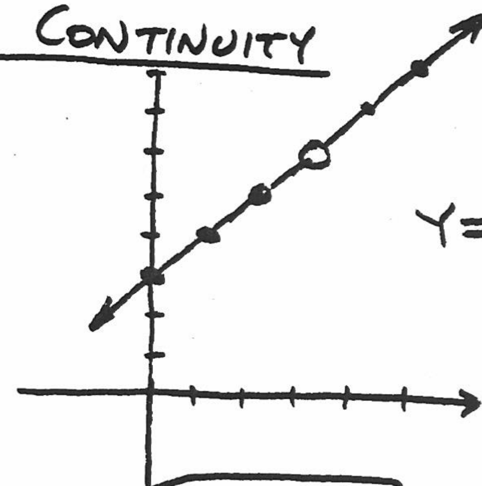
## 2.1 LIMITS AND CONTINUITY

$$f(x) = \frac{x^2-9}{x-3}$$

| X | Y |
|---|---|
| 0 | 3 |
| 1 | 4 |
| 2 | 5 |
| 3 | UNDEFINED |
| 4 | 7 |
| 5 | 8 |



$$Y = \frac{x^2-9}{x+3}$$

$$\boxed{\lim_{x \to 3} \frac{x^2-9}{x-3} = 6}$$

LIKE 21, 22, 23

NOTE: $\dfrac{x^2-9}{x-3} = \dfrac{(x-3)(x+3)}{x-3} = x+3 \quad (x \neq 3)$

$x \to 3 \qquad x+3 = 3+3 = 6$

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REVIEW $(3+x)^2 \qquad (3+x)(3+x)$

$$\underset{F}{9} + \underset{O}{3x} + \underset{I}{3x} + \underset{L}{x^2}$$

$$9 + 6x + x^2$$

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$(3+x)^3 \qquad (3+x)(3+x)(3+x)$

$(3+x)(9+6x+x^2)$

$3 \cdot 9 + 3 \cdot 6x + 3 \cdot x^2 + x \cdot 9 + x \cdot 6x + x \cdot x^2$

$27 + 18x + 3x^2 + 9x + 6x^2 + x^3$

$x^3 + 9x^2 + 27x + 27$

HWORK p. 63 → 21-23, 33, 35

EVALUATE $\lim_{x \to 0} \frac{(3+x)^3 - 27}{x}$

2

WAYS TO EVALUATE A LIMIT

① T-CHART ② GRAPH

③ ALGEBRAIC SIMPLIFICATION

LIKE 20,25

$$\frac{(3+x)^3-27}{x} = \frac{x^3+9x^2+27x+27-27}{x}$$

$x \neq 0$

$$= \frac{x^3+9x^2+27x}{x} = \frac{x(x^2+9x+27)}{x} = x^2+9x+27$$

$x \to 0 \quad x^2+9x+27 = 0^2+9\cdot 0+27 = 27$

④ SUBSTITUTE A CLOSE NUMBER

$$\frac{(3+.001)^3-27}{.001} = 27.009001 \quad \underline{\underline{(27)}}$$

⑤ TI-89 F3 limit(((3+x)^3-27)/x,x,0)

← NOT ON TESTS OR QUIZZES !!

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$\boxed{\text{IF } f(x) \text{ IS DEFINED AT } c \text{ THEN } \lim_{x \to c} f(x) = f(c)}$

JUST PLUG IN !!

