BOARD NOTES

12 FEBRUARY 2019

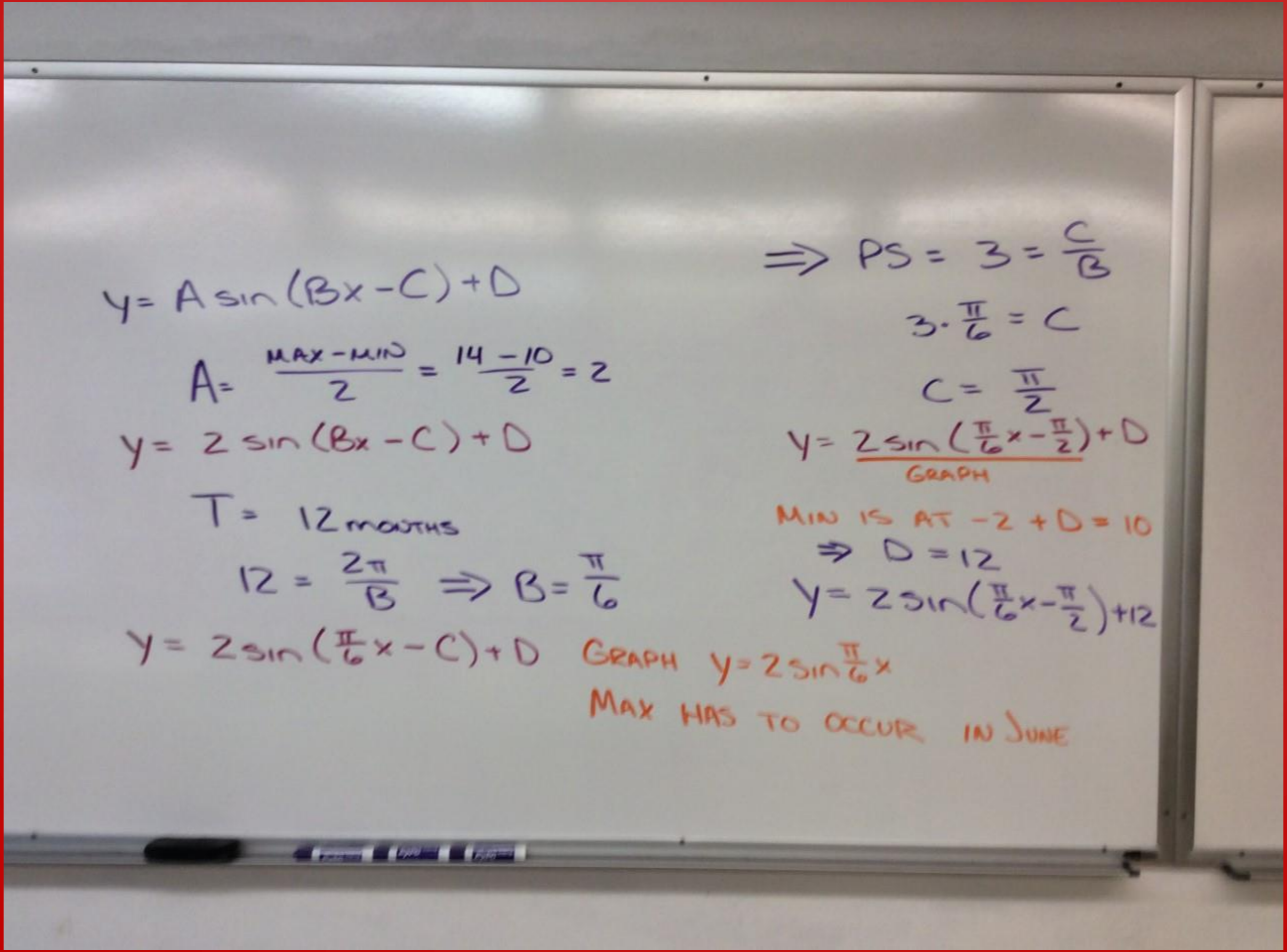
CC TRIGONOMETRY
CHAPTER 2 – GRAPHS OF THE TRIGONOMETRIC FUNCTIONS; INVERSE TRIGONOMETRIC FUNCTIONS

SECTION 2.1 - Graphs of Sine and Cosine Functions

Objectives:

- Understand the graph of $y = \sin x$.
- Graph variations of $y = \sin x$.
- Understand the graph of $y = \cos x$.
- Graph variations of $y = \cos x$.
- Use vertical shifts of sine and cosine curves.
- Model periodic behavior.

