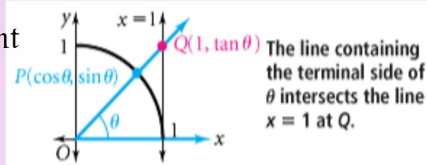


13.6 The Tangent Function

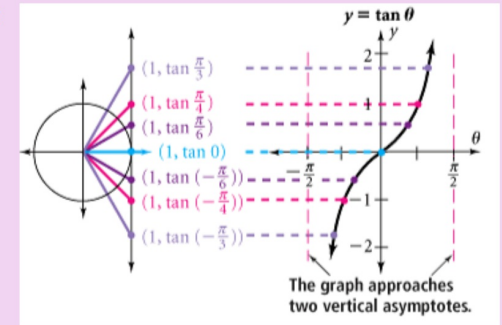
The sine and cosine of an angle derive from the coordinates of a point on the unit circle. The tangent of an angle derives from the coordinates of a point on a line *tangent* to the unit circle.

For an angle θ in standard position, the **tangent of θ** is the y-coordinate of the point where the line containing the terminal side of the angle intersects the tangent line $x = 1$.



The graph shows one cycle of the tangent function, $y = \tan \theta$. Since the period is π , the asymptote that occurs at $\theta = \frac{\pi}{2}$ repeats every π units.

You can estimate function values from the graph of the tangent function.



Use the graph of $y = \tan \theta$ to find each value

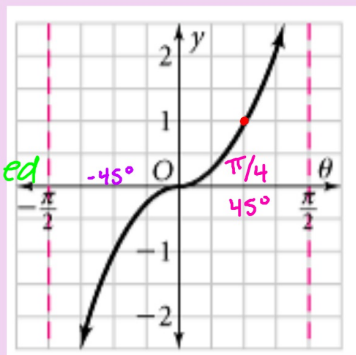
$\tan \frac{\pi}{4}$ |

$\tan 0$ 0

$\tan(-\frac{\pi}{2})$ undefined

$\tan 45^\circ$ |

$\tan -45^\circ$ -|

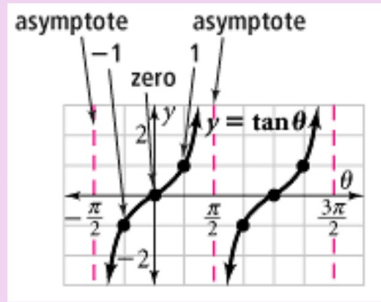


Properties of Tangent Function

Suppose $y = a \tan b\theta$, with $b > 0$, and θ in radians.

- $\frac{\pi}{b}$ is the period of the function
- One cycle occurs in the interval from $-\frac{\pi}{2b}$ to $\frac{\pi}{2b}$
- There are vertical asymptotes at each end of the cycle.

You can use asymptotes and three points to sketch one cycle of a tangent curve. As with sine and cosine, the five elements are equally spaced through one cycle.



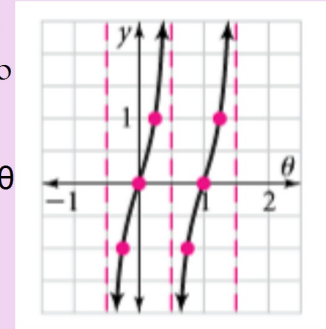
Use the pattern *asymptote ... - a ... zero ... a ... asymptote*.
In the graph at the right, $a = b = 1$.

The example at the right, shows how to use the period, asymptotes, and points to graph a tangent function.

Sketch two cycles of the graph $y = \tan \pi \theta$

period = $\frac{\pi}{b}$ use the period formula

$\frac{\pi}{\pi} = 1$ substitute $\pi = b$, simplify



Sketch two cycles of the following graph.

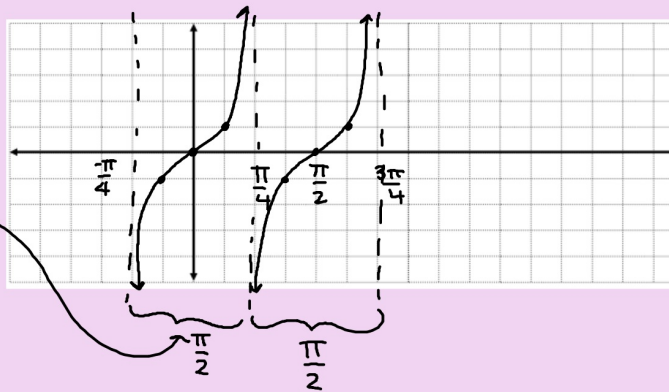
$$y = \tan 2\theta$$

$$a = 1$$

$$b = 2$$

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

$$\text{each } \frac{\pi}{2} \cdot \frac{1}{2} = \frac{\pi}{4}$$



Sketch two cycles of the following graph.

$$y = \tan \frac{\pi}{2} \theta$$

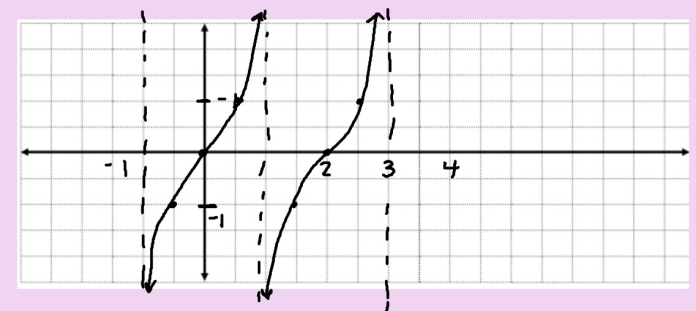
$$a = 1$$

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

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

$$= \pi \cdot \frac{2}{\pi} = 2$$

$$\text{each} = 1$$



Sketch two cycles of the following graph.

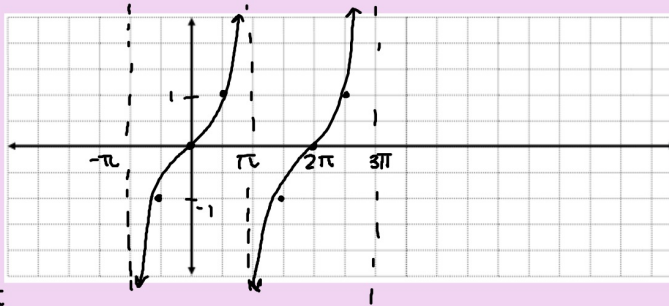
$$y = \tan \frac{\theta}{2}$$

$$a = 1$$

$$b = \frac{1}{2}$$

$$\text{period} = \frac{\pi}{\frac{1}{2}}$$

$$= \pi \cdot \frac{2}{1} = 2\pi$$



homework:

page 737 # 1-18 #15-18 2+ cycles