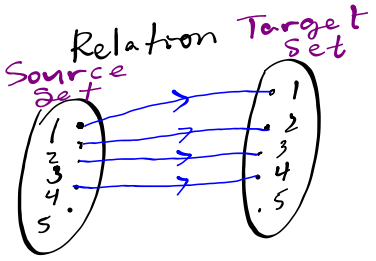
Unit 1: Effects of Changing the Parameters of a Real Function (a/b/h/k)

Recall: Definition: A function is a relation where each element of the domain (x-values) corresponds to only one element of the range (y-values)



Domain $\{1, 2, 3, 4\}$

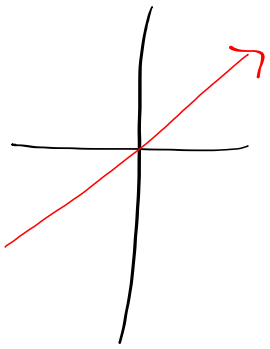
Domain is always a subset of source set

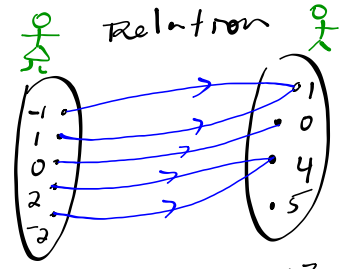
Function?

Y

N

$y = x$





Range $\{1, 0, 4\}$

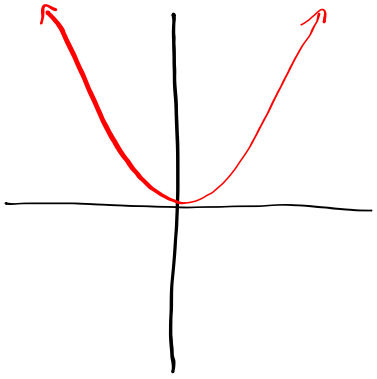
Range is always a subset of target set

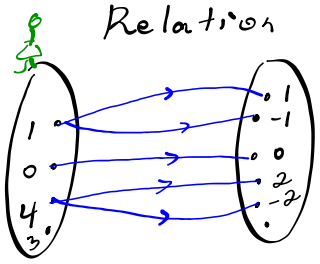
Function?

Y

N

$y = x^2$





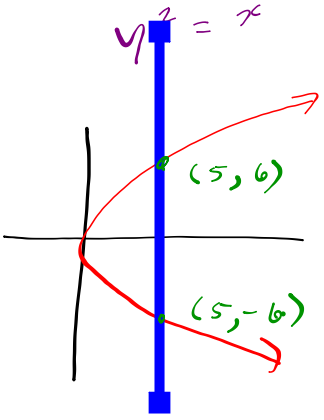
Function?

Y

N

Bonus: Find each equation

$y^2 = x$



a relation is a function if a vertical line only goes thru it once.

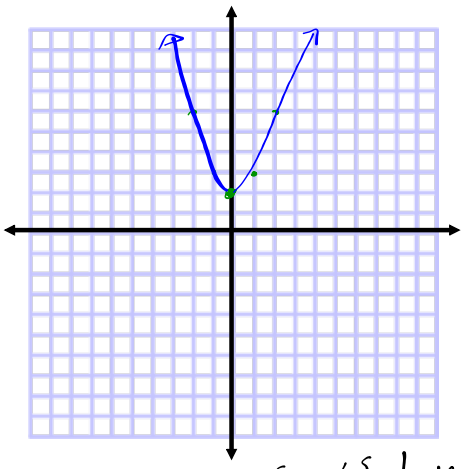
Definition: Cartesian Product: a set of all possible ordered pairs (x, y) a function could use.

