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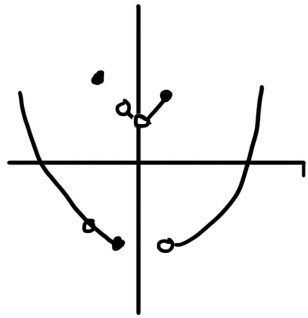
Definitions

- $\lim\limits_{x\to a^-} f(x)$, $\lim\limits_{x\to a^+} f(x)$, $\lim\limits_{x\to a} f(x)$, $\lim\limits_{x\to \pm\infty} f(x)$

- Algebraically, Graphifically

$$f(x)=\begin{cases} 8+x^2 & \text{if } x<0 \\ 8-x^2 & \text{if } x\geq 0 \end{cases}$$



$\lim\limits_{x\to 0} f(x) = 2$

$\lim\limits_{x\to 0} f(x)$: compare both. If they are dif, the limit DNE, otherwise, it exists.

$$\lim_{x\to 1} f(x) = 8-x^2 = 7$$

$\cancel{1<0}$

$1\geq 0$

$\lim\limits_{x\to 0^-} f(x) = 8+0 = 8$

Same so the limit exists

$\lim\limits_{x\to x^+} f(x) = 8-0 = 8$

Asymptotes

2.21

$$\lim_{x\to\infty} \frac{\cancel{3+2x}+2x^2}{1x^2} = \frac{2}{1} = 2$$

If degrees are same, divide coefficient
If bottom degree is higher, limit = 0
If top degree is higher, limit = ∞

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2.3 : Continuity

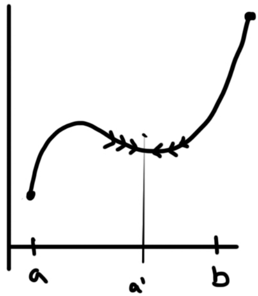
- Sign Chart, partition numbers
- Continous on a point, ( ), [ ]
- Types of discont. Jump, Removable (hole), Infinite

• f(x) is continous on x = a

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

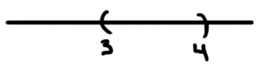
• $\lim_{x \to b^-} f(x) = f(b)$

• $\lim_{x \to a^+} f(x) = f(a)$



2.3 problems 9 and 11 include these

Does not include ← $(3,4) \neq [3,4]$ → Includes



- Sign chart and partitions

Determine whether the function is continous

$$g(x) = \frac{(x+3)}{(x-3)(x-2)}$$

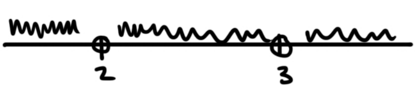
$\cancel{-3}$, 3, 2

$$\lim_{x \to a} g(x) = \frac{-3+3}{(-3-3)(-3-2)} = \frac{0}{(-6)(-5)} = \frac{0}{30} = 0$$

$$\lim_{x \to a} g(x) = \frac{3+3}{(3-3)(3-2)} = \frac{6}{(0)(1)} = \frac{6}{0}$$

$$\lim_{x \to a} g(x) = \frac{2+3}{(2-3)(2-2)} = \frac{5}{(-1)(0)} = \frac{5}{0}$$

} Discontinuous



$(-\infty, 2) \cup (2,3) \cup (3, \infty)$

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2.3-11: Sign Chart

$x^2-2x-24<0$

$(x-6)(x+4)<0$

$x-6=0 \quad x+4=0$

$x=6 \quad x=-4$

ALWAYS make equal to 0.
If not equal to, open circles
If equal to, closed circles

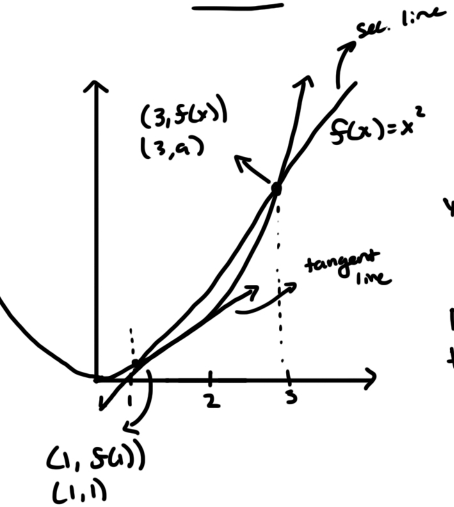
asking for negative only so...

Ans: $(-4,6)$

$(-5-6)(-5+4)$ | $(0-6)(0+4)$ | $(7-6)(7+4)$
$-11 \quad -1$ | $-6 \quad 4$ | $1 \quad 11$
positive | negative | positive

Derivatives

Sec. line passes through multiple points
Tangent line passes through one lines



$h(x)=mx+b$

$m = \frac{9-1}{3-1} = \frac{8}{2}$

$h = 4x+b$

$y-y_1 = 4(x-x_1)$ | $1 = 4(1)$
$1 = 4+b$
$-3 = b$

For a tangent line, you don't have two points.

Slope and derivative are similar concepts.

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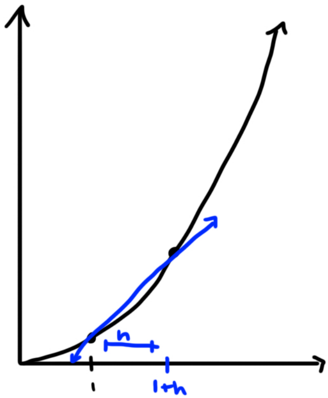
$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

$$= \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$



$$\lim_{h \to 0} \frac{f(1+h) - f(1)}{1+h-1} = \lim_{h \to 0} \frac{(1+h)^2 - 1^2}{h}$$

$$= \lim_{h \to 0} \frac{(1+h)^2 - 1^2}{h}$$

$$= \frac{\cancel{1^2} + 2h + h^2 - \cancel{1}}{h}$$

$$= \lim_{h \to 0} 2h+1 \rightarrow \lim_{h \to 0} = 2$$