Section 2.6 *Limits at infinity; Horizontal asymptotes*

Learning outcomes

After completing this section, you will inshaAllah be able to

1. compute limits of the form $\lim_{x\to\pm\infty} f(x)$
2. explain what are horizontal asymptotes
3. find horizontal asymptotes of a function

Computing limits $\lim_{x\to\pm\infty} f(x)$

Based on following basic limits

- $\lim_{x\to\infty} k = k$ $\quad$ k : constant
- $\lim_{x\to\pm\infty} \frac{k}{x^n} = 0$ $\quad$ for $n > 0$
- $\lim_{x\to\infty} x^n = \infty$ $\quad$ for $n > 0$
- $\lim_{x\to-\infty} x^n = \begin{cases} \infty & n = 2,4,6,\cdots \\ -\infty & n = 1,3,5,\ldots \end{cases}$

Technique for finding $\lim_{x\to\pm\infty} f(x)$

- Take **highest power common** from numerator & denominator
- **Simplify & use above** basic limits

See examples 1, 2, 3, 4, 5, 6, 7, 8 done in class

What to do if $\lim_{x\to\pm\infty} f(x)$ gives $\infty - \infty$

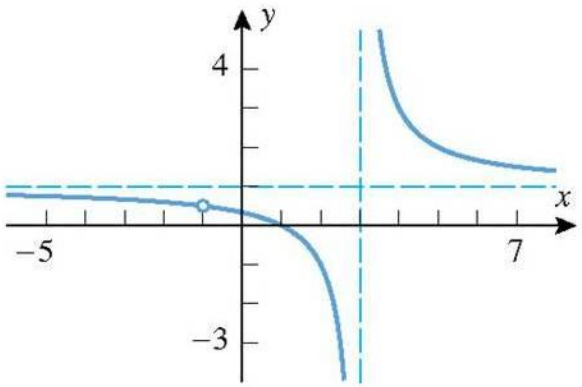
- We learn with the help of example

See example 9 done in class

Usually useful when

Horizontal Asymptotes

- Look at the following graph.



It runs (very close &) parallel to graph up to $x = \pm\infty$

What's special about line y=1

What happens to graph when we x gets near $\pm\infty$

The graph approaches (gets closer to) the horizontal line y=1

A horizontal line $y = b$ is called horizontal asymptote of graph of $f(x)$ if

- $\lim_{x\to\infty} f(x) = b$

or

- $\lim_{x\to-\infty} f(x) = b$

See examples 10, 11, 12 done in class

End of 2.6