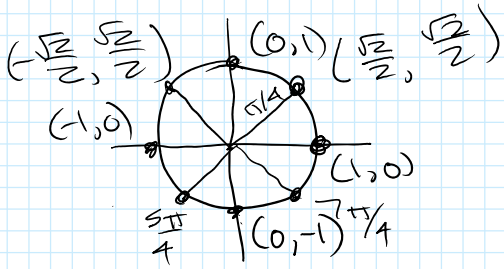
4.3.1

4.3: Graphs of the Tangent and cotangent Functions

Graph of $y = \tan x$

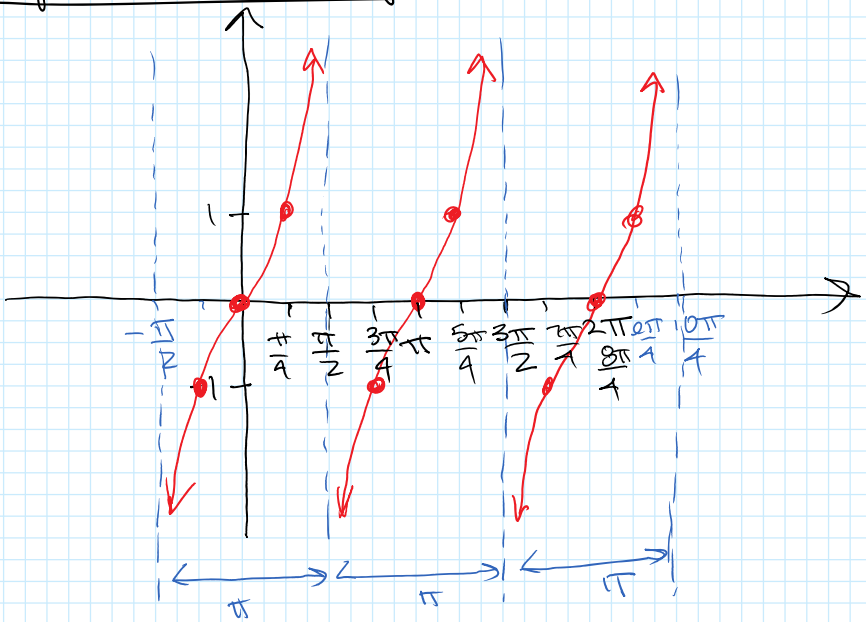
x	$y = \tan x$
0	$\frac{0}{1} = 0$
$\pi/4$	1
$\pi/2$	~~$\frac{1}{0}$~~ undefined
$3\pi/4$	-1
π	$\frac{0}{-1} = 0$
$5\pi/4$	$\frac{-\sqrt{2}/2}{-\sqrt{2}/2} = 1$
$3\pi/2$	~~$\frac{-1}{0}$~~ undefined
$7\pi/4$	-1
2π	$\frac{0}{1} = 0$



Notice: $y = \tan x$ repeats after π instead of after 2π

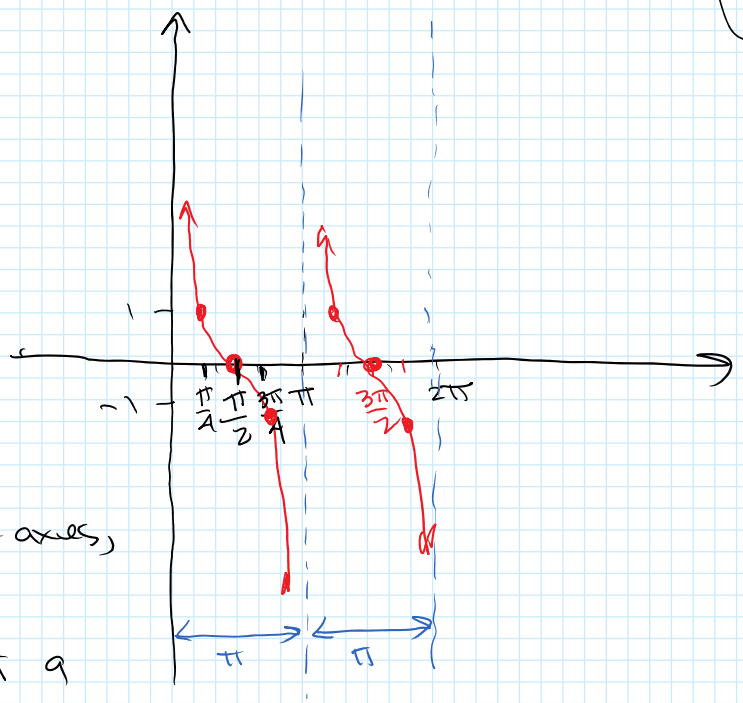
$y = \tan x$ and $y = \cot x$ have period π.

Graph of $y = \tan x$



4.3.2

Graph of $y = \cot x$



If you have same scale on x- and y-axes, $y = \tan x$ and $\cot x$ cross x-axis at a 45° angle

