

## Limits From Graph

-1      3      dne      -1

-2      2      dne      2

1      1      1      1

0      0      0      undefined

-1      -1      -1      undefined

5      5      5      5

$\infty$        $\infty$

Labeled crystal

labeled crystal

labeled crystal

labeled crystal

labeled crystal

## Algebraic Limits

$$1. \lim_{x \rightarrow 2^+} 3x^2 - 4$$

$\infty + \infty = \infty$

$$\infty \text{ (as) } \infty$$

$$8 \cdot \infty / \infty$$

$\infty$

$$2. \lim_{x \rightarrow 3^-} \frac{x^2 - 2x}{x^2 - 9}$$

$$\lim_{x \rightarrow 3^-} \frac{(x-2)(x)}{(x+3)(x-3)}$$

$$\text{small}+ \times \text{small}- \quad \infty \times \infty = \infty$$

$$\infty \cdot \infty = \infty$$

$\infty$

$$3. \lim_{x \rightarrow -1} \frac{x^2 - 4x - 5}{x^2 - 1}$$

$$\lim_{x \rightarrow -1} \frac{(x-5)(x+1)}{(x+1)(x-1)}$$

$$\cancel{(x+1)} \cdot \cancel{(x-1)} = 3$$

$\infty$

$$4. \lim_{x \rightarrow 9} \frac{5 - \sqrt{x}}{x - 9}$$

$\infty - \infty$

$$\infty - \infty$$

$$\lim_{x \rightarrow 9^-} \frac{5 - \sqrt{x}}{x - 9} \quad (+)$$

$\text{small}-$

$$\lim_{x \rightarrow 9^+} \frac{5 - \sqrt{x}}{x - 9} \quad (+)$$

$\text{small}+$

$$-\infty - \infty = \infty$$

$$\infty$$

l.dne  $\infty - \infty$

$$\infty - \infty$$

$$5. \lim_{x \rightarrow 3} \frac{x^2 + 7x - 18}{x^2 + 10x + 9}$$

$$x \rightarrow 3 \quad \infty + \infty = \infty$$

$$\lim_{x \rightarrow 3} \frac{(x+9)(x-2)}{(x+9)(x+1)}$$

\* or just use  
substitution

$$\frac{1}{4}$$

Dan

# Limits Chapter 1

6.  $\lim_{x \rightarrow 5^-} e$

e

7.  $\lim_{\theta \rightarrow \pi} \sin \theta$

0

8.  $\lim_{x \rightarrow \infty} \frac{3x^2 - 5x + 2}{x^2 - 9}$

3

9.  $\lim_{x \rightarrow 2^+} \frac{x^2 - 3x - 15}{x+2}$  (-)

$\infty$

10.  $\lim_{x \rightarrow -\infty} \frac{-2x+5}{x^2+10x}$

0

11.  $\lim_{\theta \rightarrow \frac{2\pi}{3}} \sec \theta$

-2

12.  $\lim_{x \rightarrow \infty} \frac{-2x^2 + 5x - 3}{x-4}$

$-\infty$

13.  $\lim_{\theta \rightarrow \frac{\pi}{2}} \tan \theta$

dne

14.  $\lim_{x \rightarrow \infty} \frac{\sqrt{x^4 - 3x}}{3x^2 + 2}$

$$\lim_{x \rightarrow \infty} \frac{x^4 - 3x^3}{(3x^2 + 2)^2}$$

$$\lim_{x \rightarrow \infty} \frac{x^4 - 3x^3}{9x^4 + 12x^2 + 4}$$

$$(\sqrt{\frac{1}{9}} = \frac{1}{3})$$

15.  $\lim_{x \rightarrow 60^\circ} \sin x$

$$\frac{\sqrt{3}}{2}$$

$$\lim_{x \rightarrow 0} \frac{\sin x}{\cos x}$$

$$x \rightarrow 0$$

$$\lim_{x \rightarrow 0} \sin x$$

$$x \rightarrow 0$$

17.  $\lim_{x \rightarrow \infty} \sqrt{x^5 + 3x}$

$$x^2 - 5$$

$$\lim_{x \rightarrow \infty} \frac{x^5 + 3x}{(x^2 - 5)^2}$$

$$(x \sqrt{x^5 + 3x})$$

$$(1 + x^2 - 5) x^2$$

$$18. \lim_{x \rightarrow -3^+} \frac{-x^2 + 5x}{x^2 - 6x + 9}$$

$$\lim_{x \rightarrow -3^+} \frac{-x(x-5)}{(x-3)(x-3)} \quad (+)(-)$$

-∞

$$19. \lim_{x \rightarrow 3^-} \frac{-x^2 + 5x}{x^2 - 6x + 9}$$

$$\lim_{x \rightarrow 3^-} \frac{-x(x-5)}{(x-3)(x-3)} \quad (+)(-)$$

-∞

$$20. \lim_{x \rightarrow \infty} \frac{x^2 + 4x - 12}{x^2 - 36}$$

$$21. \lim_{x \rightarrow 6^+} \frac{x^2 + 4x - 12}{x^2 - 36}$$

$$\lim_{x \rightarrow 6^+} \frac{(x+6)(x-2)}{(x+6)(x-6)}$$

$\frac{-8}{-12} = \frac{2}{3}$

$$22. \lim_{x \rightarrow 6^+} \frac{x^2 + 4x - 12}{x^2 - 36}$$

$$\lim_{x \rightarrow 6^+} \frac{(x+6)(x-2)}{(x+6)(x-6)} \quad \frac{(+)}{(+)}$$

∞

23.  $\lim_{x \rightarrow \infty} \frac{\sqrt{2x^2 + 5x}}{3x - 4}$

$$\lim_{x \rightarrow \infty} \frac{\sqrt{2x^2 + 5x}}{\sqrt{(3x - 4)^2}}$$

$$\lim_{x \rightarrow \infty} \frac{\sqrt{2x^2 + 5x}}{\sqrt{9x^2 - 24x + 16}} = \frac{\sqrt{2/9}}{1} = \frac{\sqrt{2}}{3}$$

24.  $\lim_{x \rightarrow \infty} \frac{\sqrt{x+3}}{x}$

$\infty$

25.  $\lim_{x \rightarrow -\infty} \frac{\sqrt{x+3}}{x}$

dne

26.  $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 - 1}$

$$\lim_{x \rightarrow 1} \frac{(x-1)(x^2 + x + 1)}{(x+1)(x-1)}$$

3/2

27.  $\lim_{x \rightarrow -3^-} \frac{\sqrt{x+3}}{x}$

dne

## Piecewise Limits

1. 8      2. -9      3. dne      4. 8

5. 1      6. 3      7. dne      8. 1

9.  $\infty$       10.  $-\infty$

1. -2      2. 2      3. dne      4. -2

5. 1      6. 1      7. 1      8. 1

9.  $\infty$       10.  $\infty$

eternal thought

24 Oct 1981

18 Oct 1981

20-21 Oct 1981

24 Oct 1981

18

21-22 Oct 1981