ex $\mathbb{R} \times \mathbb{R}$ (source set, target set)

graph

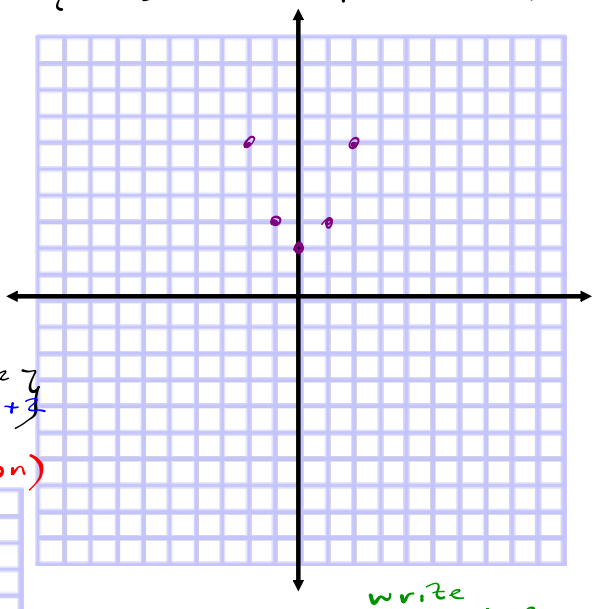
$f : \{(x, y) \in \mathbb{R} \times \mathbb{R} \mid y = x^2 + 2\}$ C.P.

- first draw function, and then apply restriction from C.P.



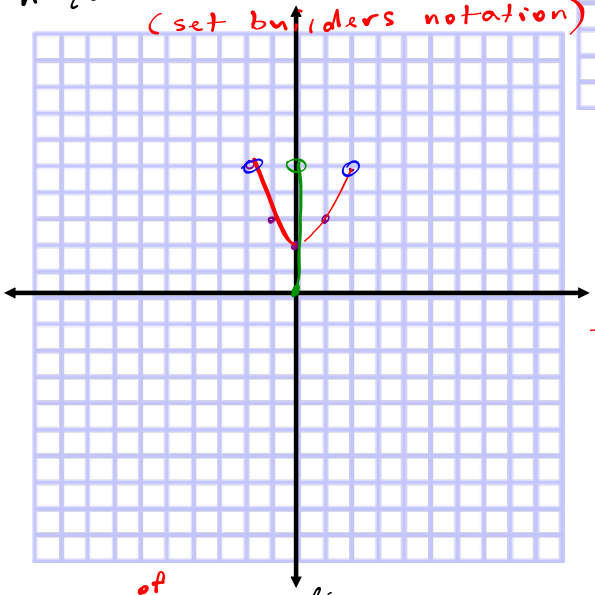
$g : \{(x, y) \in \mathbb{Z} \times \mathbb{Z} \mid y = x^2 + 2\}$

integers: whole #'s



$h : \{(x, y) \in \mathbb{R} \times [0, 6[\mid y = x^2 + 2\}$

(set builders notation)



$R : [2, 6[$

$D :]-2, 2[$

write f and g in functional notation.

function notation

$h : \mathbb{R} \longrightarrow [0, 6[$

$x \longrightarrow x^2 + 2$

$y =$

$y = x^2 + 2$

$f(x) = x^2 + 2$ of x equals ...

$y \rightarrow$ the y value for a given x-value.

find $f(0)$ → find the value of y when x is equal to zero.

