☆Everyone should start cutting slides apart

p. 18

FINDING LIMITS FROM TABLES & GRAPHS

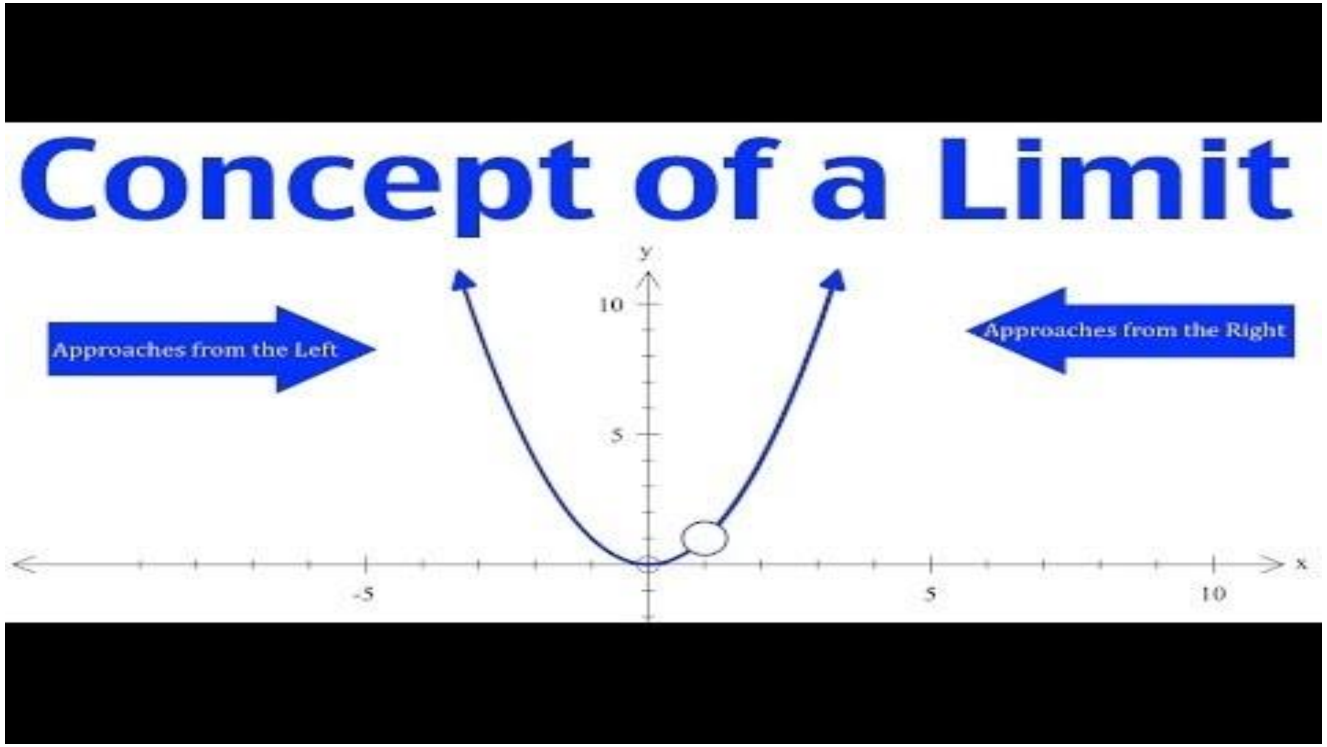
Keeper 7

Honors Calculus

Srs. leave for meeting at 8:30

Jrs. leave for meeting at 9:15

WHAT IS A LIMIT?



DEFINITION OF A LIMIT

If $f(x)$ becomes arbitrarily close to a unique number L as x approaches c from either side, then the **limit** of $f(x)$ as x approaches c is L. This is written as

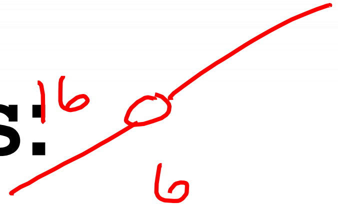
$$\lim_{x \to c} f(x) = L$$

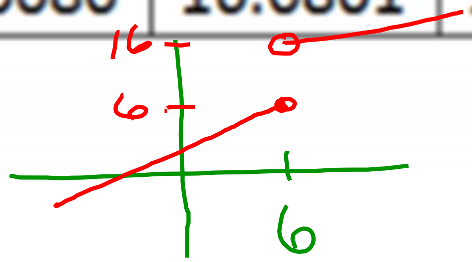
y-value

x-value

LIMITS FROM A TABLE

x	8.9	8.99	8.999	8.9999	9	9.001	9.01	9.1
f(x)	5.98329	5.99883	5.99983	5.999983	6	6.00016	6.00166	6.016
g(x)	15.21	15.9201	15.99201	15.999200	und	16.00080	16.0801	16.81
h(x)	5.98329	5.99883	5.99983	5.999983	6	16.00080	16.0801	16.81