A region that is 30° north of the Equator averages a minimum of 10 hours of daylight in December. Hours of daylight are at a maximum of 14 hours in June. Let x represent the month of the year, with 1 for January, 2 for February, 3 for March, and 12 for December. If y represents the number of hours of daylight in month x, use a sine function of the form $y = A\sin(Bx - C) + D$ to model the hours of daylight.


$y = A\sin(Bx - C) + D$
$A = \frac{MAX - MIN}{2} = \frac{14 - 10}{2} = 2$
$y = 2\sin(Bx - C) + D$
T = 12 MONTHS
$12 = \frac{2\pi}{B} \Rightarrow B = \frac{\pi}{6}$
$y = 2\sin(\frac{\pi}{6}x - C) + D$
GRAPH $y = 2\sin\frac{\pi}{6}x$
MAX HAS TO OCCUR IN JUNE
$\Rightarrow PS = 3 = \frac{C}{B}$
$3 \cdot \frac{\pi}{6} = C$
$C = \frac{\pi}{2}$
$y = 2\sin(\frac{\pi}{6}x - \frac{\pi}{2}) + D$
GRAPH
MIN IS AT $-2 + D = 10$
$\Rightarrow D = 12$
$y = 2\sin(\frac{\pi}{6}x - \frac{\pi}{2}) + 12$

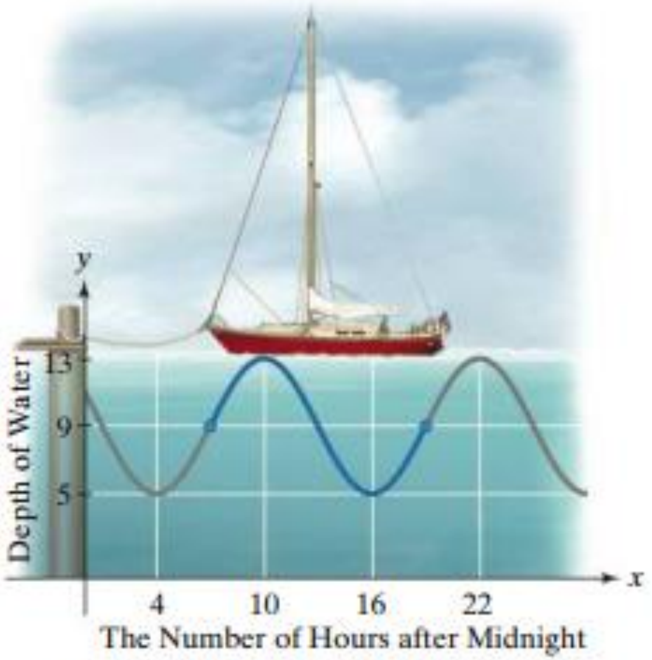


FIGURE 2.19

EXAMPLE 10 Modeling a Tidal Cycle

Figure 2.19 shows that the depth of water at a boat dock varies with the tides. The depth is 5 feet at low tide and 13 feet at high tide. On a certain day, low tide occurs at 4 A.M. and high tide at 10 A.M. If y represents the depth of the water, in feet, x hours after midnight, use a sine function of the form $y = A\sin(Bx - C) + D$ to model the water's depth.

