MA 121-001

Thursday, August 30

$$f(x) = 3x^2 - 5x + 4 \qquad \text{domain: } \mathbb{R}$$

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

$$(1, 2)$$

$$f(a) = 3(a)^2 - 5(a) + 4 = 3a^2 - 5a + 4$$

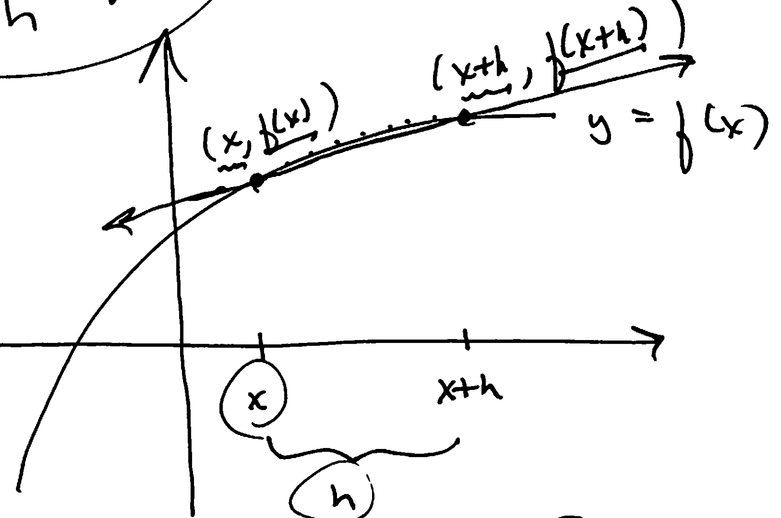
$$(a, 3a^2 - 5a + 4)$$

$$f(x+h) = 3(x+h)^2 - 5(x+h) + 4$$
$$= 3(x^2 + 2xh + h^2) - 5x - 5h + 4$$
$$= 3x^2 + 6xh + 3h^2 - 5x - 5h + 4$$

$$(x+h, 3x^2 + 6xh + 3h^2 - 5x - 5h + 4)$$

$$\frac{f(x+h) - f(x)}{h}$$

DIFFERENCE QUOTIENT



$$m = \frac{f(x+h) - f(x)}{(x+h) - x}$$

$$m = \frac{f(x+h) - f(x)}{h}$$

AVE. RATE OF CHANGE
(slope of secant line)

$f(x) = 3x^2 - 5x + 4$

$\dfrac{f(x+h) - f(x)}{h} = m$ $\quad$ $(x, f(x))$ & $(x+h, f(x+h))$

$= \dfrac{(3x^2 + 6xh + 3h^2 - 5x - 5h + 4) - (3x^2 - 5x + 4)}{h}$

$= \dfrac{\cancel{3x^2} + 6xh + 3h^2 \cancel{- 5x} - 5h \cancel{+ 4} \cancel{- 3x^2} \cancel{+ 5x} \cancel{- 4}}{h}$

$= \dfrac{\cancel{h}(6x + 3h - 5)}{\cancel{h}}$ $\quad$ $(h \neq 0)$

$= 6x + 3h - 5 = m$

$\dfrac{8}{4} = 2$ $\quad$ (check: $2 \cdot 4 \overset{?}{=} 8$)

$\dfrac{0}{5} = 0$ $\quad$ (check: $0 \cdot 5 \overset{?}{=} 0$)

$\dfrac{4}{0} = \alpha$ $\quad$ (check: $\alpha \cdot 0 \overset{?}{=} 4$) $\quad$ no sol.

$\dfrac{0}{0} = {}^{-}1437$ $\quad$ (check: $11 \cdot 0 \overset{?}{=} 0$) $\quad$ inf. # of solutions

(check: $14 \cdot 0 \overset{?}{=} 0$)

indet. form:

"split-domain" function:

(piecewise ...)

$$f(x) = \begin{cases} 2x-1, & x \le -1 \\ x^2+4, & -1 < x \le 2 \\ 3, & x > 2 \end{cases}$$

$y = 2x - 1$
$(x \le -1)$

x	y
-1	-3
-2	-5
-3	-7
⋮	⋮

$y = x^2 + 4$
$(-1 < x \le 2)$

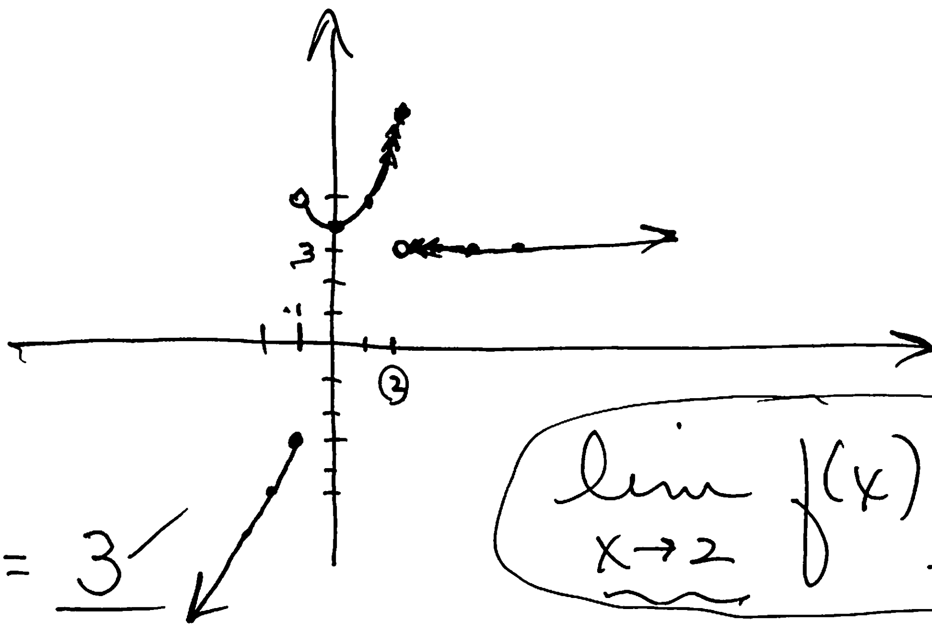
x	y
-1	5
0	4
1	5
2	8

DELETE

$y = 3$
$(x > 2)$

x	y
2	3
3	3
4	3
⋮	⋮

DELETE



$\lim_{x \to 2^+} f(x) = 3$

(from the right)