$f(x) = x^2 + 2$

$f(0) = 0^2 + 2$

$f(0) = 2$ when $x = 0$

$y = 2$

if $f(x) = x^2 + 2$

find $f(1)$

Role of the Parameters

$(a/b/h/k)$

$(x, y) \longrightarrow \left(\frac{x}{b} + h,\ ay + k\right)$

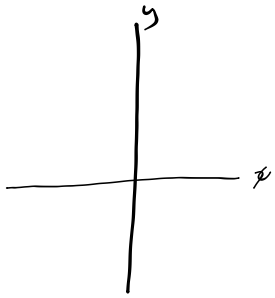
a - flips graph up/down

p1.21 - scale factor

- vertical

b - scale factor

p1.28 - flips graph left/right

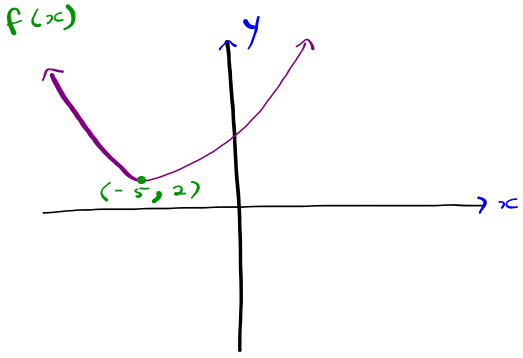


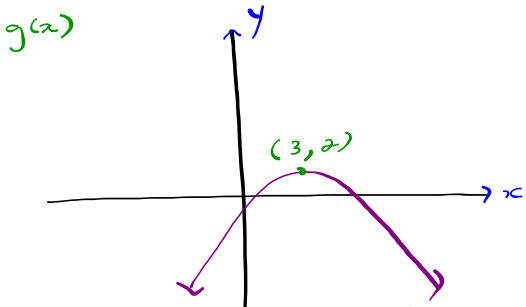
h - horizontal translation

k - vertical translation

} vertex
- starting point
- asymptotes

Typical Exam Question:





what happened to the parameters of f(x) to get g(x)

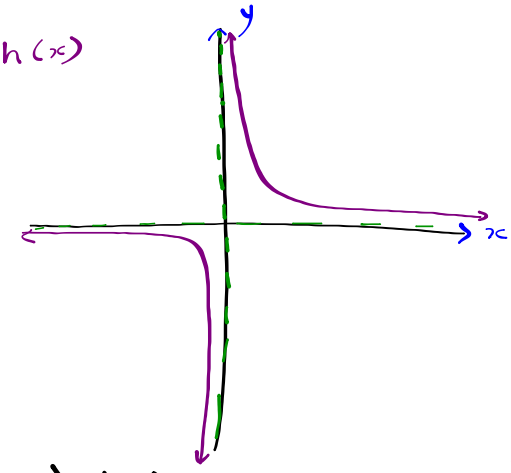
~~a) h ↑, k ↑~~

~~b) h ↑, b's sign changed~~

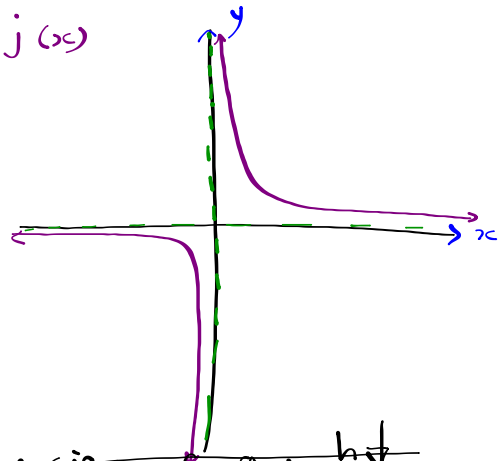
c) h ↑, a's sign changed

d) h ↓, a's sign changed

h(x)



j(x)