Find the following limits:

(a) $\lim_{x\to 9} f(x)$

6

(b) $\lim_{x\to 9} g(x)$

left

$x \to 9^- = 16$

$x \to 9^+ = 16$

right

16

(c) $\lim_{x\to 9} h(x)$

left: 6

right: 16

DNE

EX 1: EVALUATING LIMITS FROM A GRAPH

★Remember...
c^- from left
c^+ from right
c from both sides

a. $\lim_{x\to 0^-} f(x)$ from left

0

b. $\lim_{x\to 0^+} f(x)$ right

2

c. $\lim_{x\to 0} f(x)$ both

DNE

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

-2

e. $\lim_{x\to 2^+} f(x)$

0

f. $\lim_{x\to 2} f(x)$

DNE

g. $\lim_{x\to 4^-} f(x)$

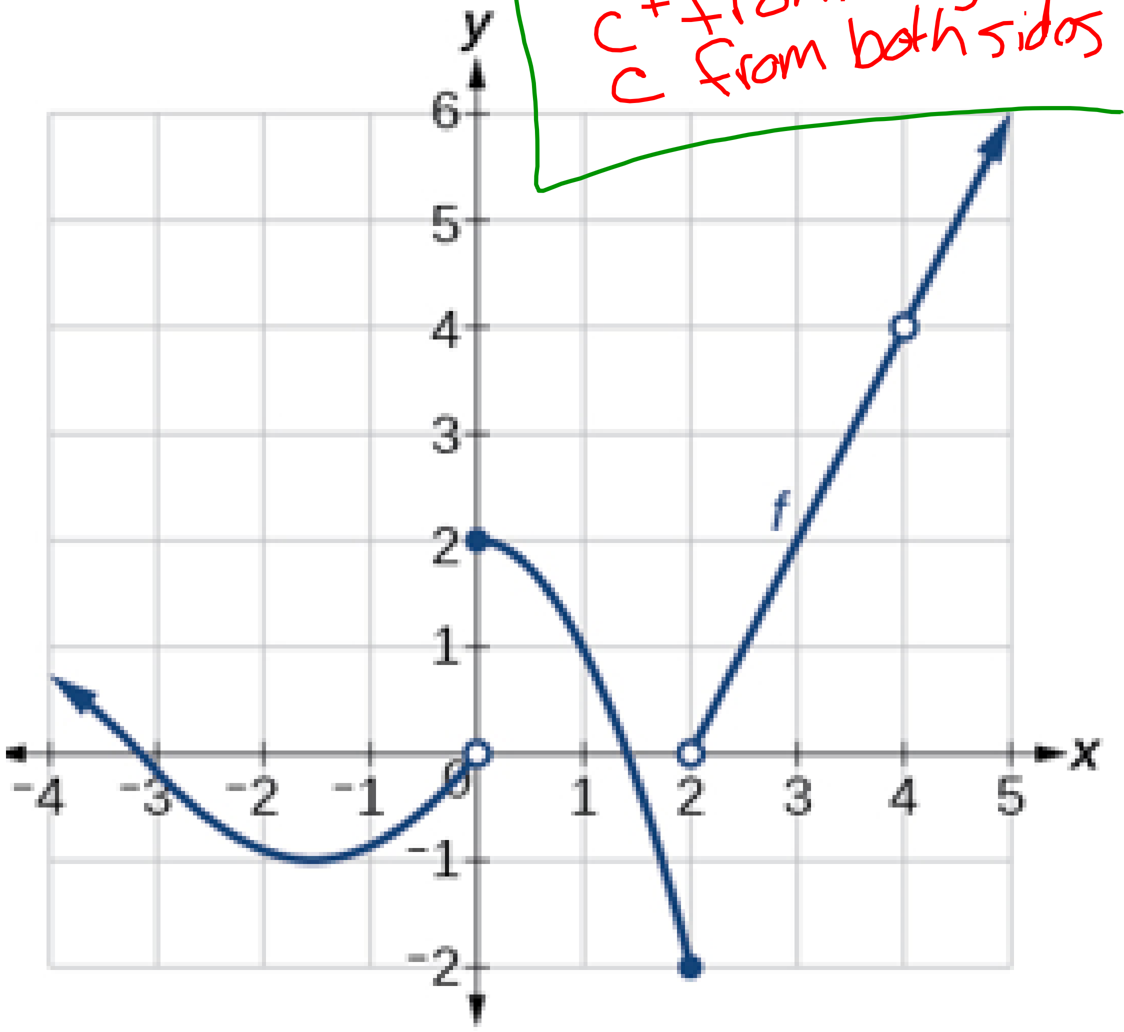
4