$\lim_{x \to 2} f(x) = \text{D.N.E.}$

no lim

x "approaches" 2

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

(from the left)

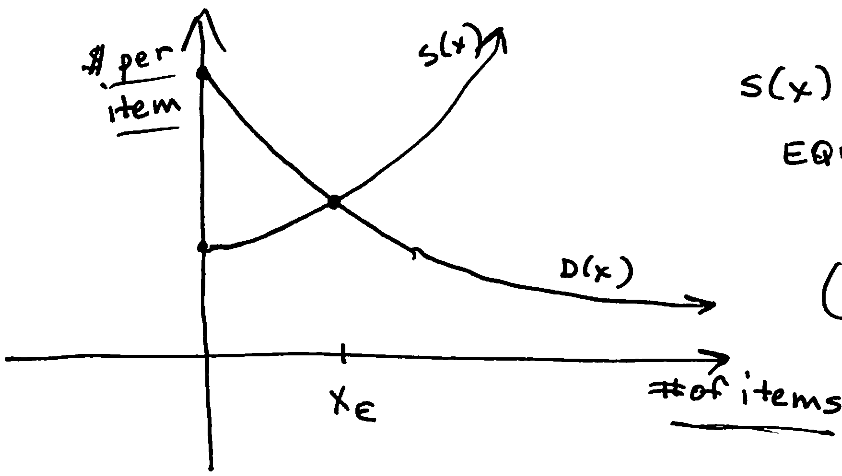
$$8^{-2/3} = \frac{1}{8^{2/3}} = \frac{1}{\left[\sqrt[3]{8}\right]^2} = \frac{1}{4}$$

square cube root

$$= \frac{1}{\sqrt[3]{8^2}}$$

$$((a+b))^{-1} = \frac{1}{a+b}$$

supply & demand functions:



$S(x) = D(x)$

EQUIL. PT.

solve for X_E

$\left(X_E,\ D(X_e) \text{ or } S(X_e)\right)$

$$f(x) = \sqrt{x-5}$$

$x \in \mathbb{R}$??

¿ restrict domain ?

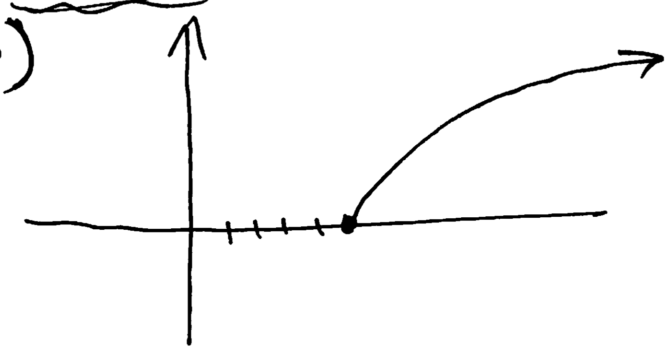
$x - 5 \geq 0$

$x \geq 5$

$[5, \infty)$

$\sqrt{-1} = i$

$-1 = i^2$



range ??

$y \geq 0$

$[0, \infty)$

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

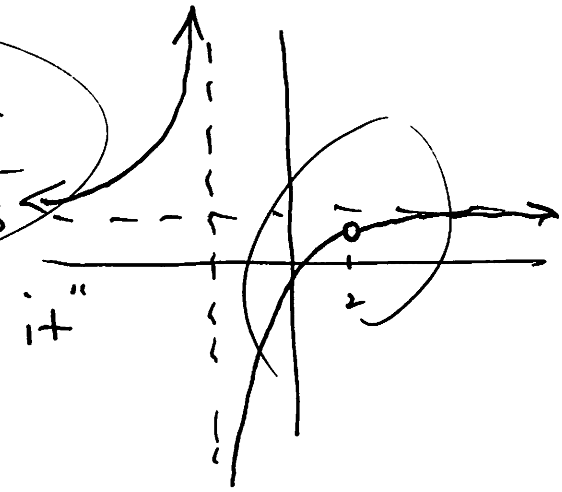
domain: $x \neq 3$

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

$$f(x) = \frac{\cancel{(x-2)}(x+5)}{\cancel{(x-2)}(x+3)}$$

delete $x = 2$

$$f(x) = \frac{x+5}{x+3}$$



"hole in it"

$$f(x) = ax^2 + bx + c \qquad (a \neq 0)$$

vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

$$f(x) = 3x^2 - 4x - 2$$

$$\frac{-b}{2a} = \frac{-(-4)}{2(3)} = \frac{4}{6} = \frac{2}{3}$$

$$\boxed{\text{vertex}\left(2/3,\ -10/3\right)}$$

$$f(2/3) = 3\left(\tfrac{2}{3}\right)^2 - 4\left(\tfrac{2}{3}\right) - 2$$

$$= \cancel{3}\cdot\frac{4}{\cancel{9}\,3} - \frac{8}{3} - \frac{6}{3} = \frac{-10}{3}$$