Warm-Up

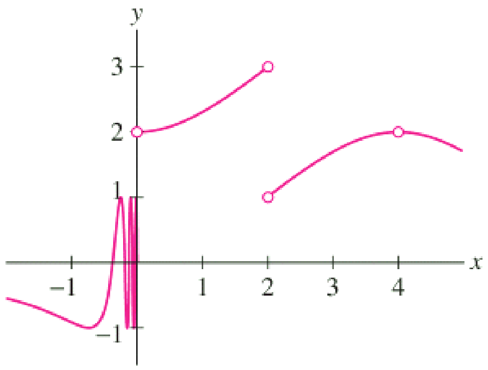


FIGURE 7

Evaluate the following. If a limit DNE, explain why.

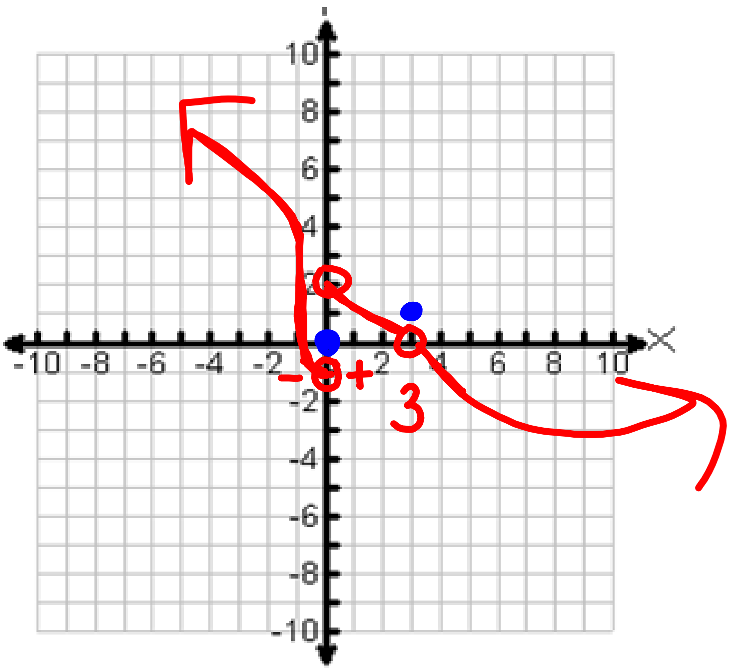
1. $\lim_{x\to 2} f(x)$ = dne
2. $f(2) =$ und.
3. $\lim_{x\to 4} f(x)$
4. $f(4) =$ und
5. $\lim_{x\to 0} f(x)$ = dne

Warm-up: 1.12.22

1) Pick up two handouts on back table and get supplies. Glue pages into INB.

2) Get out HW and calendar. Get calculator.

3) Complete sketch at the bottom of pg. 23 in the packet for warm-up.


10
8
6
4
2
-2
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10
X
- 0 +
3

Properties of Limits

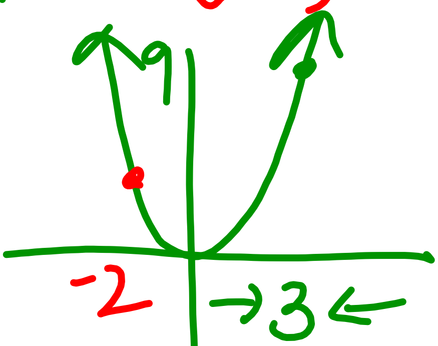
1. $\lim\limits_{x\to c} a = a$

2. $\lim\limits_{x\to c} x = c$

3. $\lim\limits_{x\to c} x^n = c^n$

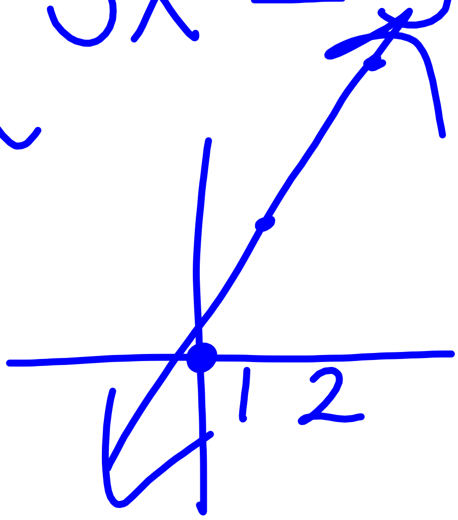
4. $\lim\limits_{x\to c} ax = ac$

$$\lim_{x\to -2} x^2 = (-2)^2 = 4$$



$$\lim_{x\to 2} 5x = 5(2) = \underline{10}$$

$$y = \frac{5}{1}x$$



THEOREM 1 Basic Limit Laws Assume that $\lim_{x \to c} f(x)$ and $\lim_{x \to c} g(x)$ exist. Then:

(i) **Sum Law:**

$$\lim_{x \to c} \big(f(x) + g(x)\big) = \lim_{x \to c} f(x) + \lim_{x \to c} g(x)$$

(ii) **Constant Multiple Law:** For any number k,

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

(iii) **Product Law:**

$$\lim_{x \to c} f(x) g(x) = \left(\lim_{x \to c} f(x)\right)\left(\lim_{x \to c} g(x)\right)$$

(iv) **Quotient Law:** If $\lim_{x \to c} g(x) \neq 0$, then

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

http://archives.math.utk.edu/visual.calculus/1/limits.18/index.html

Evaluate the following using the limit laws:

