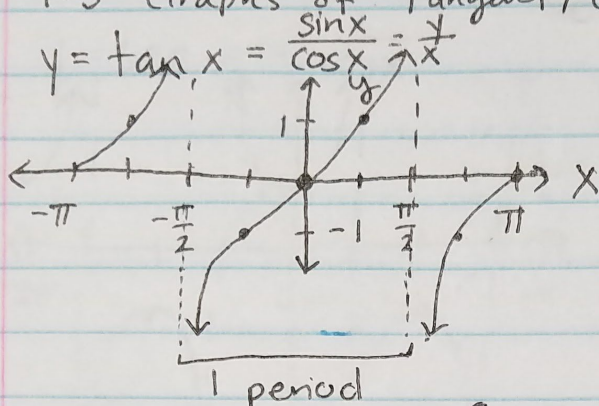


4.5 Graphs of Tangent, Cotangent, Secant & Cosecant

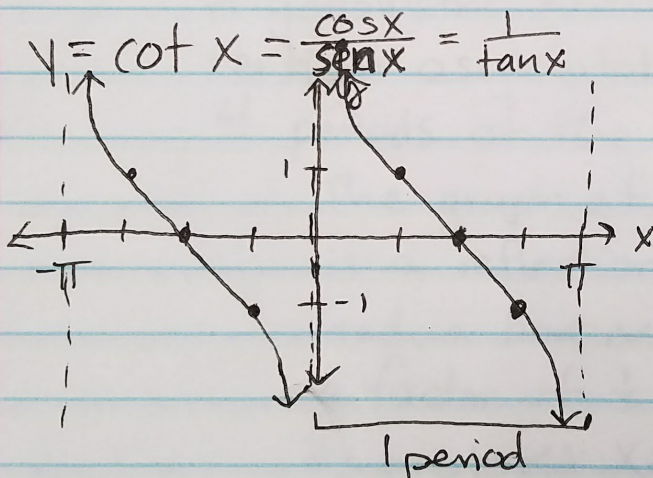


$T = \pi$ odd function

Asymptotes: $x = \frac{\pi}{2} + \pi n, n \in \mathbb{Z}$

$D: \{x \mid x \in \mathbb{R}, x \neq \frac{\pi}{2} + \pi n\}$ "x such that x is a member of the real numbers & $x \neq \frac{\pi}{2} + \pi n$ "

$R: (-\infty, \infty)$

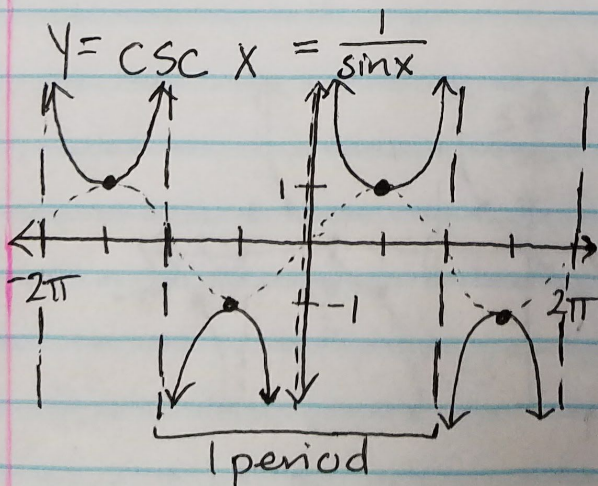


$T = \pi$ odd function

Asymptotes: $x = \pi n$

$D: \{x \mid x \in \mathbb{R}, x \neq \pi n\}$

$R: (-\infty, \infty)$

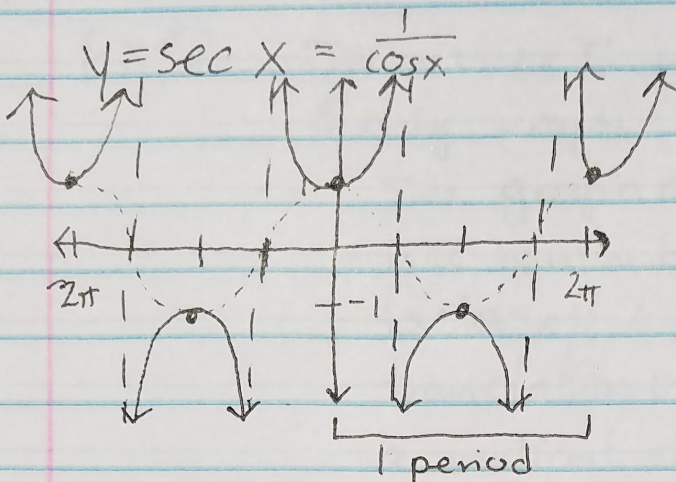


$T = 2\pi$ odd function

Asymptotes: $x = \pi n$

$D: \{x \mid x \in \mathbb{R}, x \neq \pi n\}$

$R: (-\infty, -1] \cup [1, \infty)$

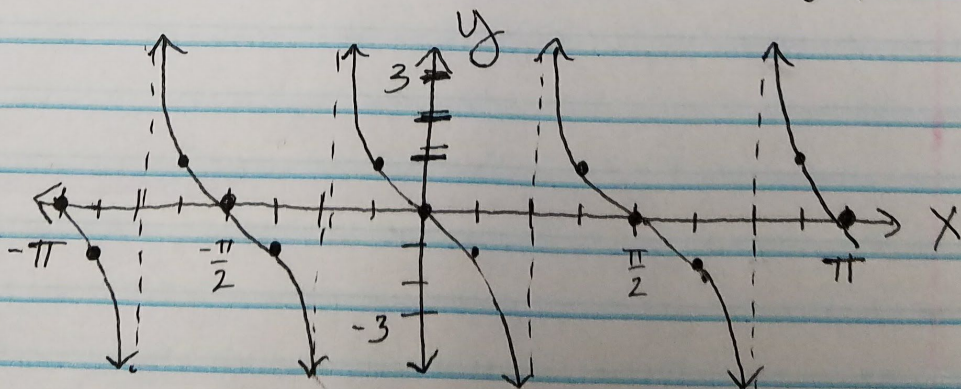


$T = 2\pi$ even function
 Asymptotes: $x = \frac{\pi}{2} + \pi n$
 $D: \{x \mid x \in \mathbb{R}, x \neq \frac{\pi}{2} + \pi n\}$
 $R: (-\infty, -1] \cup [1, \infty)$

EX#1 Describe the graph of the function $y = -\tan 2x$ in terms of a basic trigonometric function. Locate vertical asymptotes and graph 4 periods of the function.

The graph of $y = -\tan 2x$ is a reflection over the x-axis and a horizontal shrink by a factor of $\frac{1}{2}$ of the graph $y = \tan x$.

Asymptotes: $x = \frac{\pi}{4} + \frac{\pi}{2}n$
 ↑ "first" asymptote
 ← length of 1 period



EX #2 Do as ex #1 with $y = 3\sec\left(\frac{x}{2}\right) + 1$
 & only graph 2 periods.

The graph of $y = 3\sec\left(\frac{x}{2}\right) + 1$
 is a horizontal stretch by a
 factor of 2, a vertical
 translation of 1 unit up &
 a vertical stretch by a factor
 of 3 of the graph of $y = \sec x$.

Asymptotes: $x = \pi + 2k\pi$
 ↑ $\frac{1}{2}$ period length

