Function – f = Rule that assigns each element in A to EXACTLY one element in B

Arrow diagram

Domain – group of A input independent

Range – group of B output dependent

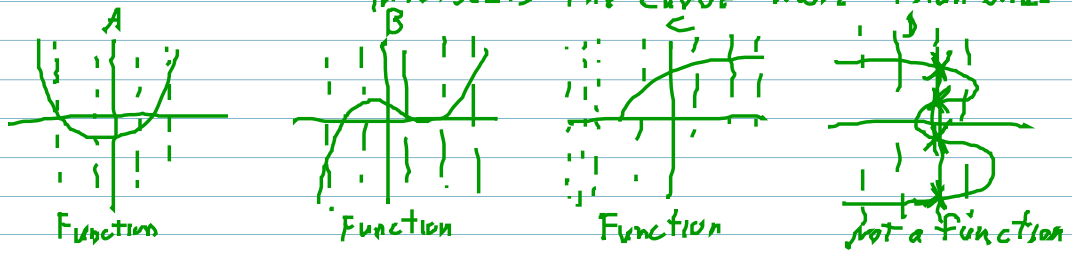
Graph – set of ordered pairs $\{(x, f(x)) : x \in A\}$

Representations of functions

Verbal – describe w/ words
Visual – graph
Numerical – table of values
Algebraic – Explicit function

Vertical Line Test

curve in xy-plane is function iff no vertical line intersects the curve more than once



Function Function Function Not a function

Piece-wise

$$f(x) = \begin{cases} f_1(x), & x \in I_1 \\ f_2(x), & x \in I_2 \\ \vdots & \vdots \\ f_n(x), & x \in I_n \end{cases}$$

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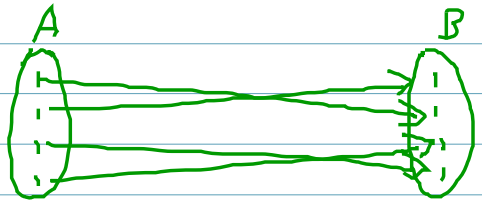

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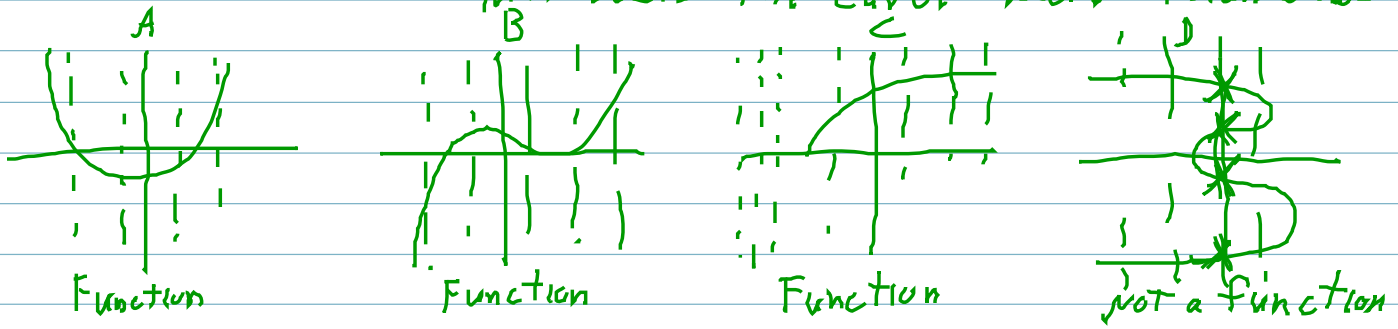

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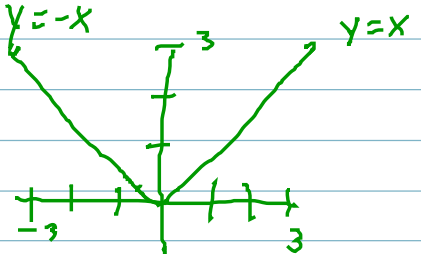
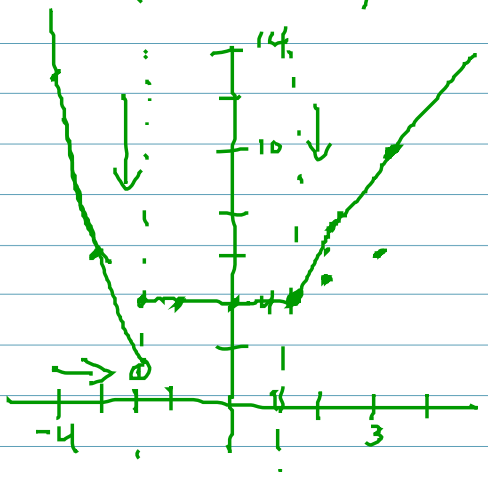
Absolute Value