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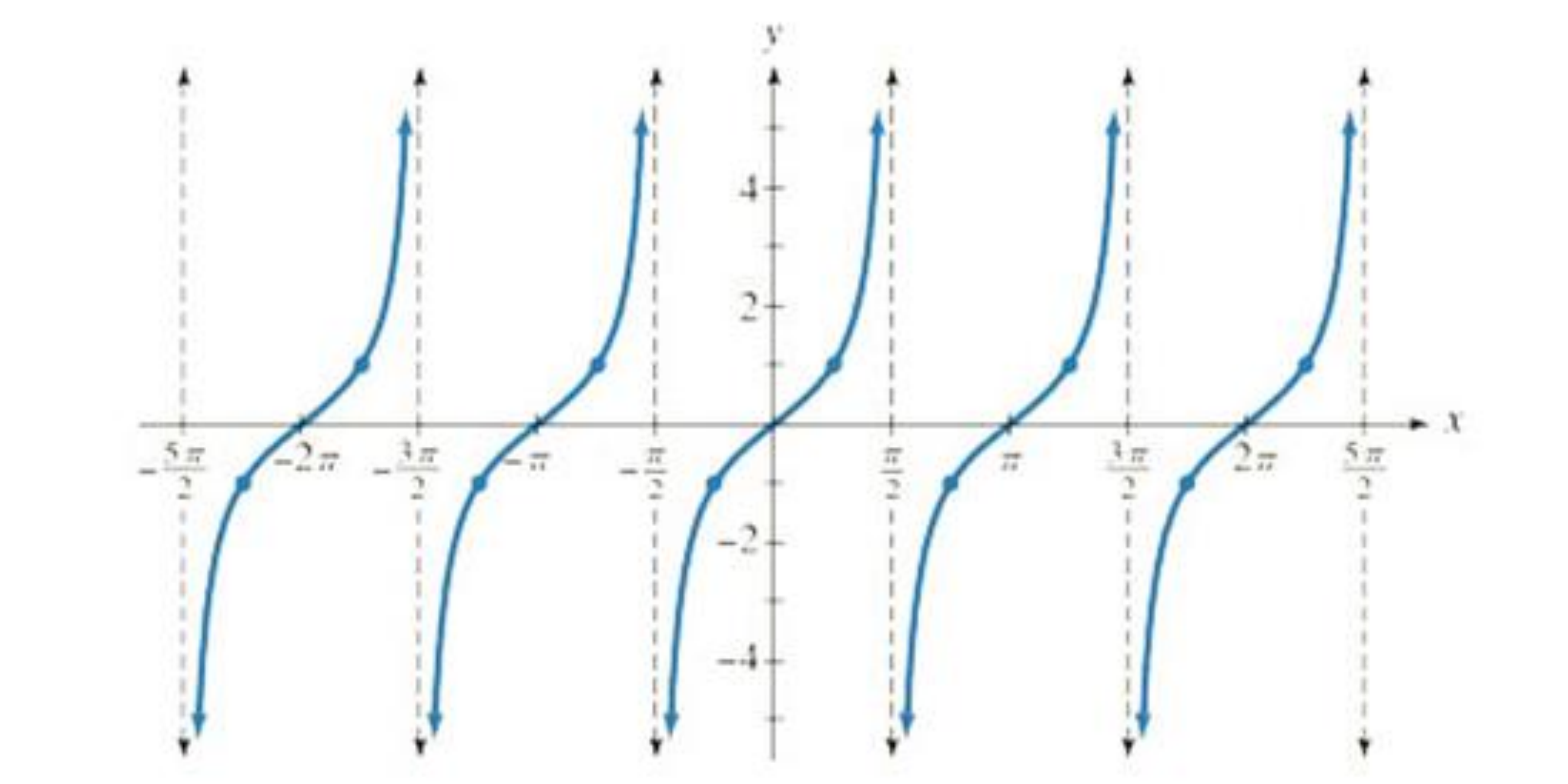
SECTION 2.2 - Graphs of Other Trigonometric Functions

Objectives:

