# 10.3 Graphing Tangent

$\tan\theta = \frac{y}{x}\left(\frac{\sin\theta}{\cos\theta}\right)$

1) Give the exact value of the trig function.

a. $\tan\pi$ 0

b. $\tan\frac{\pi}{4}$ 1

c. $\tan\frac{\pi}{3}$ $\sqrt{3}$

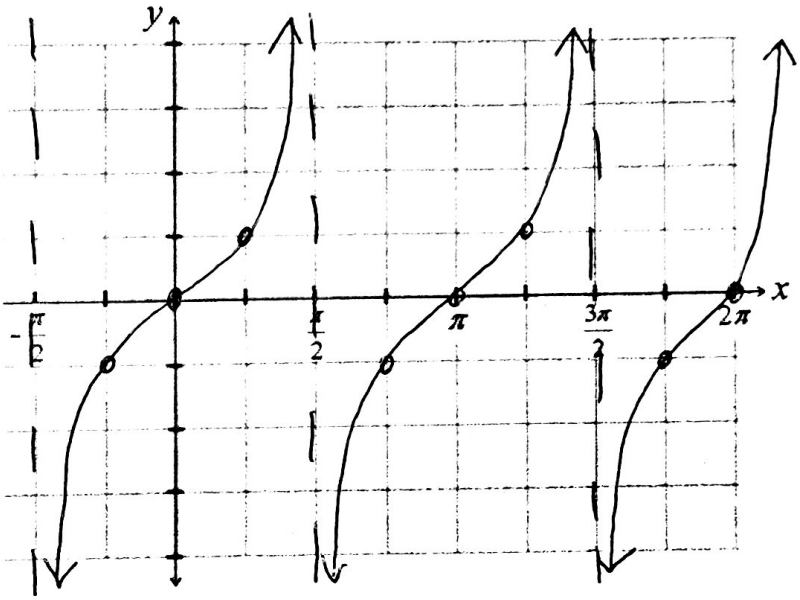
d. $\tan\frac{\pi}{6}$ $\frac{\sqrt{3}}{3}$

e. $\tan\frac{\pi}{2}$ $\frac{1}{0}$ DNE

Tangent is different than sine and cosine because it involves the relationship between two existing trig functions. Fill out the table below and plot the points on the graph to see the shape that tangent makes.

| $\theta$ | $y$ |
|---|---|
| $-\frac{\pi}{2}$ | DNE |
| $-\frac{\pi}{4}$ | -1 |
| 0 | 0 |
| $\frac{\pi}{4}$ | 1 |
| $\frac{\pi}{2}$ | DNE |
| $\frac{3\pi}{4}$ | -1 |
| $\pi$ | 0 |
| $\frac{5\pi}{4}$ | 1 |
| $\frac{3\pi}{2}$ | DNE |
| $\frac{7\pi}{4}$ | -1 |
| $2\pi$ | 0 |

$y = \tan\theta$




Why does tangent have vertical asymptotes? How often do they occur?

$\frac{y}{x}$, you can't divide by 0, $\pi$ units apart

We see that every time we get to a multiple of $\frac{\pi}{4}$, the coordinate becomes 1 or -1. How does that relate to the unit circle?

The radius of the unit circle

How long is one tangent cycle (aka the period)?

$\pi$

What pattern could you use to graph tangent?

VA - (-1) - 0 - 1 - VA

What is the domain and range of $y = \tan\theta$?