EVALUATE $\lim_{x \to -2} (x+1)^{211} = (-2+1)^{211} = (-1)^{211}$

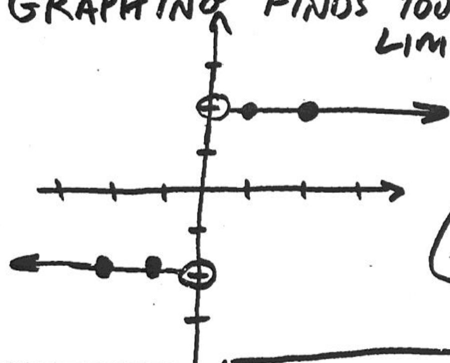
$= \underline{\underline{-1}}$

LIKE 7-15

HWORK p. 62-63 → 7, 8, 9, 11, 13, 15, 16, 20, 25

$f(x) = \frac{|2x|}{x}$ GRAPHING FINDS TOUGH LIMITS

| X | Y |
|---|---|
| -2 | -2 |
| -1 | -2 |
| 0 | UNDEFINED |
| 1 | 2 |
| 2 | 2 |



LIKE 17-19, 24, 26-30

**LEFT HAND LIMIT**

$$\lim_{x \to 0^-} \frac{|2x|}{x} = -2$$

**RIGHT HAND LIMIT**

$$\lim_{x \to 0^+} \frac{|2x|}{x} = 2$$

$\lim_{x \to 0} \frac{|2x|}{x}$ DOES NOT EXIST

IF THE RIGHT & LEFT HAND LIMIT DO NOT AGREE THE LIMIT DOES NOT EXIST

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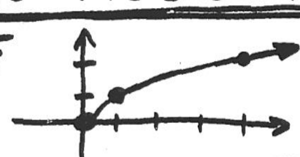
$f(x) = \sqrt{x}$

| X | Y |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 4 | 2 |



$\lim_{x \to 4} f(x) = 2$ $\boxed{\lim_{x \to 0} f(x) = 0}$

$\boxed{\lim_{x \to 0^+} f(x) = 0}$ $\boxed{\lim_{x \to 0^-} f(x) \text{ DOES NOT EXIST}}$

$\lim_{x \to -9} f(x)$ DOES NOT EXIST

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EX. 8 p. 60-61 $\lim_{x \to 1^-} f(x) = 0$ $\lim_{x \to 1^+} f(x) = 1$ LIKE 1-6

$\lim_{x \to 2} f(x) = 1$ EVEN THOUGH $f(2) = 2$

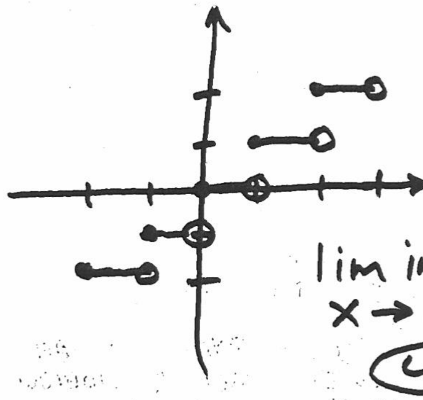
HWORK p. 62-63 → 1-6, 17-19, 24, 26-29 RADIAN MODE

## GREATEST INTEGER FUNCTION p.60

$Y = \text{int}(x)$ $\quad$ $Y = [\![x]\!]$

(THE LARGEST INTEGER $\leq X$)

| X | Y |
|---|---|
| -1.1 | -2 |
| -1 | -1 |
| -.1 | -1 |
| 0 | 0 |
| .1 | 0 |
| 1 | 1 |
| 1.5 | 1 |



$\lim_{x \to 1^+} \text{int}\,x = 1$

$\lim_{x \to 1^-} \text{int}\,x = 0$

$\lim_{x \to 1} \text{int}\,x$ DOES NOT EXIST

LIKE 37-40

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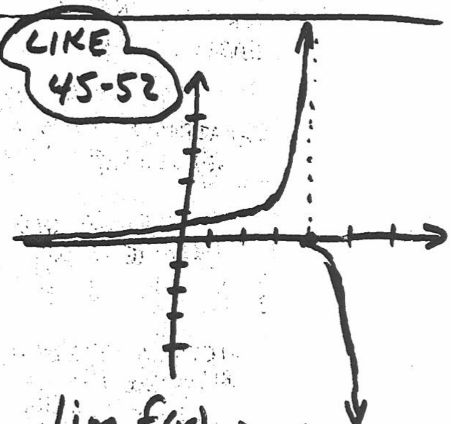
## PIECEWISE FUNCTIONS

LIKE 45-52

LET $f(x) = \begin{cases} \frac{1}{4-x} & x < 4 \\ 16 - x^2 & x \geq 4 \end{cases}$



TI-89

Y1 = 1/(4-x)(x<4)

Y2 = (16-x²)(x≥4)

$\lim_{x \to 4^-} f(x) = \infty$ $\quad$ $\lim_{x \to 4^+} f(x) = 0$ $\quad$ $\lim_{x \to 4} f(x)$ D.N.E.

HOMEWORK p.63-64 → 37-42, 45, 47, 49, 51, 59, 61