $x = \frac{\pi}{2} + n\pi$, where n is an integer
- The tangent function is odd, so it is *symmetric with respect to the origin*, and $\tan(-x) = -\tan(x)$
- The *period* is π (this is because if you look at the unit circle, the values of tangent repeat themselves every half revolution, or π revolutions)
- *Domain:* all real numbers except where the asymptotes occur: $x \neq \frac{\pi}{2} + n\pi$, where n is an integer
- *Range*: all real numbers
- *No amplitude*
  - Between 0 and $\frac{\pi}{2}$ sine and cosine are both positive → tangent is positive
  - Between $\frac{\pi}{2}$ and π sine is positive but cosine is negative → tangent is negative
  - Between π and $\frac{3\pi}{2}$ sine is negative and cosine is negative → tangent is positive
  - Between $\frac{3\pi}{2}$ and 2π sine is negative and cosine is positive → tangent is negative

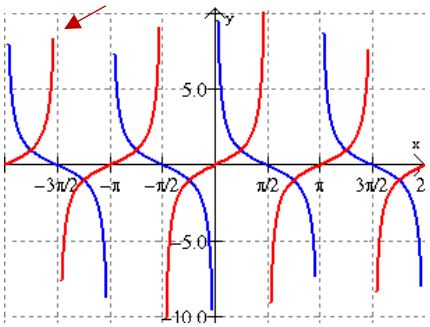
Cotangent:

Cotangent is the reciprocal of tangent → While the graph of y=tan(x) has vertical asymptotes where cos(x)=0, y=cot(x) has vertical asymptotes where sin(x)=o [since cot(x) = cos(x)/sin(x)]

Same rules apply to construct the graph as we did y=tan(x) → check to see what the sigh of cot is based upon the sign of sin and cos on that interval (quadrant)

$y = \tan(x)$

$y = \cot(x)$

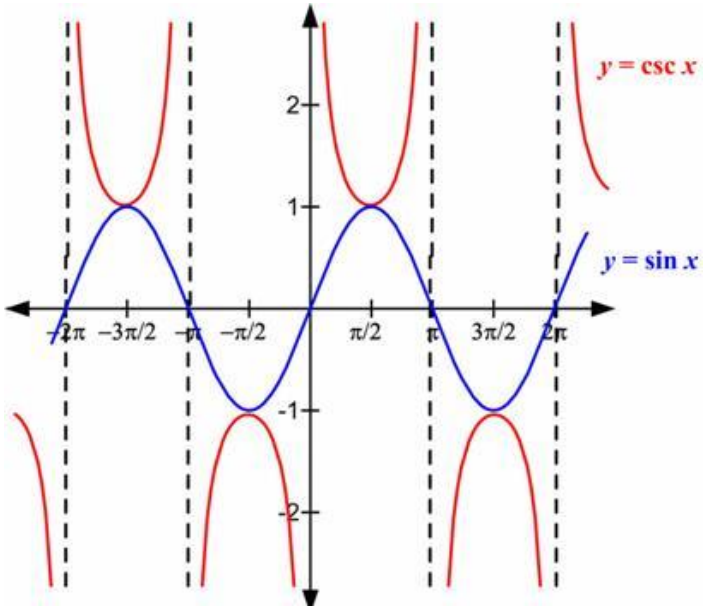


- Between 0 and $\frac{\pi}{2}$ sine and cosine are both positive → cotangent is positive
- Between $\frac{\pi}{2}$ and π sine is positive but cosine is negative → cotangent is negative
- Between π and $\frac{3\pi}{2}$ sine is negative and cosine is negative → cotangent is positive
- Between $\frac{3\pi}{2}$ and 2π sine is negative and cosine is positive → cotangent is negative

Graphs of Secant and Cosecant

Cosecant:

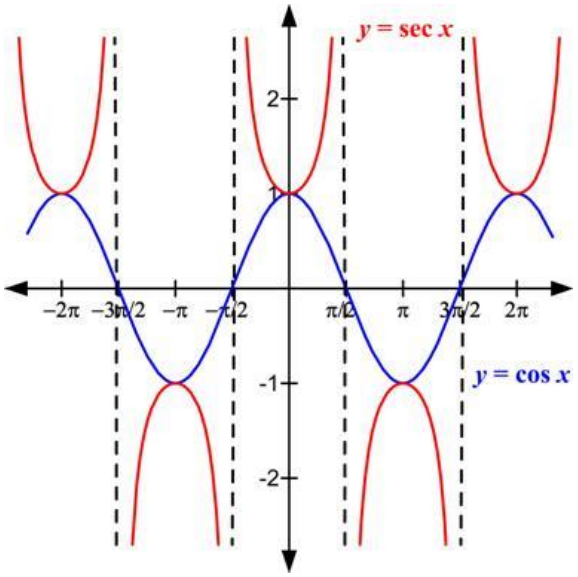
Cosecant is the reciprocal of sine → where sine has a max value of 1, cosecant will have a min value at 1; where sine has a min value of -1, cosecant will have a max value at -1, etc



← vertical asymptotes (dashed lines) where the sine function touches the x axis

Secant:

Secant is the reciprocal of cosine → where cosine has a max value of 1, secant will have a min value at 1; where cosine has a min value of -1, secant will have a max value at -1, etc



← vertical asymptotes (dashed lines) where the sine function touches the x axis