a) ~~h ↑, k ↓~~

b) change sign of a and b

c) ~~change sign of a, h ↓~~

d) ~~change sign of b, h ↓~~

Hmwk

p 1.43 #6

1.44 - 1.47 #8

Unit 2: Cartesian Graph of a Real Function

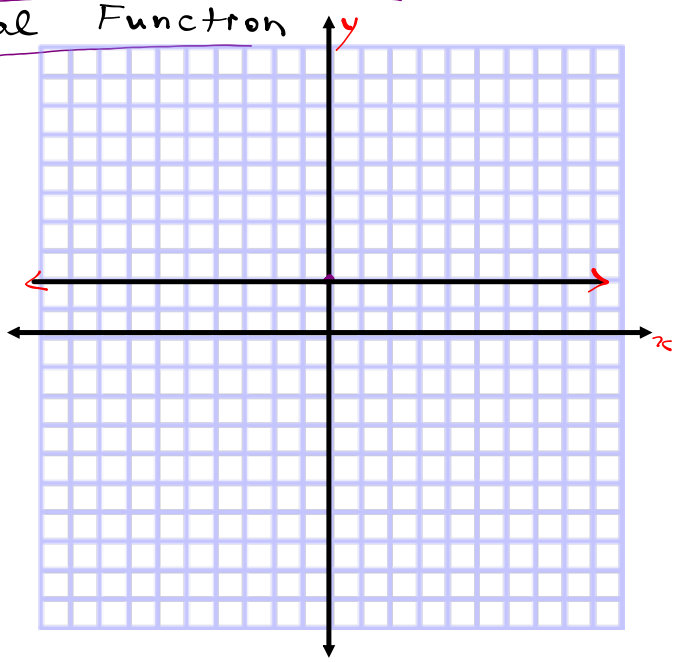
Constant Function (zero degree)

$y = k$

$(0, k) \rightarrow$ y-intercept

ex graph

$y = 2$



$-6 \overset{+6}{} - 3y = 0 + 6$

$\frac{-3y}{-3} = \frac{6}{-3}$

$y = -2$

$y = k$

initial value of parameter

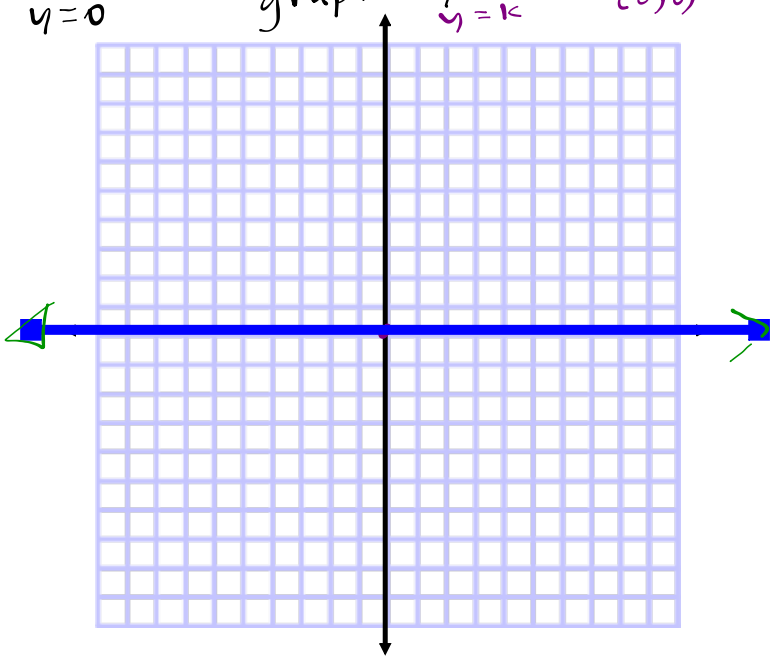
$a = 1$ $h = 0$ $y = k$

$b = 1$ $k = 0$ initially

$y = 0$

graph $y = 0$ $(0, k)$

$y = k$ $(0, 0)$



$y = 0$

Linear Function
(degree one)

$y = ax + k$

a - slope (m)

