HW : Page 161 # 39 - 47 (odd)

If the work is worthwhile, then whether we can complete it or not, it's worth making the attempt. That's why courage is important.

Do Now:

Do problems #2 - 27 about the graphs of f and g.

This is based on material you did last year, see what you remember.

Front of Room Windows

Kolaczyk Carolyn	Jauniskis Zoe	Gunning Maren	Bastepe Isinsu	Chan Winnie	Waitz Ava	
Chin Alex	Gavish Ilai	Reilly Harrison	Bennett Max	Razis Costa	Zhang Nick	Gilman Gershon
Gavish Einat	Gilman Noah	Kahhale Tamara	Cohen Sophie	Lailler Julia	Shen Sophie	
Grossman Gabby	Perlo Devin	Scott Nick	Klein Nathaniel	Liao Iris	Reilly Liana	

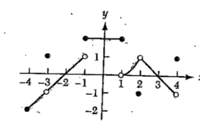
Page 160 - Limits from Graphs

BASICS

1. Let $f(x) = \begin{cases} 1, & \text{if } x \text{ is an integer} \\ 2, & \text{if } x \text{ is not an integer.} \end{cases}$
   (a) Draw a graph of f over the interval $[0, 5]$.
   (b) Evaluate $\lim_{x \to 4} f(x)$.
   (c) Evaluate $\lim_{x \to 5/2} f(x)$.
   (d) For which values of a does $\lim_{x \to a} f(x)$ exist? Why?

Let f be the function whose graph is shown below. Using the graph, evaluate each of the limits in Exercises 2–15 or explain why the limit does not exist. [NOTE: $f(1) = 2$.]

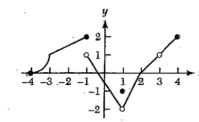
Graph of f



2. $\lim_{x \to 0} f(x)$ 2
3. $\lim_{x \to -3} f(x)$
4. $\lim_{x \to -1} f(x)$ dne
5. $\lim_{x \to 2^-} f(x)$
6. $\lim_{x \to 2^+} f(x)$ 1
7. $\lim_{x \to 2} f(x)$
8. $\lim_{x \to -2^-} f(x)$ 0
9. $\lim_{x \to 1^+} f(x)$
10. $\lim_{x \to -4^+} f(x)$ −2
11. $\lim_{x \to 4^-} f(x)$
12. $\lim_{x \to 3} f'(x)$ −1
13. $\lim_{x \to -1^+} f'(x)$
14. $\lim_{x \to -1^-} f'(x)$ 1
15. $\lim_{x \to -3} f'(x)$
16. Over which intervals is f continuous?

Let g be the function whose graph is shown below. Using the graph, evaluate each of the limits in Exercises 17–26 or explain why the limit does not exist.

Graph of g



17. $\lim_{x \to -4^+} g(x)$
18. $\lim_{x \to -3} g(x)$ 1
19. $\lim_{x \to -2} g(x)$
20. $\lim_{x \to -1^+} g(x)$ 1
21. $\lim_{x \to -1} g(x)$
22. $\lim_{x \to 0^-} g(x)$ -0.5
23. $\lim_{x \to 1} g(x)$
24. $\lim_{x \to 2} g(x)$ 0
25. $\lim_{x \to 3} g(x)$
26. $\lim_{x \to 4^-} g(x)$ 2
27. Over which intervals is g continuous?

What are our two limit definitions of the derivative?

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

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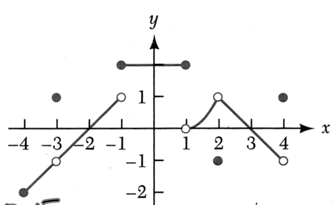
Use the graph of f and g, and the definition of the derivative (as appropriate) to evaluate each limit. If the limit does not exist, explain why.

Graph of f



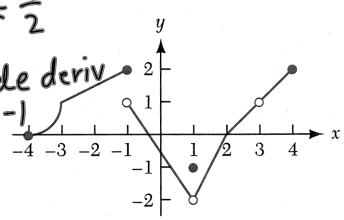
51. $\lim_{x \to 0} \frac{f(x) - 2}{x - 0} = f'(0) = 0$

52. $\lim_{x \to 3} \frac{f(x)}{x - 3} = f'(3) = -1$

Wrong answer in packet

53. $\lim_{x \to 1} \frac{f(x)}{x + 2} = \frac{0}{3} = 0$ NOT A DERIVATIVE

Graph of g



54. $\lim_{h \to 0} \frac{g(-2+h) - \cancel{3}/2}{h} = g'(-2) = \frac{1}{2}$

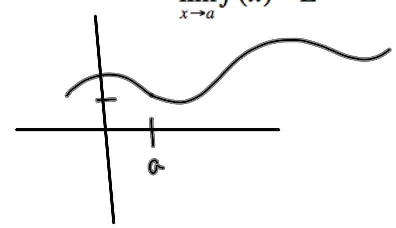
55. $\lim_{h \to 0^-} \frac{g(-1+h) - 2}{h}$ = left-side deriv of g at -1 $= \frac{1}{2}$

56. $\lim_{h \to 0} \frac{g(2+h)}{h} = g'(2)$, does not exist

What is our intuitive definition of limits?

What do we mean when we write

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



For x values closer to a, then the y-values are closer to L

CONTINUITY

What is our definition of continuity?

We say f(x) is continuous at x=a if

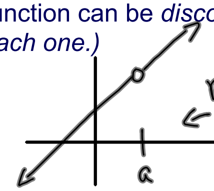
1) $\lim_{x \to a} f(x)$ exist

2) $f(a)$ exists

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

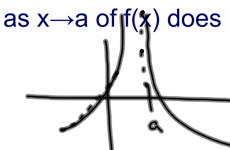
So there are three ways a function can be *discontinuous:*
(Generate an example for each one.)

1) f(a) is not defined

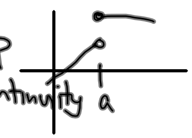


removeable discontinuity

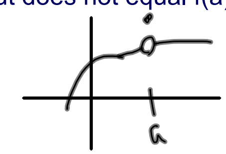
2) the limit as x→a of f(x) does not exist



jump discontinuity



3) the limit as x→a of f(x) exists but does not equal f(a)



Example:

Let $f(x)=\begin{cases} bx^2+1 & \text{if } x<-2 \\ x & \text{if } x\geq -2 \end{cases}$

What value of *b* makes *f* continuous at x= -2?