- Understand the graph of $y = \tan x$.
- Graph variations of $y = \tan x$.
- Understand the graph of $y = \cot x$.
- Graph variations of $y = \cot x$.
- Understand the graph of $y = \sec x$ & $y = \csc x$.
- Graph variations of $y = \sec x$ & $y = \csc x$.



y
x
4
2
−2
−4
$-\frac{5\pi}{2}$
-2π
$-\frac{3\pi}{2}$
$-\pi$
$-\frac{\pi}{2}$
$\frac{\pi}{2}$
π
$\frac{3\pi}{2}$
2π
$\frac{5\pi}{2}$

The Graph of *y* = tan *x*

x	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{5\pi}{12}(75^\circ)$	$\frac{17\pi}{36}(85^\circ)$	$\frac{89\pi}{180}(89^\circ)$	1.57	$\frac{\pi}{2}$
y = tan *x*	0	$\frac{\sqrt{3}}{3} \approx 0.6$	1	$\sqrt{3} \approx 1.7$	3.7	11.4	57.3	1255.8	undefined

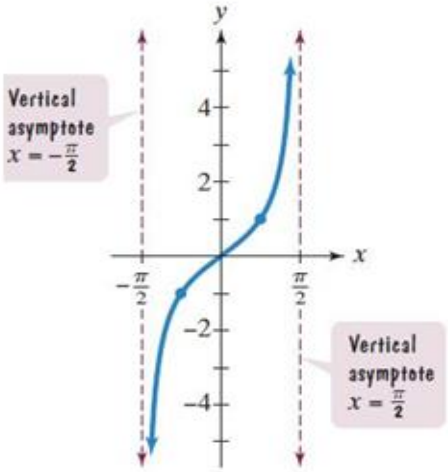
As x increases from 0 toward $\frac{\pi}{2}$, y increases slowly at first, then more and more rapidly.

Period: π

The tangent function is an odd function.