$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

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

x	x^2-3	4	$3x+1$
-4	13		
-3	6		
-2	1	4	
-1		4	
0		4	
1		4	4
2			7
3			10



D: $(-\infty, \infty)$

R: $(1, \infty)$

Step Function
Greatest Integer Function — Floor Function

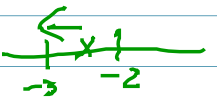
$$f(x) = [x] = [\![x]\!] = \lfloor x \rfloor$$

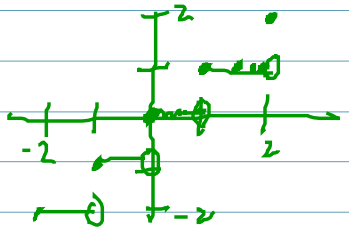
$\lfloor 3.5 \rfloor = 3$

$\lfloor 4.2 \rfloor = 4$

$\lfloor 7.9 \rfloor = 7$

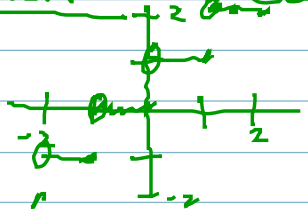
$\lfloor -2.4 \rfloor = -3$





Least Integer Function — Ceiling Function

$$f(x) = \lceil x \rceil$$



$\lceil 3.5 \rceil = 4$

$\lceil 4.2 \rceil = 5$

$\lceil 7.9 \rceil = 8$

$\lceil -2.4 \rceil = -2$

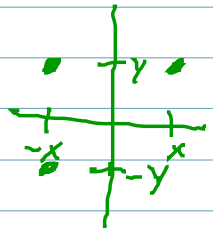
$f(x) = \lfloor 2x \rfloor$ $\quad g(x) = 2\lfloor x \rfloor$

$f(0.75) = 1$ $\quad g(0.75) = 0$

Symmetry

Even - y-axis
Odd - origin

$f(-x) = f(x)$ ←
$-f(-x) = f(x)$ ←
$f(-x) = -f(x)$ ←



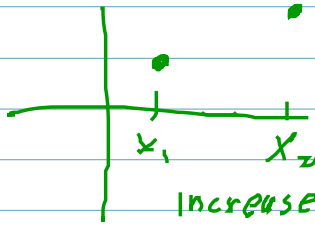
$f(x) = x^2 - 5x^4 + 2$
$f(-x) = (-x)^2 - 5(-x)^4 + 2 = x^2 - 5x^4 + 2$ Even
$-f(x) = -(x^2 - 5x^4 + 2) = -x^2 + 5x^4 - 2$ Not odd

$f(x) = 7x^5 - 4x^3$ Not Even
$f(-x) = 7(-x)^5 - 4(-x)^3 = -7x^5 + 4x^3$
$-f(x) = -(7x^5 - 4x^3) = -7x^5 + 4x^3$ odd

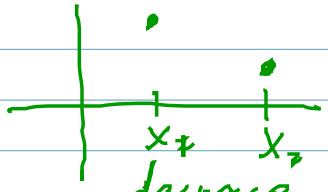
Direction

Increase – If $x_1 < x_2$, Then $f(x_1) < f(x_2)$, $x_1, x_2 \in I$

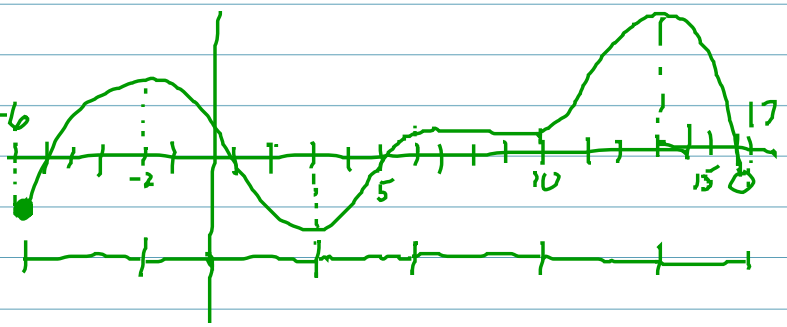
decrease – If $x_1 < x_2$, Then $f(x_1) > f(x_2)$, $x_1, x_2 \in I$



Increase



decrease



inc - $(-6, -2) \cup (3, 6) \cup (10, 13)$
dec - $(-2, 3) \cup (13, 17)$
con - $(6, 10)$