Sec 3.5.1
Asymptotic behavior & domain restrictions

Determine the domain of each:

$f(x) = \frac{3x}{x-4}$

$x \neq 4$

d: $(-\infty, 4) \cup (4, \infty)$

$f(x) = \frac{4}{(x-2)(x+3)}$

$x \neq 2$ or -3

d: $(-\infty, -3) \cup (-3, 2) \cup (2, \infty)$

***use interval notation**

$$f(x) = \frac{6x}{x^2 - 81}$$

$$x^2 - 81 \neq 0$$

$$x^2 \neq 81$$

$$x \neq \pm 9$$

$$d: (-\infty, -9) \cup (-9, 9) \cup (9, \infty)$$

$$f(x) = \frac{5x^2}{x^2 + 9}$$

$$x^2 + 9 \neq 0$$

$$\sqrt{x^2} \neq \sqrt{-9}$$

$$x \neq \pm 3i$$

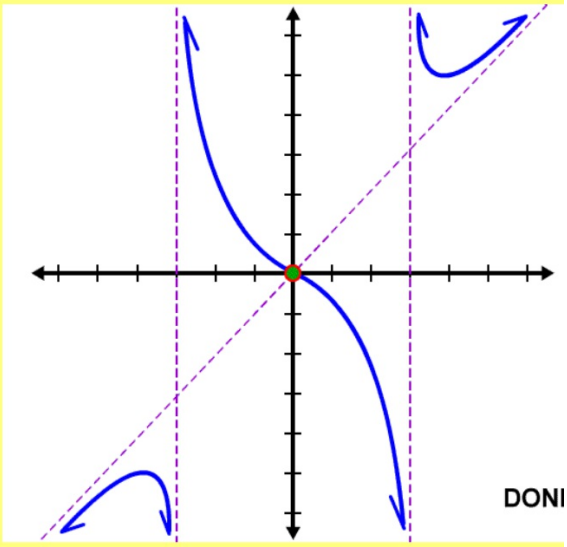
$$d: \mathbb{R}$$

Asymptotic Behavior

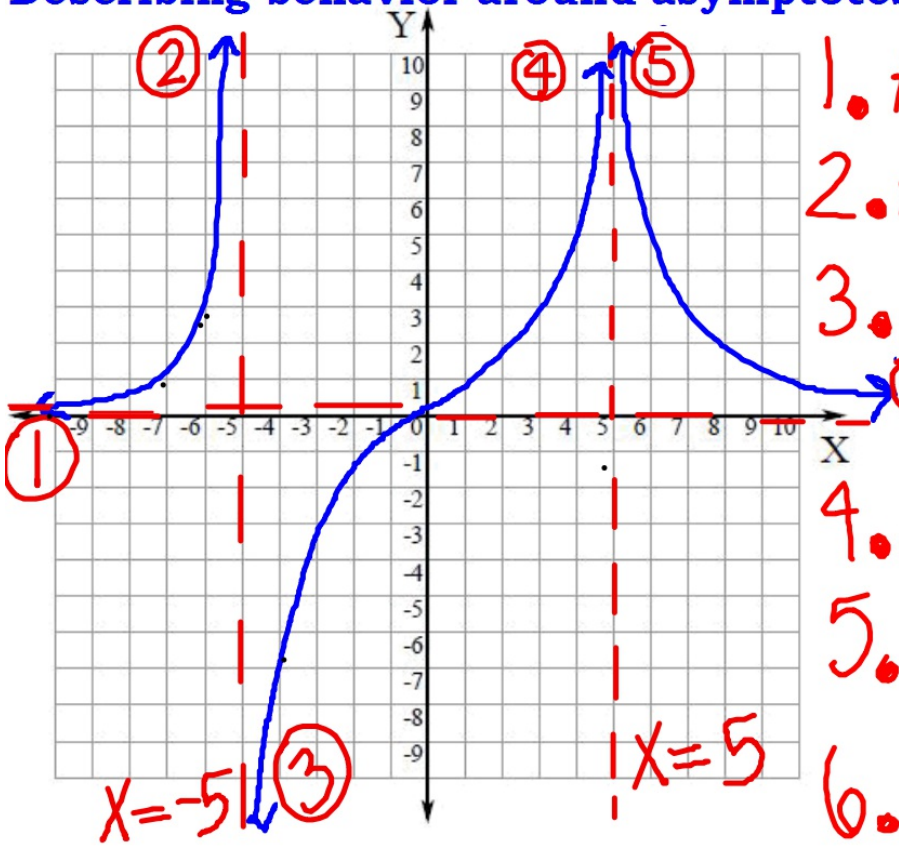
Asymptotes act like boundaries on a graph.