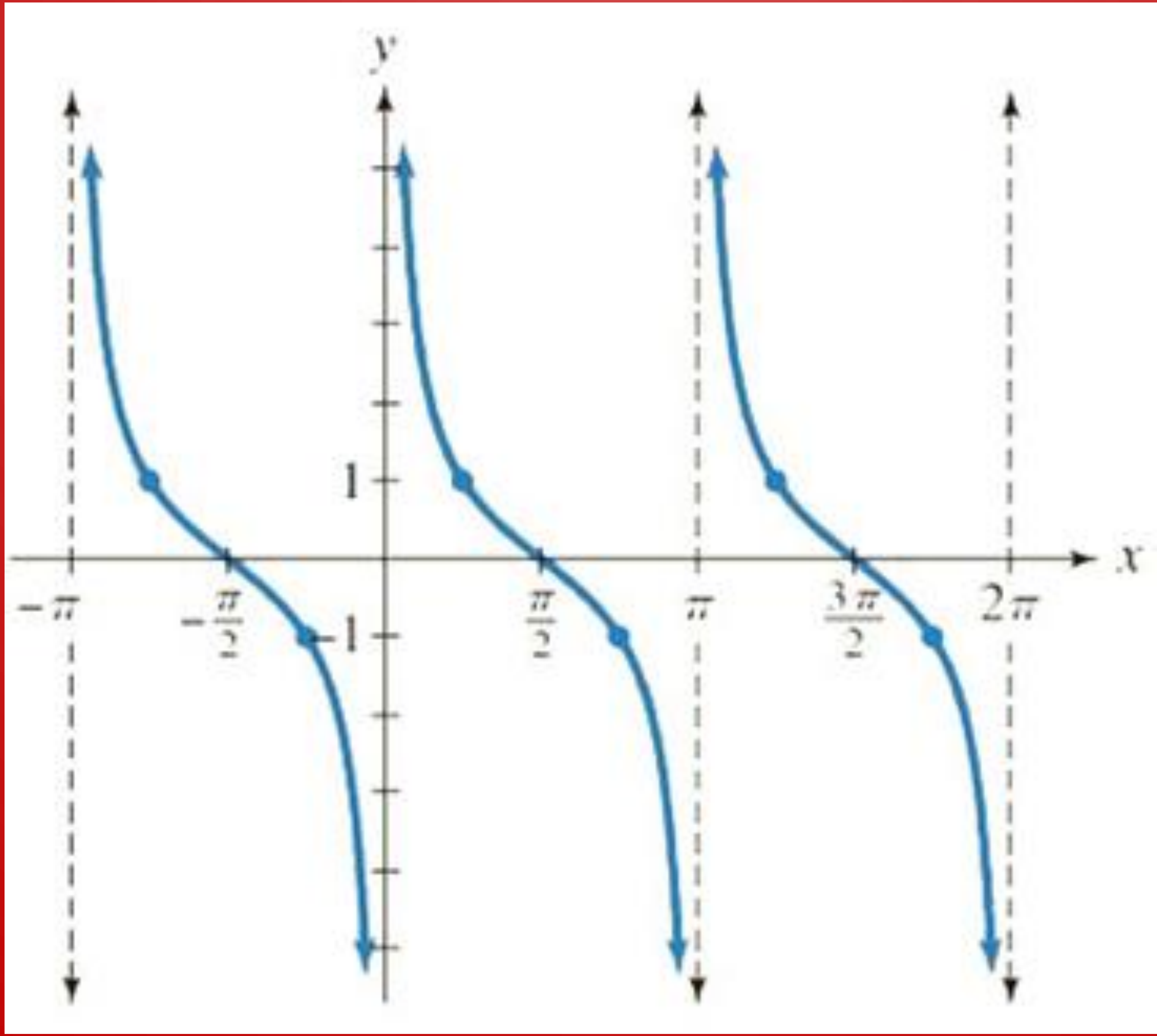
$$\tan(-x) = -\tan x$$

The tangent function is undefined at odd multiples of $x = \frac{\pi}{2}$.