h. $\lim_{x\to 4^+} f(x)$

4

i. $\lim_{x\to 4} f(x)$

4



EX 2: EVALUATING LIMITS FROM A GRAPH

a. $\lim_{x\to -1^-} h(x)$ left

1

b. $\lim_{x\to -1^+} h(x)$ right

-2

c. $\lim_{x\to -1} h(x)$

DNE

d. $h(-1)$ $h(x) = ?$

actual pt. on graph

1

e. $\lim_{x\to 3^-} h(x)$

2

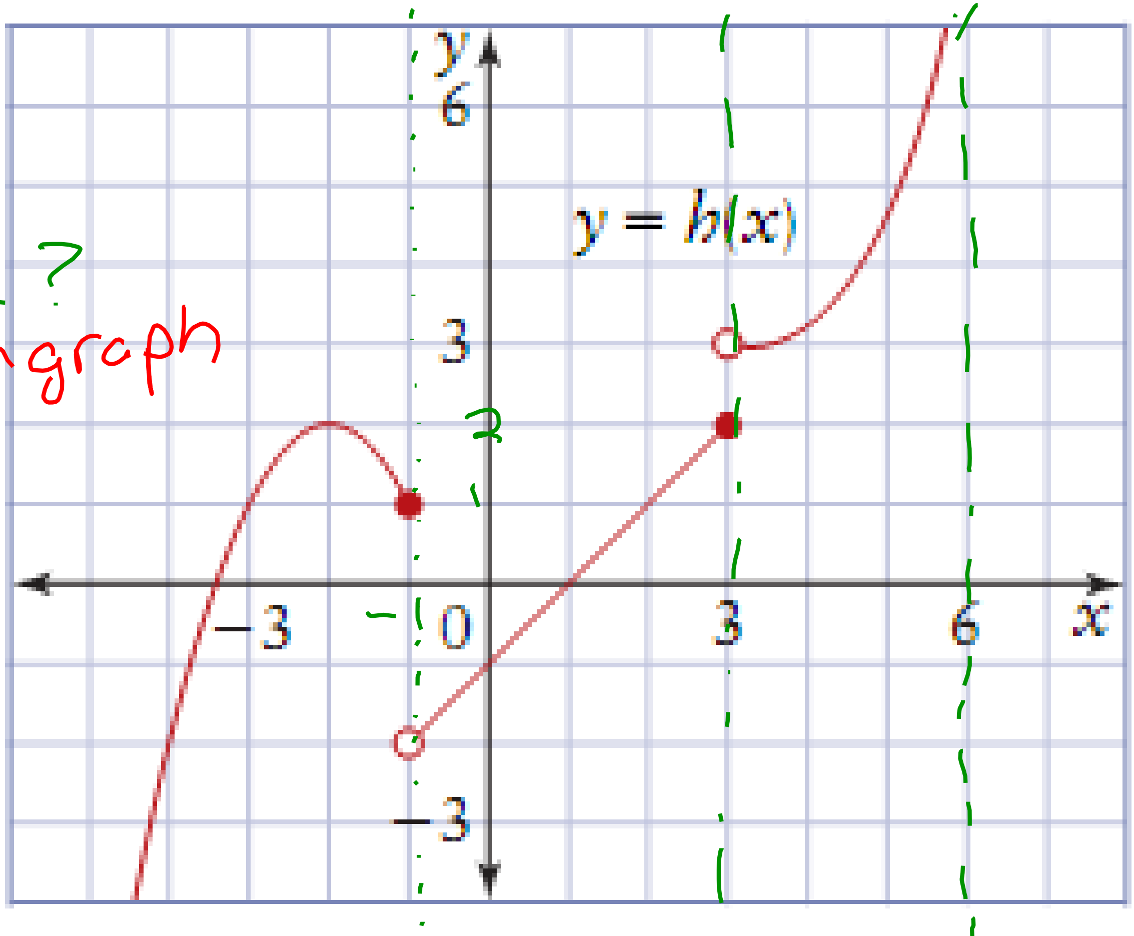
f. $\lim_{x\to 3^+} h(x)$

3

g. $\lim_{x\to 3} h(x)$ DNE

h. $h(3)$

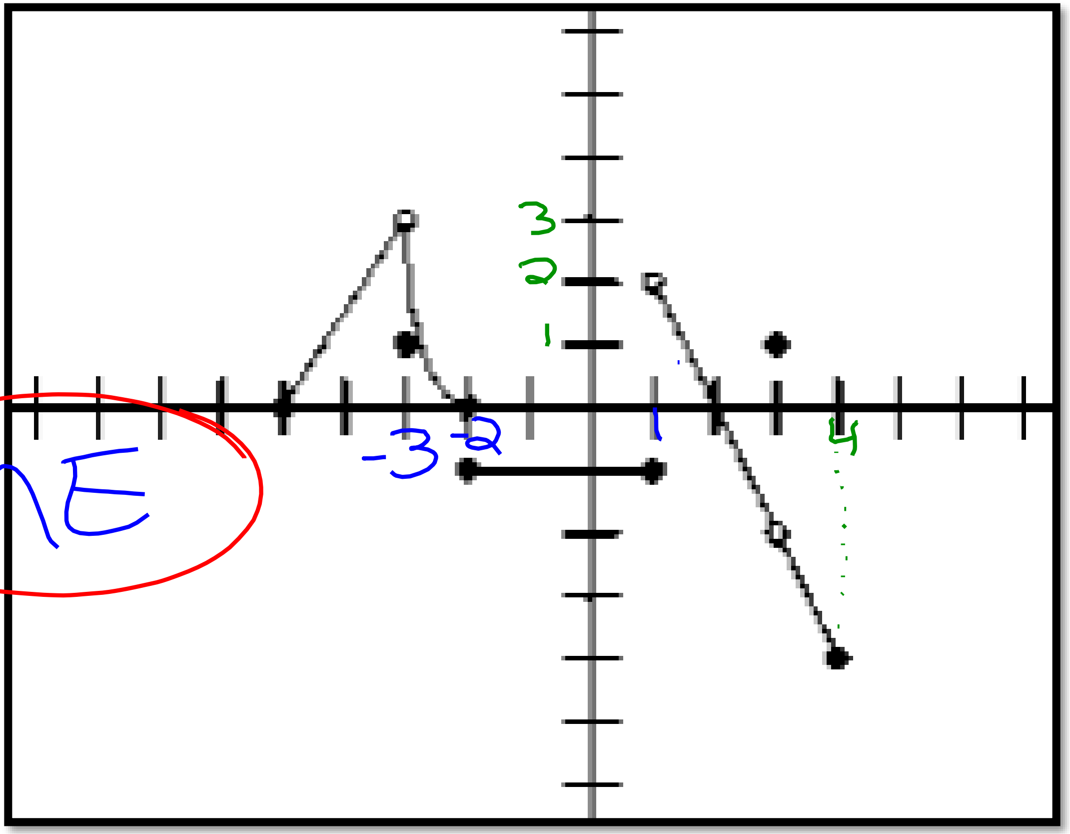
2



i. $\lim_{x\to 6^-} = \infty$

EX 3: EVALUATING LIMITS FROM A GRAPH

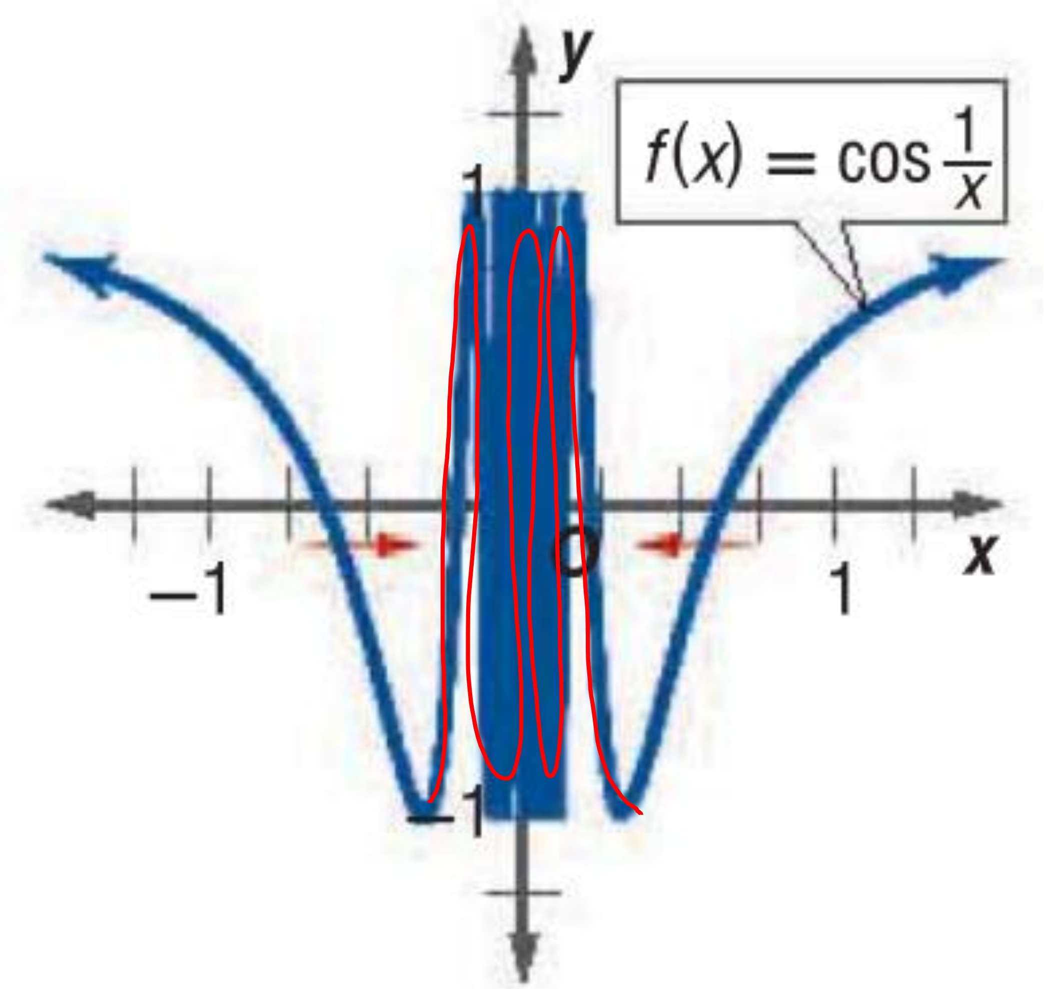
1. $\lim_{x\to 3} g(x)$ = -2
2. $\lim_{x\to 0} g(x)$ = -1
