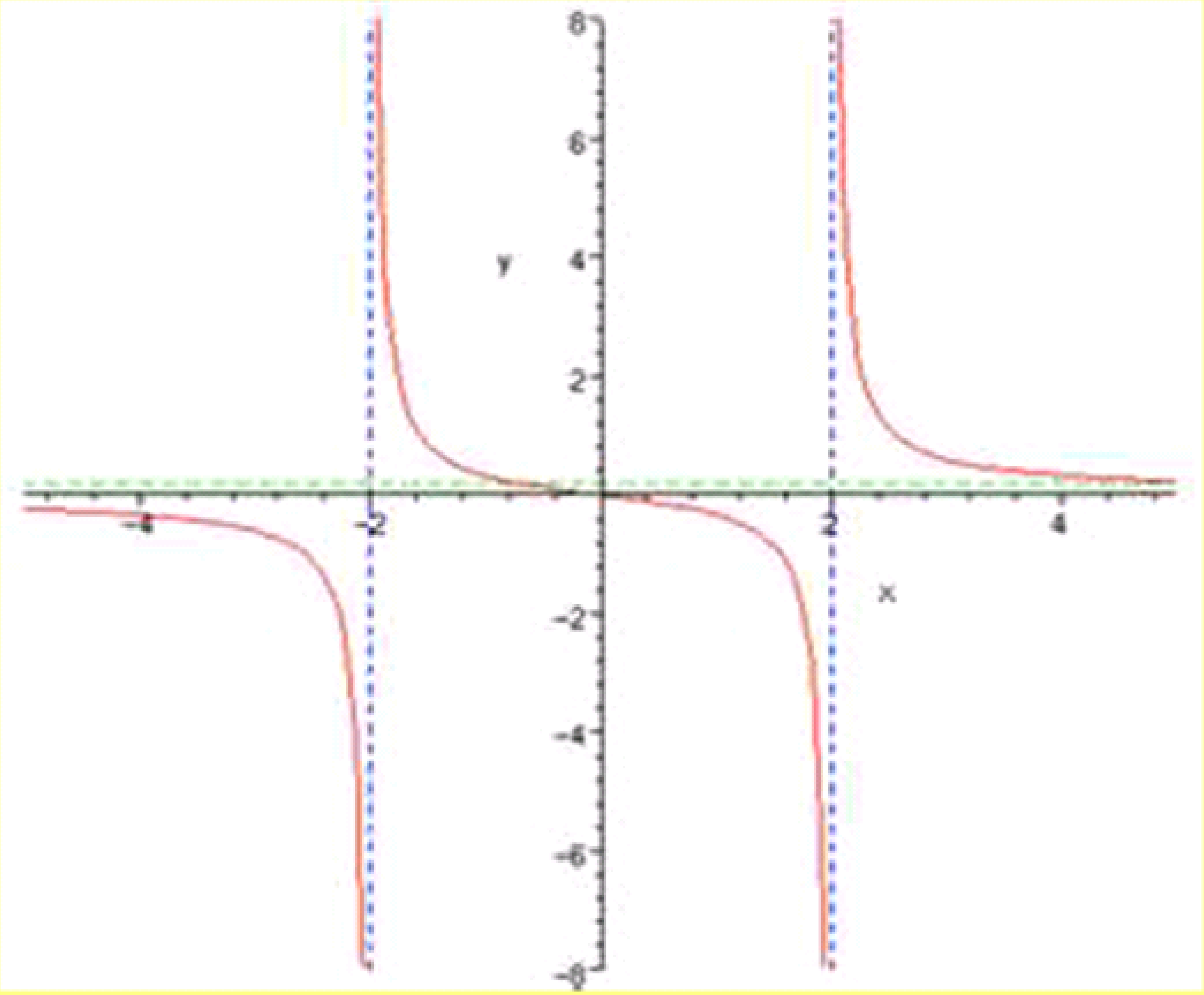
Sec 3.5
Finding vertical and horizontal asymptotes

Asymptotes act like boundaries for a graph. On both sides, the graph will approach either negative, or positive, infinity.

Yesterday, we described asymptotic behavior and end behavior.

Today...finding the asymptotes that cause it.



Three types of asymptotes occur:

① Vertical

② Horizonal

③ Slant/oblique

Well work with only vertical & horizontal in one lesson; slant in another.

Finding vertical

Simple! Set denominator equal to zero and solve.

Example-

$f(x) = \frac{x}{x^2 - 9}$

VA's

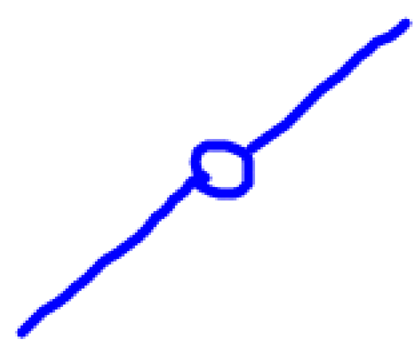
$x = \pm 3$

$f(x) = \frac{x+4}{x^2 - 16}$

$\frac{\cancel{x+4}}{\cancel{(x+4)}(x-4)}$

VA @ $x = 4$

hole @ $x = -4$



$f(x) = \frac{x+4}{x^2 + 16}$

$x^2 + 16 = 0$

$\sqrt{x^2} = \sqrt{-16}$

no VA's

Finding horizontal

We will compare the *degree* of the numerator vs. denominator, where "*n*" is the degree of the numerator and "*m*" is the degree of the denominator.

- If n < m there is a horizontal asymptote @ y = 0
- If n = m, there is a horizontal asymptote at the ratio of the leading coeffiecients
- If n > m there is *no* horizontal asymptote (this is when slant asymptotes will occur, however)

n = m	n < m	n > m
horizontal at ratio	horiztonal at y = 0	none
$\frac{6-4x}{5+2x}$	$\frac{4x+3}{x^3-8}$	$\frac{6x^3+2}{x^2}$
HA @ $y = -2$	HA @ $y = 0$	no HA (later: slant)

Suggested Practice

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21-44 odds

*find asymptotes only...no graphing today

21. VA @ $x=-4$

23. VA @ $x=-4$
$x=0$

25. VA @ $x=-4$
hole @ $x=0$

27. none

29. hole @ $x=3$

31. VA @ $x=-3$
hole @ $x=3$

33. VA @ $x=3$
hole @ $x=-7$

35. hole @ $x=-7$

37. $y=0$

39. $y=4$

41. no HA

43. $y=-2/3$