

1.2 Finding Limits Graphically and Numerically

- Estimate a limit using a numerical or graphical approach.
- Learn different ways that a limit can fail to exist.
- Study and use a formal definition of limit.

1. Numerical approach

Construct a table of values.

2. Graphical approach

Draw a graph by hand or using technology.

3. Analytic approach

Use algebra or calculus.

Ex 1

$$\lim_{x \rightarrow 2} \frac{x-2}{x^2-4}$$

$$= \frac{0}{0}$$

indeterminate form

general limit

| | | | | | | |
|--------|-------|-------|--------|--------|--------|-------|
| x | 1.9 | 1.99 | 1.999 | 2.001 | 2.01 | 2.1 |
| $f(x)$ | .2564 | .2506 | .25006 | .24994 | .24938 | .2439 |

$x \rightarrow 2^-$
(from the left)

$x \rightarrow 2^+$
(from the right)

$$= .25$$

Ex 2

$$\lim_{x \rightarrow 3} \frac{1}{(x-3)}$$

| | | | | | | |
|------|-----|------|-------|-------|------|-----|
| X | 2.9 | 2.99 | 2.999 | 3.001 | 3.01 | 3.1 |
| f(x) | 10 | 100 | 1000 | -1000 | -100 | -10 |

→ DNE

$$\lim_{x \rightarrow 3^-} \frac{1}{x-3} \neq \lim_{x \rightarrow 3^+} \frac{1}{x-3}$$

Justify
for
DNE

Ex 3

$$\lim_{x \rightarrow 4} \frac{[x/(x+1)] - (4/5)}{x-4}$$

p. 54 # 1-9
odd

| | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|
| x | 3.9 | 3.99 | 3.999 | 4.001 | 4.01 | 4.1 |
| $f(x)$ | .04082 | .04008 | .04001 | .03999 | .03992 | .03922 |



$\rightarrow = .04$

$$7.) \lim_{x \rightarrow 0} \frac{\sin x}{x}$$

radian
mode

| x | -0.1 | -0.01 | -0.001 | .001 | .01 | .1 |
|------|-------|-------|--------|------|-----|----|
| f(x) | .9983 | | | | | |