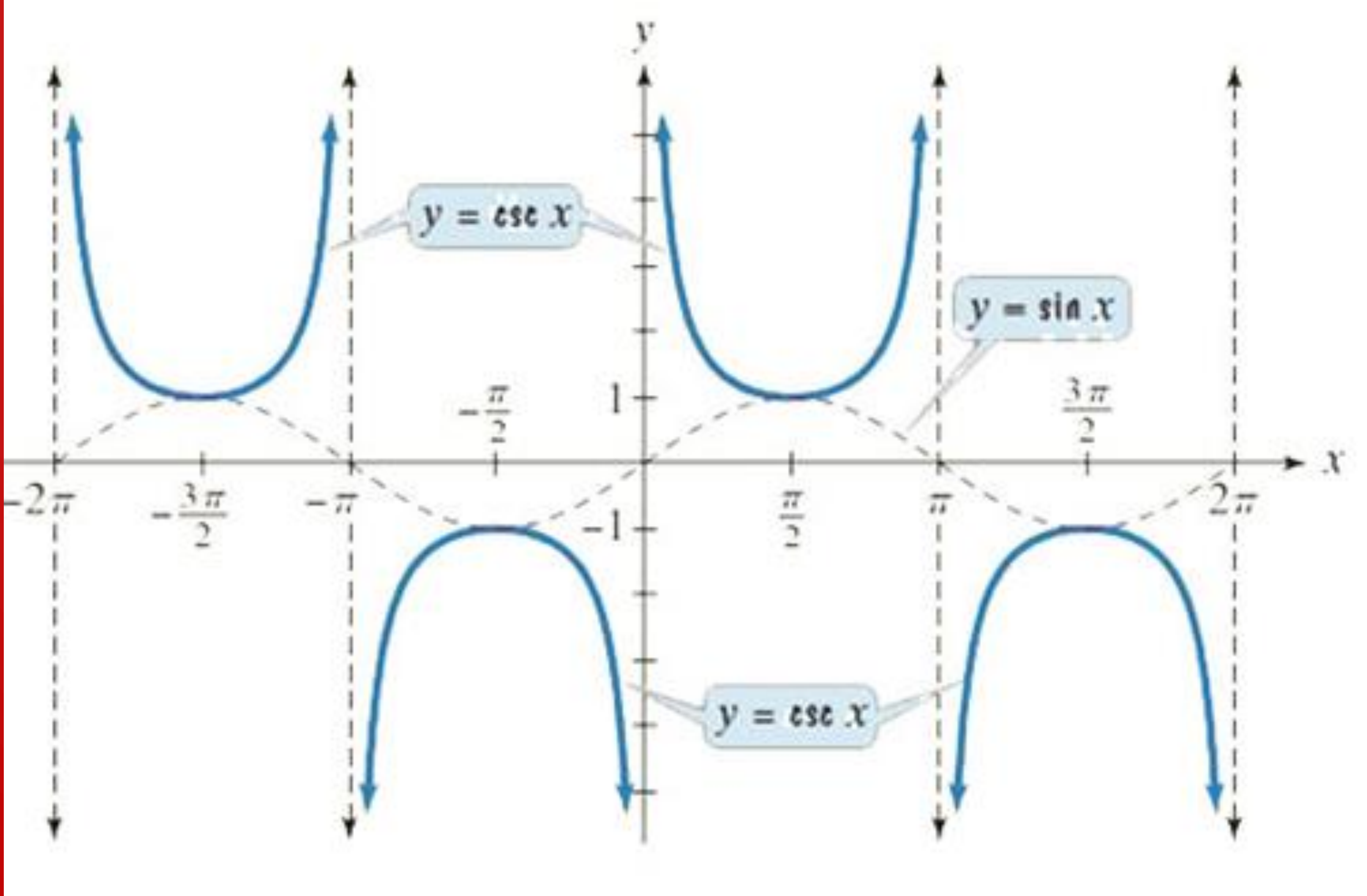


Characteristics

- **Period:** π
- **Domain:** All real numbers except odd multiples of $\frac{\pi}{2}$
- **Range:** All real numbers
- **Vertical asymptotes** at odd multiples of $\frac{\pi}{2}$
- **An *x*-intercept** occurs midway between each pair of consecutive asymptotes
- **Odd function** with origin symmetry
- Points on the graph $\frac{1}{4}$ and $\frac{3}{4}$ of the way between consecutive asymptotes have *y*-coordinates of −1 and 1, respectively.


y
1
-1
x
−π
−π/2
π/2
π
3π/2
2π

- **Period:** π
- **Domain:** All real numbers except integral multiples of π
- **Range:** all real numbers
- **Vertical asymptotes** at integral multiples of π
- **An *x*-intercept** occurs midway between each pair of consecutive asymptotes
- **Odd function** with origin symmetry
- Points on the graph $\frac{1}{4}$ and $\frac{3}{4}$ of the way between consecutive asymptotes have *y*-coordinates of 1 and −1, respectively.



y
y = csc x
y = sin x
1
-1
-2π
$-\frac{3\pi}{2}$
$-\pi$
$-\frac{\pi}{2}$
$\frac{\pi}{2}$
π
$\frac{3\pi}{2}$
2π
x
y = csc x