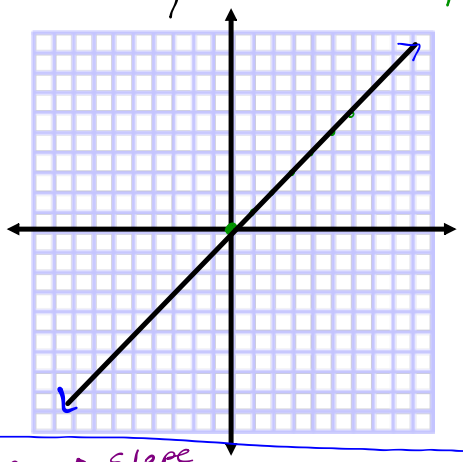
(0,k) - y-intercept

initially $a = 1$ $h = 0$

$b = 1$ $k = 0$

$a = \frac{1}{1} = \frac{\text{rise}}{\text{run}}$

$y = x$



graph $y = -2x + 3$

$y = ax + k$

$a = -2 \rightarrow$ slope

$k = 3 \rightarrow (0,3)$

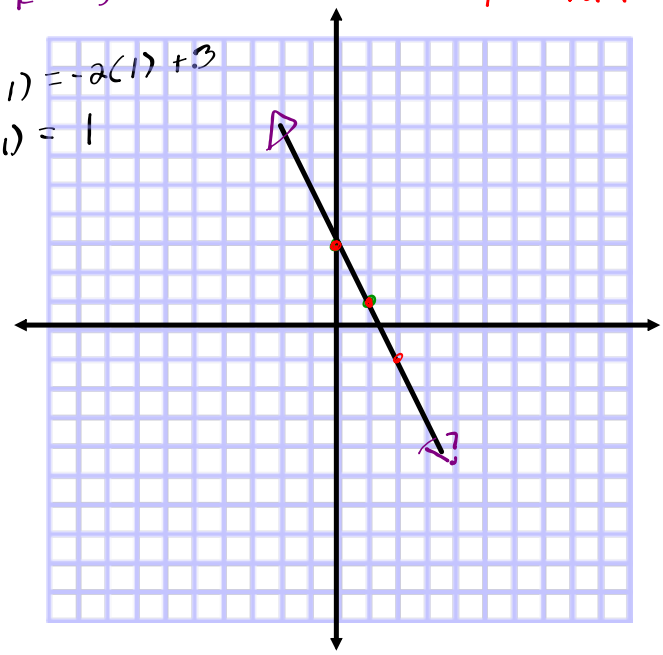
$a = \frac{-2}{1} = \frac{\text{rise}}{\text{run}}$

x	y
0	k
10	

x	y
0	3
1	1

$f(1) = -2(1) + 3$

$f(1) = 1$



graph $f(x) = -\frac{3}{2}x - 1$

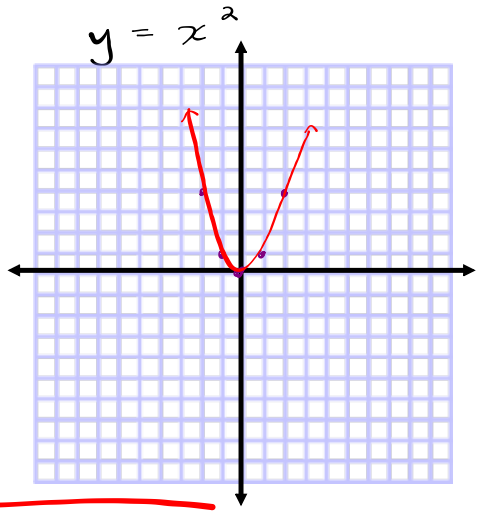
Quadratic Function

(second degree)

$y = a(b(x-h))^2 + k$

Vertex (h, k)

initially $y = x^2$



graphing

step i find (h,k) vertex

step ii construct table of value

x	y
h-1	
h	k
h+1	

step iii plot points draw curve.

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ex graph $f(x) = (x-2)^2 + 2$

$y = a(b(x-h))^2 + k$

$a = 1 \quad h = 2$

$b = 1 \quad k = 2$

$V(2,2)$

---

ex graph $g(x) = (-x + 4)^2 + 2$

$g(x) = a(b(x-h))^2 + k$

$a = 1 \quad h = 4$

$b = -1 \quad k = 2$

you must factor out b, before identifying h.

s, identify b and place in front of empty brackets

st divide each term by b and put answer in brackets

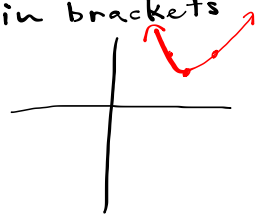
$g(x) = (-x + 4)^2 + 2$

$g(x) = (-1)^2(x-4))^2 + 2$

$g(x) = a(b(x-h))^2 + k$

$a = 1 \quad h = 4$

$b = -1 \quad k = 2$



x	y
3	3
4	2
5	3

$g(3) = (-(3-4))^2 + 2$

$g(3) = 3$

---

graph $y = -(-2x + 6)^2 - 2$

show me value of parameters.

