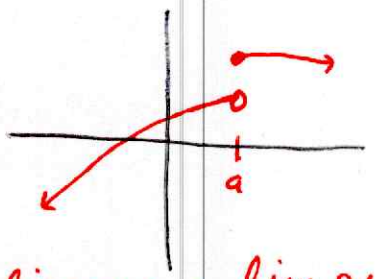
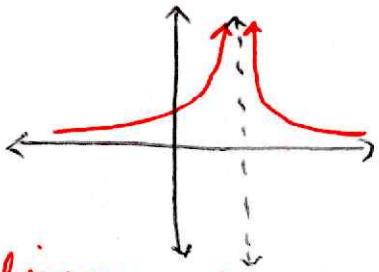
Today's Topic: Failing Limits; Limit Laws

In-class examples:

Ex. 1 Identify the three ways in which a limit will fail to exist. Include a graph for each.



$\lim_{x\to a^-} f(x) \neq \lim_{x\to a^+} f(x)$



$\lim_{x\to a} f(x) = \pm\infty$

$f(x)$ oscillates

Ex. 2 Assume that $\lim_{x\to 4} f(x) = -1$, $\lim_{x\to 4} g(x) = 3$, and $\lim_{x\to 4} h(x) = 2$. Find

a. $\lim_{x\to 4}\left(2g(x)+3f(x)\right)$

$2\lim_{x\to 4} g(x) + 3\lim_{x\to 4} f(x)$

$2(3) + 3(-1)$

$\boxed{3}$

b. $\lim_{x\to 4}\sqrt{h(x)+\left[g(x)\right]^2}$

$\sqrt{\lim_{x\to 4} h(x) + \left[\lim_{x\to 4} g(x)\right]^2}$

$\sqrt{(2) + (3)^2}$

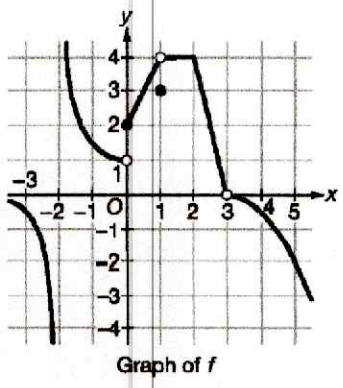
$\boxed{\sqrt{11}}$

c. $\lim_{x\to 4}\dfrac{g(x)-1}{f(x)+x}$

$\dfrac{\lim_{x\to 4} g(x) - \lim_{x\to 4} 1}{\lim_{x\to 4} f(x) + \lim_{x\to 4} x}$

$\dfrac{3-1}{-1+4} = \boxed{\dfrac{2}{3}}$

Ex. 3 Given the graph of $f(x)$ and a table for selected values of $g(x)$ below, estimate $\lim_{x\to 1}\left(3g(x)-2f(x)\right)$



Graph of f

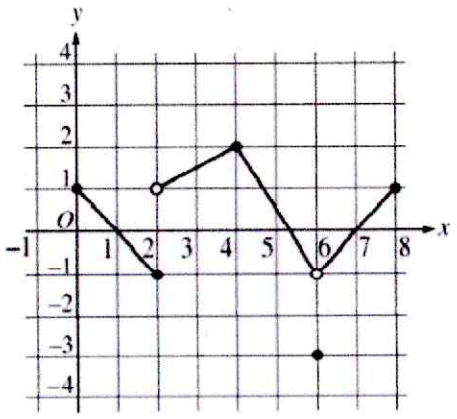
x	0.8	0.9	0.99	0.999	1.001	1.01	1.1	1.2
$g(x)$	4.16	4.59	4.960	4.996	5.004	5.040	5.39	5.76

$3\lim_{x\to 1} g(x) - 2\lim_{x\to 1} f(x)$

use table use graph

$3(5) - 2(4) = \boxed{7}$

AP Multiple Choice



The figure above shows the graph of the function f. Which of the following statements are true?

I. $\lim_{x \to 2^-} f(x) = f(2)$

II. $\lim_{x \to 6^-} f(x) = \lim_{x \to 6^+} f(x)$

III. $\lim_{x \to 6} f(x) = f(6)$

(A) II only

(B) III only

(C) I and II only

(D) II and III only

(E) I, II, and III

Homework: Worksheet 8