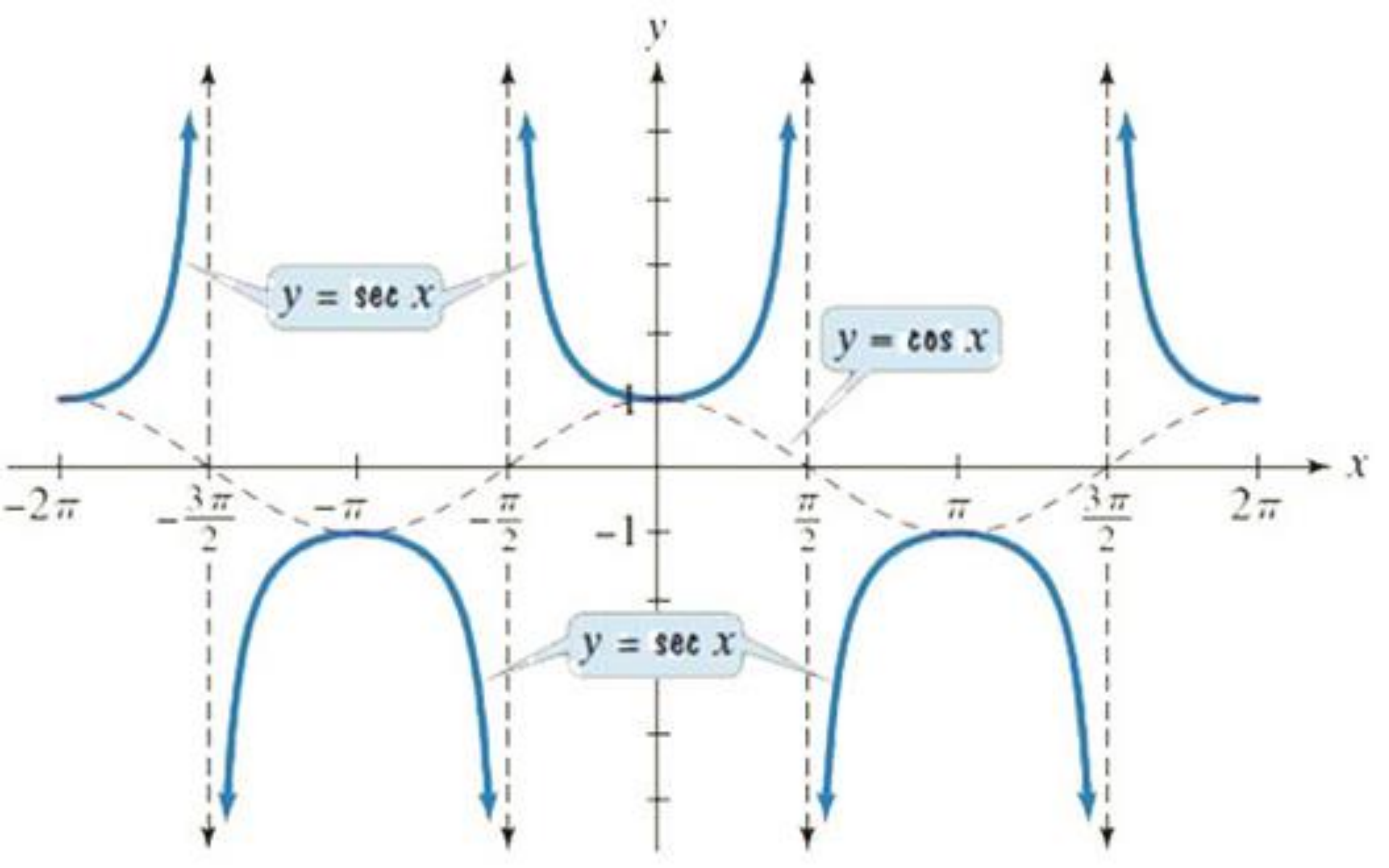
Period: 2π

Domain: All real numbers except integral multiples of π

Range: All real numbers y such that $y \le -1$ or $y \ge 1$: $(-\infty, -1] \cup [1, \infty)$

Vertical asymptotes at integral multiples of π

Odd functions, $\csc(-x) = -\csc x$, with origin symmetry


y
y = sec x
y = cos x
y = sec x
x
−2π
−3π/2
−π
−π/2
π/2
π
3π/2
2π
1
−1

- **Period:** 2π
- **Domain:** All real numbers except odd multiples of $\frac{\pi}{2}$
- **Range:** All real numbers y such that $y \le -1$ or $y \ge 1$: $(-\infty, -1] \cup [1, \infty)$
- **Vertical asymptotes** at odd multiples of $\frac{\pi}{2}$
- **Even functions,** $\sec(-x) = \sec x$, with y-axis symmetry

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