Graphing Trig Functions

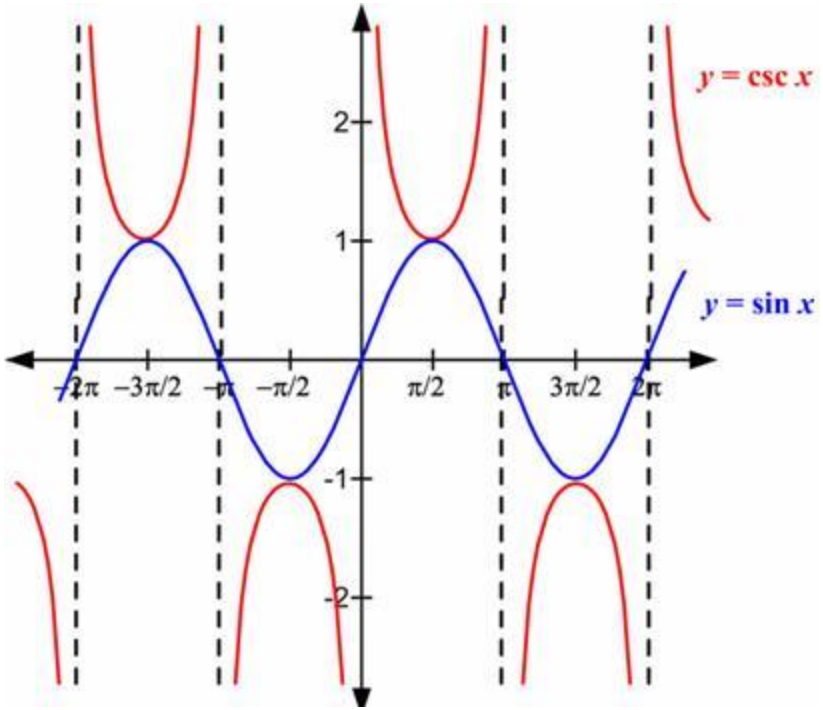
Warm-Up: Sketch

- $f(x) = \sin(x)$
- Find the following points:
- All x where $\sin(x) = 0$
- All x where $\sin(x) = \pm 1$
- All x where $\sin(x) = \pm 1/2$

Sketching Cosecant

- Start by sketching y= sin(x)
- Remember $\csc(x) = \frac{1}{\sin(x)}$, which allows you to plot key points:
- There will be a **vertical asymptote** whenever sin(x) = 0 (occurs at x=nπ)
- When sin(x) = ±1, **csc (x) = ±1** (occurs at $x = \frac{\pi}{2} + n\pi$)
- When sin (x) = ±½ , **csc(x) = ±2** (occurs at $x=\frac{n\pi}{4}$, for odd values of n)

CSC(x)



- Domain: all real numbers such that $x \neq n\pi$
- Range: $(-\infty, -1] \cup [1, \infty)$
- Symmetry: origin
- Vertical Asymptotes: $x = n\pi$