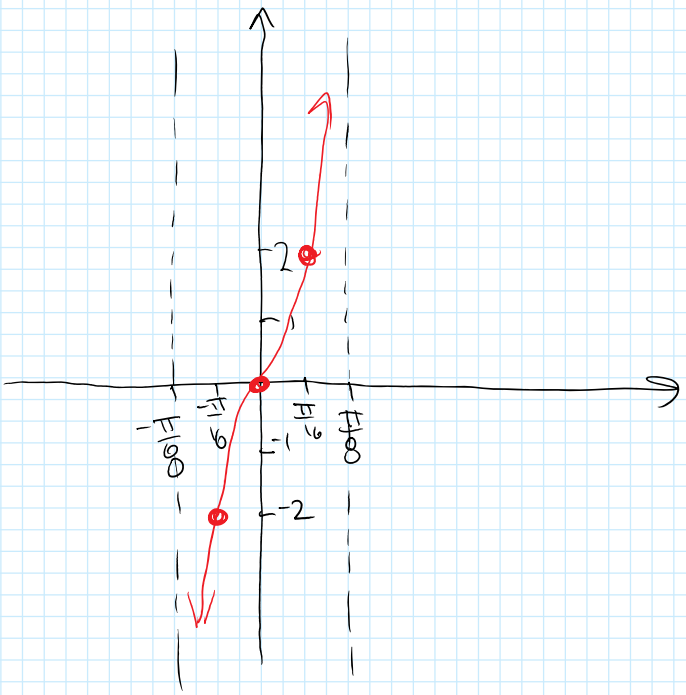
4.3.3

Ex: Graph $f(x) = 2\tan(4x)$

Vertical Stretch: 2

Period: $\frac{\text{original period}}{4} = \frac{\pi}{4}$

No phase shift, no vertical shift, no reflection



Note: For $y = \tan x$, 1 period is $0 \le x \le \pi$.

So 1 period of $y = \tan(4x)$ is

$$0 \le 4x \le \pi$$
$$\frac{0}{4} \le \frac{4x}{4} \le \frac{\pi}{4}$$
$$0 \le x \le \frac{\pi}{4}$$

or: For $y = \tan x$, we usually graph 1 period as $-\frac{\pi}{2} < x < \frac{\pi}{2}$

For $y = \tan(4x)$, this becomes

$$-\frac{\pi}{2} < 4x < \frac{\pi}{2}$$
$$\frac{-\pi/2}{4} < \frac{4x}{4} < \frac{\pi/2}{4}$$
$$-\frac{\pi}{8} < x < \frac{\pi}{8}$$

4.3, 3, 4

Ex: Graph $y = \frac{1}{2}\cot\left(5x - \frac{\pi}{2}\right)$

$y = \frac{1}{2}\cot\left(5\left(x - \frac{\pi}{10}\right)\right)$

Set $5x - \frac{\pi}{2} = 0$

$5x = \frac{\pi}{2}$

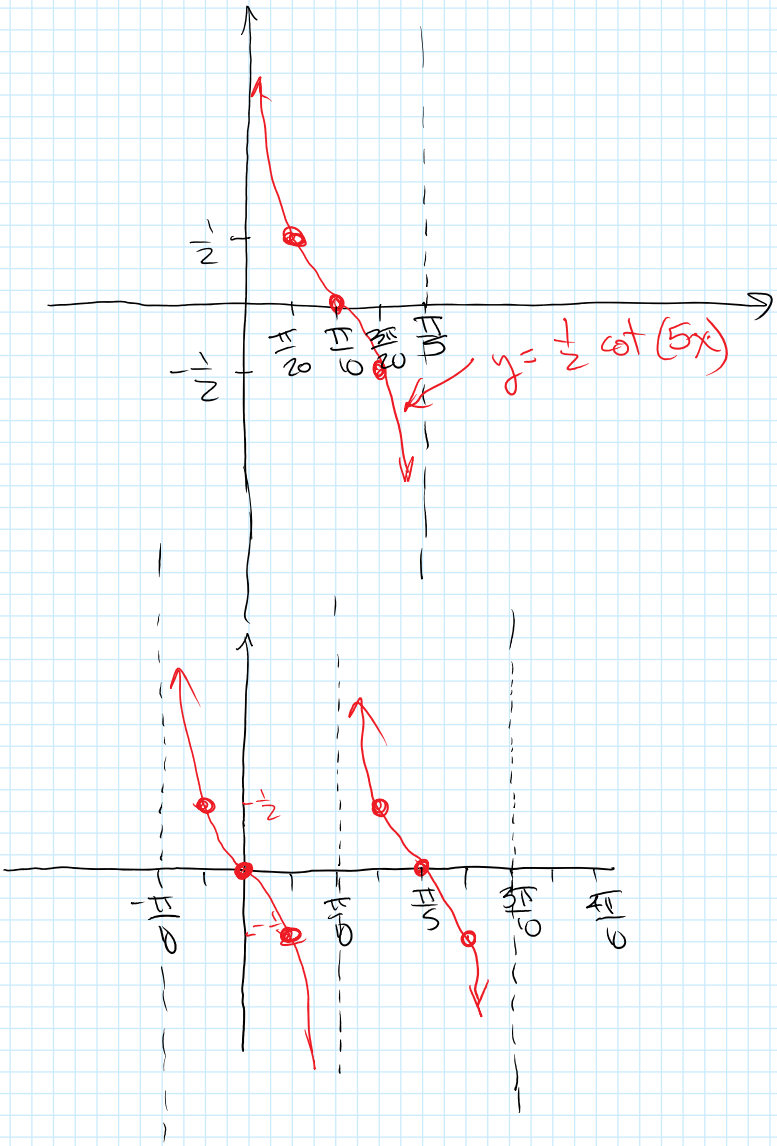
$x = \frac{\pi}{10}$

so shift right $\frac{\pi}{10}$

Phase shift: right $\frac{\pi}{10}$

Vertical stretch/shrink: $\frac{1}{2}$

Period: $\frac{\text{old period}}{5} = \frac{\pi}{5}$



Note: For $y = \cot(x)$, 1st period we graph is likely $0 < x < \pi$

For $y = \cot(5x)$, this becomes $0 < 5x < \pi$

$\frac{0}{5} < \frac{5x}{5} < \frac{\pi}{5}$

$0 < x < \frac{\pi}{5}$