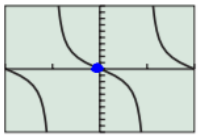
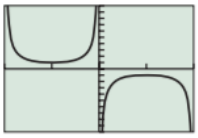
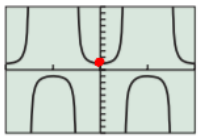
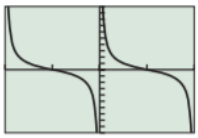
In Exercises 13–16, match the trigonometric function with its graph. Then give the Xmin and Xmax values for the viewing window in which the graph is shown. Use your understanding of transformations, not your graphing calculator.


[?, ?] by [−10, 10]
(a) tan


[?, ?] by [−10, 10] csc
(b)


[?, ?] by [−10, 10]
(c) sec


[?, ?] by [−10, 10]
(d) cot

13. $y = -2 \tan x$ (a)

14. $y = \cot x$ (d)

15. $y = \sec 2x$ (c)

16. $y = -\csc x$ (b)

Tan	cot
goes through the origin	does not
$-\frac{\pi}{2}$ and $\frac{\pi}{2}$	0 and π

Sec	csc
has y-int	does not

Reflection over y-axis

$$a\,f(-cx-h)+k$$

a<0 flip

Reflection over x-axis

|c| > 1 (ex: sin 4x)

Horizontal shrink

|a| > 1 v. stretch

0 < |a| < 1 V. shrink (compress)

0 < |c| < 1 $\sin \frac{1}{2}x$

Horizontal stretch.

In Exercises 21–28, describe the transformations required to obtain the graph of the given function from a basic trigonometric graph.

21. $y = 3 \tan x$

22. $y = -\tan x$

23. $y = 3 \csc x$

24. $y = 2 \tan x$

25. $y = 3 \cot \frac{1}{2}x$

26. $y = -2 \sec \frac{1}{2}x$

27. $y = -\tan \frac{\pi}{2}x + 2$

28. $y = 2 \tan \pi x - 2$

p366

21. V. Strech by 3

22. reflection across x-axis

23. V. stretch by 3

24. V. Stretch by 2

25. Reflection over x-axis

V. Stretch by 3

H. stretch by 2

26. V. stretch by 2
Reflection across x-axis
H. stretch by 2

27. $y = -\tan \frac{\pi}{2} x + 2$ up 2
Reflection over x-axis
H. shrink by $\frac{2}{\pi}$

28. $y = 2\tan \pi x - 2$ down 2
V. stretch by 2
$3.14 > 1$
H. shrink by $\frac{1}{\pi}$