3. $\lim_{x\to -3} g(x)$ = 3
4. $\lim_{x\to 1^+} g(x)$ = 2
5. $\lim_{x\to 1^-} g(x)$ = -1
6. $\lim_{x\to 1} g(x)$ DNE
7. $\lim_{x\to -2^+} g(x)$ = -1
8. $\lim_{x\to 4} g(x)$ DNE
   $x\to 4^- = -4$
   $x\to 4^+ =$ DNE
9. $\lim_{x\to 2} g(x)$ 0
10. $\lim_{x\to -2^-} g(x)$ 0



EXAMPLE WITH OSCILLATION

$$\lim_{x \to 0} \cos \frac{1}{x}$$

DNE



CONDITIONS UNDER WHICH LIMITS DO NOT EXIST

The limit of $f(x)$ as $x \to c$ <u>does not exist</u> under any of the following conditions:

1. $f(x)$ approaches a different number from the right side of c than it approaches from the left side of c.
2. $f(x)$ increases and decreases without bound as x approaches c.

$\lim\limits_{x \to 2^-} = -\infty$ $\lim\limits_{x \to 2^+} = \infty$ $\lim\limits_{x \to 2} = \text{DNE}$

3. $f(x)$ oscillates between two fixed values as x approaches c.

EX 4: EVALUATE THE LIMIT

a. $\lim_{x \to -3^-} h(x)$ 4

b. $\lim_{x \to -3^+} h(x)$ 4

c. $\lim_{x \to -3} h(x)$ 4

d. $h(-3)$ DNE

e. $\lim_{x \to 0^-} h(x)$ 1

f. $\lim_{x \to 0^+} h(x)$ -1

g. $\lim_{x \to 0} h(x)$ DNE

h. $h(0)$ 1

i. $\lim_{x \to 2} h(x)$ 2

j. $h(2)$ DNE

k. $\lim_{x \to 5^+} h(x)$ 3

l. $\lim_{x \to 5^-} h(x)$ DNE