1. $\lim_{x\to -3} 3x+4 = \lim_{x\to -3} 3x + \lim_{x\to -3} 4$

$3(-3)$

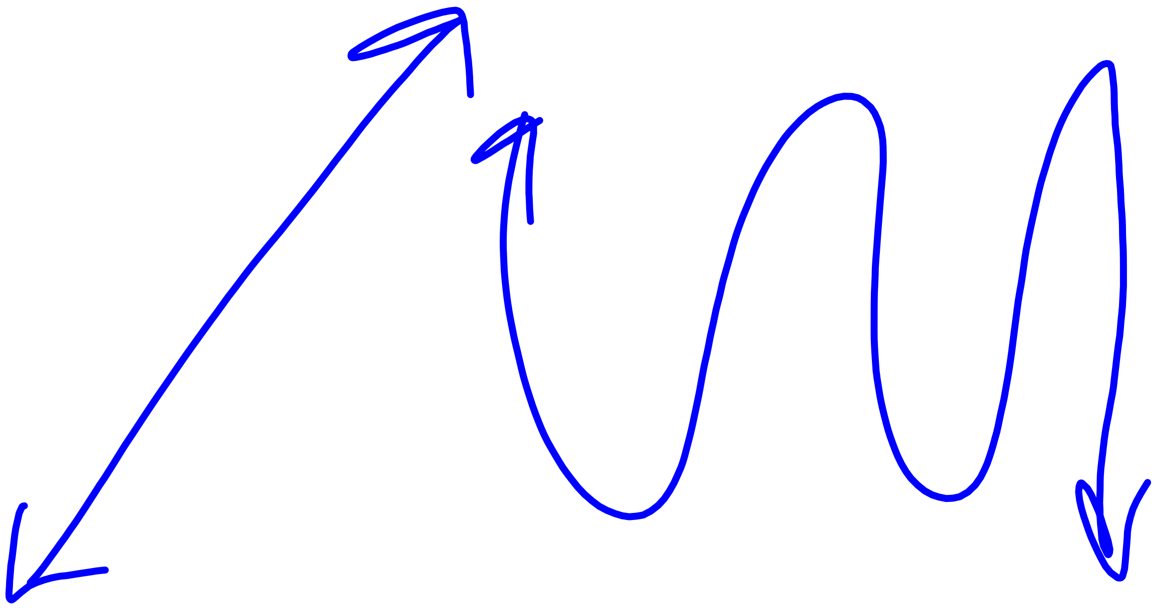
$-9 + 4 = -5$

x	y
-3	-5

2. $\lim_{x\to 2} \boxed{x(x+1)(x+2)}$

$\left(\lim_{x\to 2} x\right)\left(\lim_{x\to 2} x+1\right)\left(\lim_{x\to 2} x+2\right)$

$2 \cdot 3 \cdot 4 = \underline{24}$



Given $\underline{\lim_{x \to c}} f(x) = \underline{5}$ and $\underline{\lim_{x \to c}}\, \underline{g(x)} = -\underline{4}$

Evaluate:

1. $\lim_{x \to c} [\underline{6} g(x)] =$ $6\left(\lim_{x \to c} g(x)\right) = 6 \cdot -4 = -24$

2. $\lim_{x \to c} [3f(x) - 2g(x)] =$ $3(5) - 2(-4) = 15 + 8 = 23$

3. $\lim_{x \to c} \left[\frac{f(x)}{g(x)}\right] =$ $\frac{5}{-4} = -\frac{5}{4}$

Today, we solve limits <u>Algebraically:</u>

*Always try Direct Substitution first
*If it doesn't work then try to simplify algebraically and/or evaluate the limit graphically and numerically.

Limit

1) D.S. = direct sub

2) Factor and cancel

Finding a limit by substitution

$$\lim_{x\to 1} x^3 - 4x^2 + 5x - 3 = -1$$

$$(1)^3 - 4(1)^2 + 5(1) - 3 = -1$$

x	y
1	-1

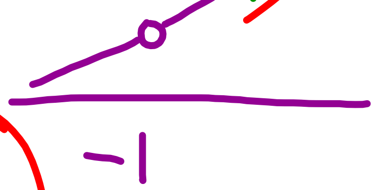
When substitution doesn't work, try Algebra

* Your new function is a "function that agrees at all but one point."

$$\lim_{x\to -1}\frac{x^2-1}{x+1} = \cancel{\frac{(-1)^2-1}{-1+1}} = \frac{\cancel{(x+1)}(x-1)}{\cancel{x+1}} =$$

D.S = und

$$\lim_{x\to -1}\frac{x^2-1}{x+1} = -2$$



$-1-1=-2$

Examples:

1. $\lim\limits_{x \to 3} \dfrac{x^2 - 1}{x + 1}$

2. $\lim_{x \to \frac{3\pi}{2}} \sin x = -1$

1) D.S. $\sin \frac{3\pi}{2}$

$(\cos, \sin)$

$x, \quad y$

$\lim_{x \to \frac{2\pi}{3}} \sin x$

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

3. $\lim_{x \to -5} \frac{x^2-25}{x^3+125} = \frac{-2}{15}$

D.S. = und

$$\frac{\cancel{(x+5)}(x-5)}{\cancel{(x+5)}(x^2-5x+25)}$$

$$\frac{-5-5}{(-5)^2-5(-5)+25} = \frac{-10}{75}$$

$$-\frac{1-4}{(1)^2-6(1)+8} = \left(\frac{-3}{3}\right) = -1$$

$$1-6+8 \qquad -(-1)=1$$

Pg. 25 omit # 10, 15
Pg. 26 ALL