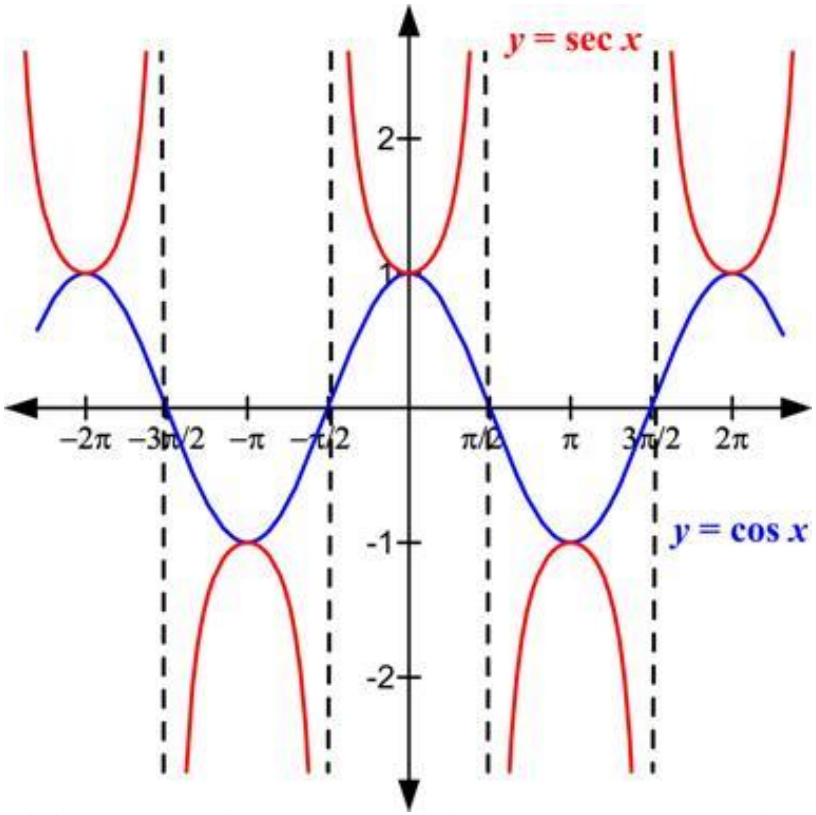
Sketch

- $f(\mathrm{x}) = 4\csc\left(2x + \frac{\pi}{3}\right) - 5$

Sketching secant

- Start by sketching y= cos(x)
- Remember sec(x) = $\frac{1}{\cos(x)}$, which allows you to plot key points:
- There will be a **vertical asymptote** whenever cos(x) = 0 (occurs at x = $\frac{\pi}{2} + n\pi$)
- When cos(x) = ±1, **sec (x) = ±1** (occurs at x =nπ)
- When cos (x) = ±½ , **sec(x) = ±2** (occurs at x=$\frac{\pi}{4} + n\frac{\pi}{2}$)

Sec(x)



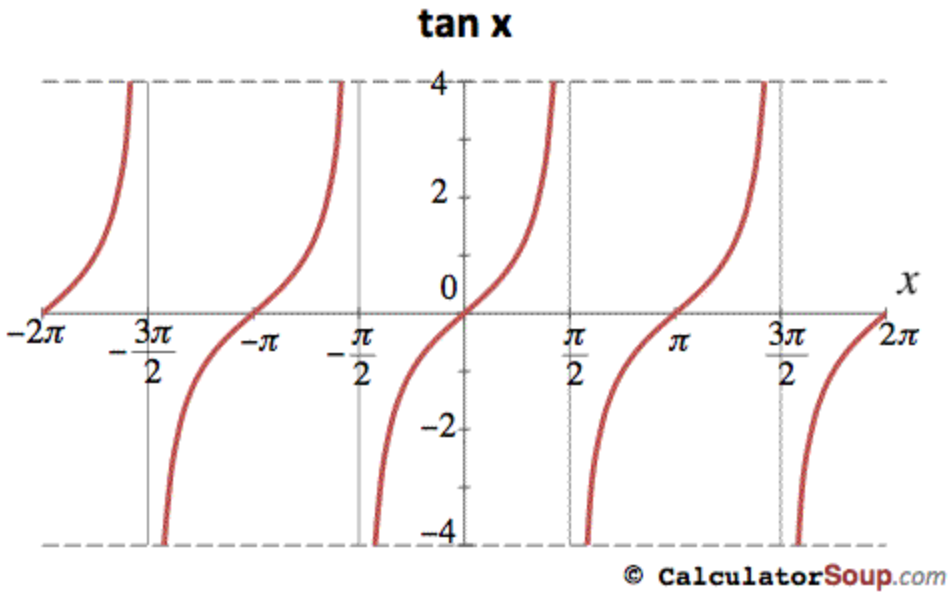
- Domain: all real numbers such that $x \neq \frac{\pi}{2} + n\pi$
- Range: $(-\infty, -1] \cup [1, \infty)$
- Symmetry: y-axis
- Vertical Asymptotes: $x = \frac{\pi}{2} + n\pi$

Sketch

- $f(x) = -3\sec\left(\frac{1}{2}x + \frac{\pi}{3}\right) + 1$
- Hint: Start by sketching

$$g(x) = -3\cos\left(\frac{1}{2}x + \frac{\pi}{3}\right) + 1$$

Sketching Tangent and Cotangent



- f(x) = tan (x)
- Period: π
- Domain: all x $\neq \frac{\pi}{2} + n\pi$
- Range (-∞,∞)
- Vertical asymptotes: x = $\frac{\pi}{2} + n\pi$