D: $x \neq \frac{\pi}{2} + \pi n$

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

$$y = a \tan b\theta$$

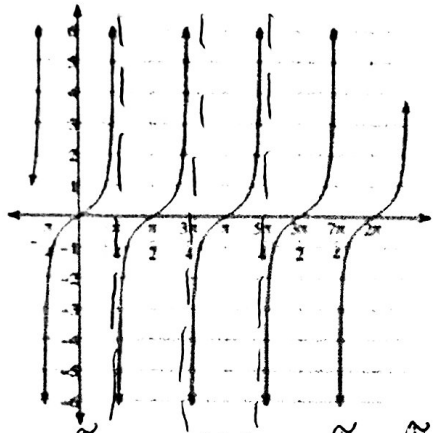
| | | |
|---|---|---|
| ~~Amplitude~~ Vertical Stretch | $a$ | The coordinate you hit at $\frac{\pi}{4}$ |
| Period | $\frac{\pi}{b}$ | How long it takes to complete one cycle |
| Frequency | $b$ | How many cycles happen between $0$ & $\pi$ |
| Vertical Asymptote | | $\frac{\frac{\pi}{2}}{b} = \frac{\pi}{2}\cdot\frac{1}{b} + \frac{\pi}{b}n = \boxed{\frac{\pi}{2b} + \frac{\pi}{b}n}$ |

*VA is half period

VA: $x = \frac{P}{2} + pn$

2) Determine period, frequency, and location of the vertical asymptotes.

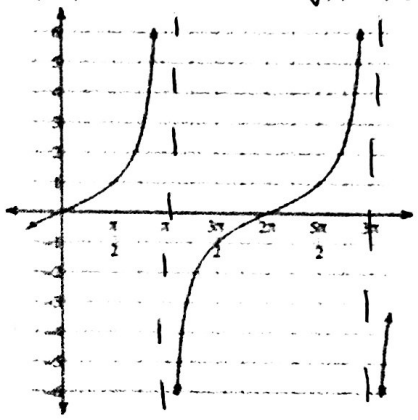
a.



$P = \frac{\pi}{2}$ VA: $x = \frac{\pi}{4} + \frac{\pi}{2}n$

$b = 2$

b.



$P = 2\pi$ VA: $x = \pi + 2\pi n$

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

c. $y = \tan 2\theta$

$P = \frac{\pi}{2}$ VA: $\frac{\pi}{2}\cdot\frac{1}{2} = \frac{\pi}{4}$

$b = 2$ $x = \frac{\pi}{4} + \frac{\pi}{2}n$

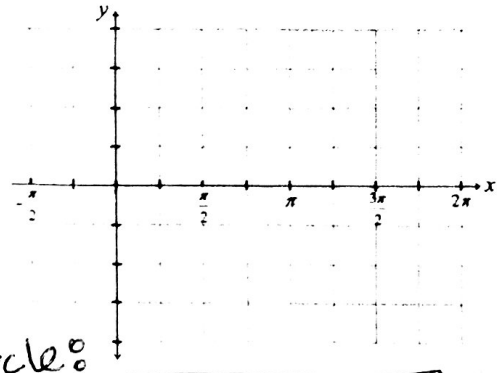
d. $y = 2\tan\frac{x}{4}$

$P = 4\pi$ VA: $\frac{\pi}{2}\cdot\frac{1}{\frac{1}{4}} = \frac{\pi}{2}\cdot\frac{4}{1} = 2\pi$

$b = \frac{1}{4}$ $x = 2\pi + 4\pi n$

3) Sketch each function.

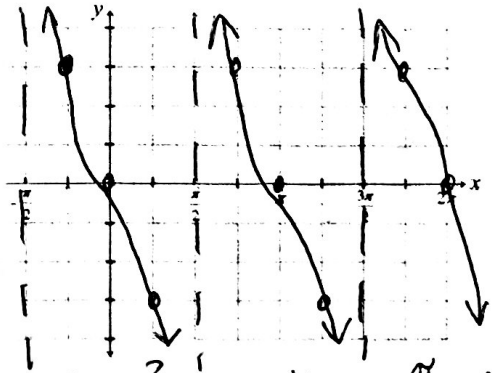
a. $y = \tan\theta$



Cycle:

VA, $-a$, 0, $a$, VA

b. $y = -3\tan\theta$



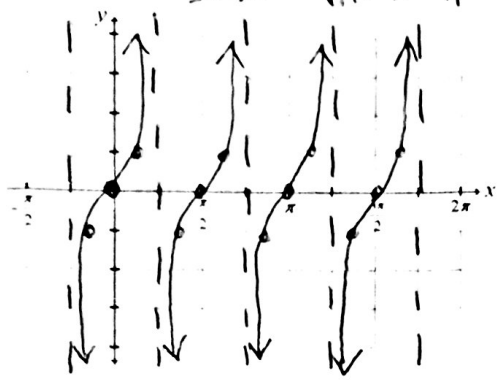
$a = -3$

$b = 1$

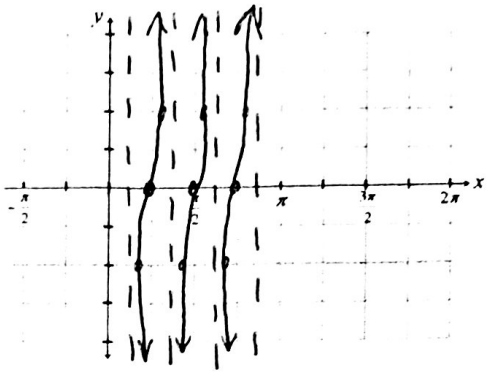
$P = \pi$

VA: $x = \frac{\pi}{2} + \pi n$

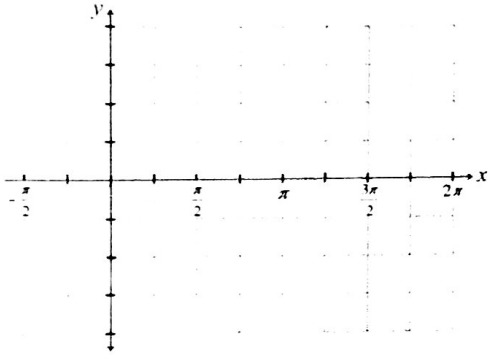
c. $y = \tan 2\theta$ $a=1$ $p=\frac{\pi}{2}$ $b=2$ VA: $x=\frac{\pi}{4}+\frac{\pi}{2}n$



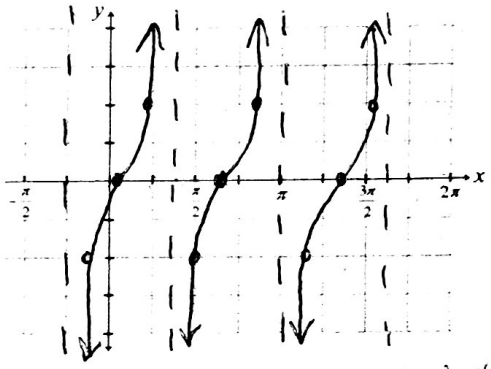
d. $y = 2\tan 4\theta$ $a=2$ $p=\frac{\pi}{4}$ $b=4$ VA: $x=\frac{\pi}{8}+\frac{\pi}{4}n$



e. $y = -\tan\frac{x}{3}$



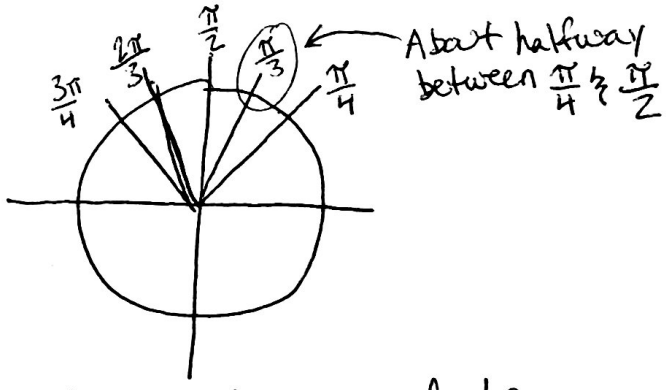
f. $y = 2\tan\frac{3x}{2}$



$a=2$ $p=\frac{2\pi}{3}$ (2.5 boxes)

$b=\frac{3}{2}$ VA: $\frac{2\pi}{6}$

$x=\frac{\pi}{3}+\frac{2\pi}{3}n$




If the point you need to graph is not on the axis, use the unit circle to help you know where to plot the point.