On both sides, the graph will approach either negative or positive infinity.

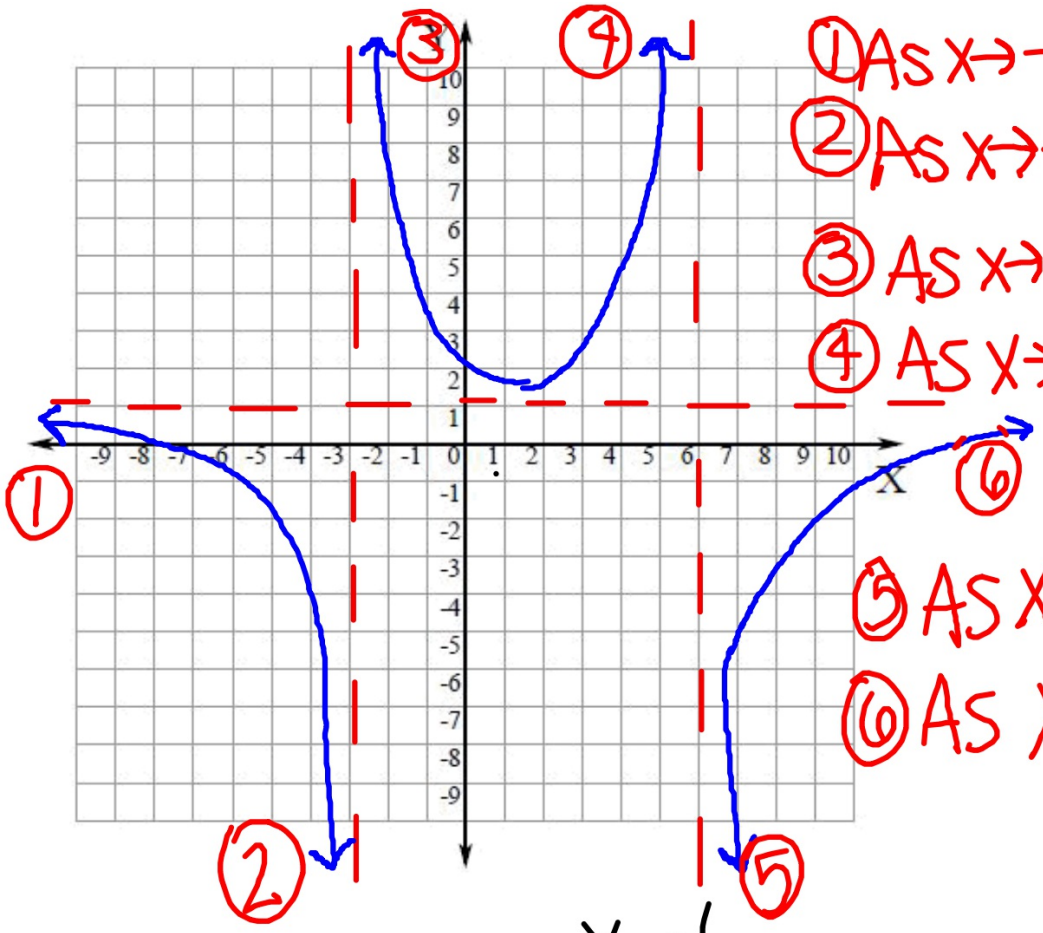
First, we'll just describe the graph's behavior. Later, we'll find the asymptotes and graph them.



Describing behavior around asymptotes-



1. As $x \to -\infty, y \to 0$
2. As $x \to -5^-, y \to \infty$
3. As $x \to -5^+, y \to -\infty$
4. As $x \to 5^-, y \to \infty$
5. As $x \to 5^+, y \to \infty$
6. As $x \to \infty, y \to 0$.



① As $x \to -\infty, y \to 1$

② As $x \to -3^-, y \to -\infty$

③ As $x \to -3^+, y \to \infty$

④ As $x \to 6^-, y \to \infty$

⑤ As $x \to 6^+, y \to \infty$

⑥ As $x \to \infty, y \to 1$

$x = 6$

Suggested Practice
Section 3.5, page 406
1,3,5,7
15-20

1. $\{ x \mid x \neq 4 \}$ → $(-\infty, 4) \cup (4, \infty)$
3. $\{ x \mid x \neq 5, x \neq -4 \}$ $(-\infty, -4) \cup (-4, 5) \cup (5, \infty)$
5. $\{ x \mid x \neq 7, x \neq -7 \}$ $(-\infty, -7) \cup (-7, 7) \cup (7, \infty)$
7. $\{ x \mid x \in R \}$ $(-\infty, \infty)$

15. ∞
16. $-\infty$
17. $-\infty$
18. ∞
19. 1
20. 1