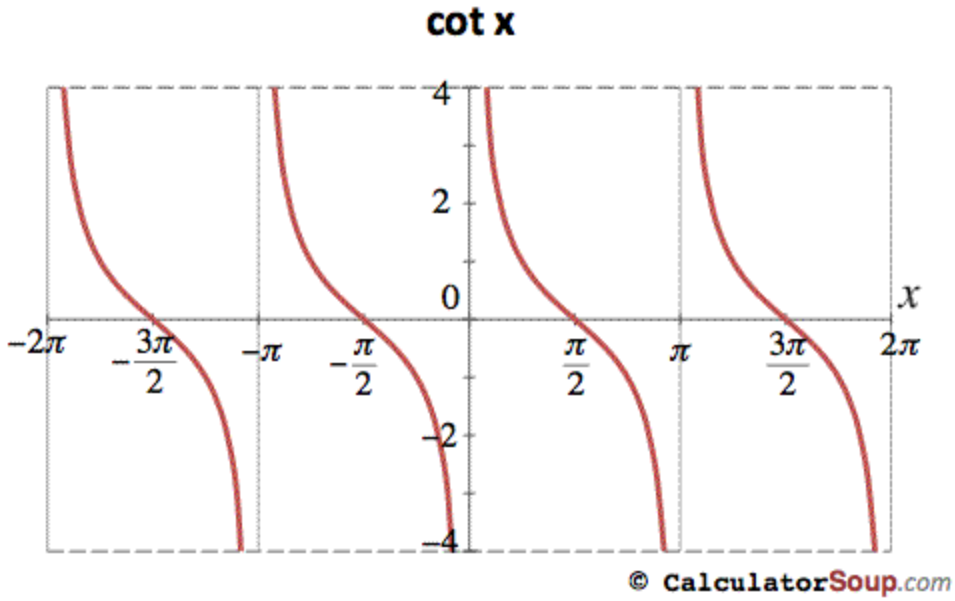
Sketching Tangent and Cotangent

- Sketch y = atan(bx − c) +d
- First, draw a line at y=d (this is your new midline)
- Then, find and sketch the vertical asymptotes:
- Left asymptote will be at $bx - c = \frac{-\pi}{2}$
- Right asymptote will be at $bx - c = \frac{\pi}{2}$
- The midpoint between the two asymptotes will be the x-intercept. Plot a point. (On the midline)
- At the midpoint between the left asymptote and the x-intercept, go down **a** units and plot a point (reverse if **a** is negative)
- At the midpoint between the x-intercept and the right asymptote, go up **a** units and plot a point (reverse if **a** is negative)
- Finish sketching the function, and add another period.

Sketching Tangent and Cotangent

- **Sketch y = -3tan(2x)+4**
- Sketch a line at y=4 (this is the new midline)
- Left asymptote at $2x=-\frac{\pi}{2}$
- Right asymptote at $2x=\frac{\pi}{2}$
- The midpoint between the two asymptotes plot the x-intercept
- At the midpoint between the L.A. and the x-intercept, go *up* 3 (because -3)
- At the midpoint between the x-intercept and the R.A., go *down* 3 (because -3)
- Finish the sketch and add a second period

Sketching Tangent and Cotangent



- f(x) = cot (x)
- Period: π
- Domain: all x ≠ $n\pi$
- Range (-∞,∞)
- Vertical asymptotes: x = $n\pi$

Sketching Cotangent - general

- Sketch $y = a\cot(bx - c)+d$
- First, draw a line at y=d (this is your new midline)
- Then, find the asymptotes:
- Left asymptote will be at $bx - c = 0$
- Right asymptote will be at $bx - c = \pi$
- The midpoint between the two asymptotes will be the x-intercept. Plot a point. (should be on the new midline)
- At the midpoint between the left asymptote and the x-intercept, go up **a** units (from the midline) and plot a point (reverse if **a** is negative)
- At the midpoint between the x-intercept and the right asymptote, go down **a** units (from the midline) and plot a point (reverse if **a** is negative)

Sketching Tangent and Cotangent

- Sketch $y = -4\cot(\frac{x}{3})+1$
- Draw the new midline (y=a)
- Sketch the left asymptote
- Sketch the right asymptote
- At the midpoint between the two asymptotes plot the x-intercept
- At the midpoint between the L.A. and the x-intercept go *down* 4 units and plot a point (because -4)
- At the midpoint between the x-intercept and the R.A. go *up* 4 units and plot a point (because -4)
- Sketch in the graph and include another period.