$y = -(-2(x-3))^2 - 2$

$f(x) = a(b(x-h))^2 + k$

$a = -1 \quad h = 3$

$b = -2 \quad k = -2$

Absolute Value Function

$y = a|b(x-h)| + k$

(h,k) - vertex

initially

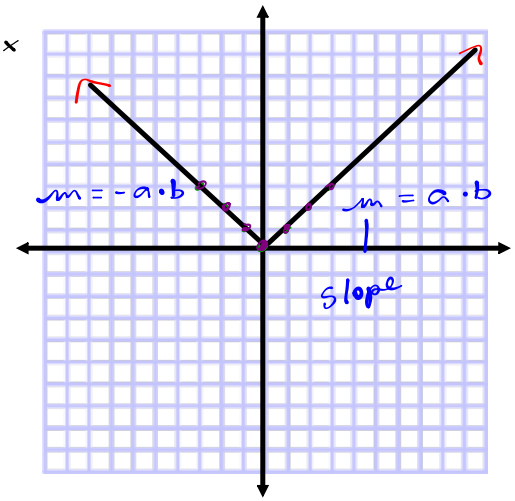
$y = |x|$

$y = |-1|$

$y = 1$

$f(-2) = |1 \cdot 2|$

$f(-2) = 2$



$g(x) = -\frac{1}{2}|4(x-1)| + 2$

$y = a|b(x-h)| + k$

$a = -\frac{1}{2}$ $h = 1$

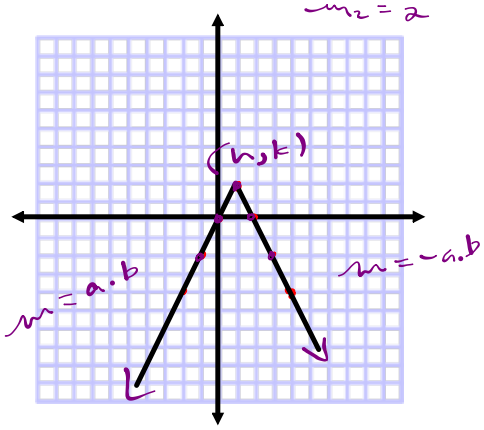
$b = 4$ $k = 2$

$m = a \cdot b$

$m = -\frac{1}{2} \cdot 4$

$m_1 = -2$

$m_2 = 2$



graph

$f(x) = 2|-2x+6|-4$

$y = a|b(x-h)|+k$

Step i. identify parameter esp (h, k)

$f(x) = 2|-2x+6|-4$

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

$y = a|b(x-h)|+k$

$a = 2 \quad h = 3$

$b = -2 \quad k = -4$

Step ii Construct TOV

x	y
h-1	k
h	k
h+1	•

x	y
2	0
3	-4
4	0

$f(2) = 2|-2(2)+6|-4$

$f(2) = 2|2|-4$

$f(2) = 2(2)-4$

$f(2) = 0$

$f(4) = 2|-2(4)+6|-4$

$f(4) = 2|-2|-4$

$f(4) = 2(2)-4$

$f(4) = 0$

Step iii Plot points draw straight lines

graph

$h(x) = -2|-x+3|+1$

$g(x) = \{(x,y) \in \mathbb{R} \times]-6,4] \mid y = 5|-x-3|-6\}$

(first graph function, then apply restriction by erasing ...)

Hmwk

p 2.3 - 2.4

p 2.9 - 2.10

p 2.21 - 2.22

p 2.35 - 2.36