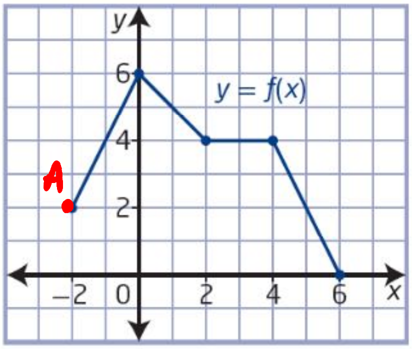
PreCalculus 12 Date ___________________

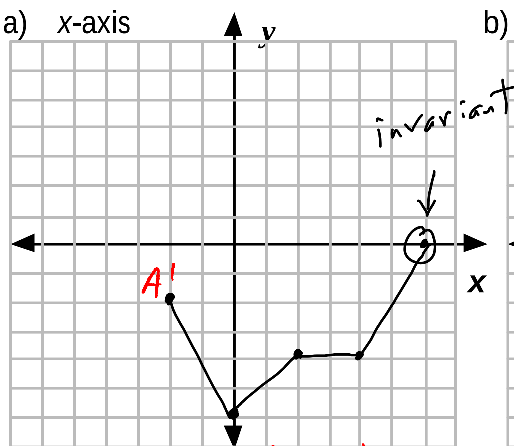
Unit 1: Function Transformations

1.2 Reflections & Stretches

Given the graph of $f(x)$ shown, sketch the mirror image of $f(x)$ reflected in the:



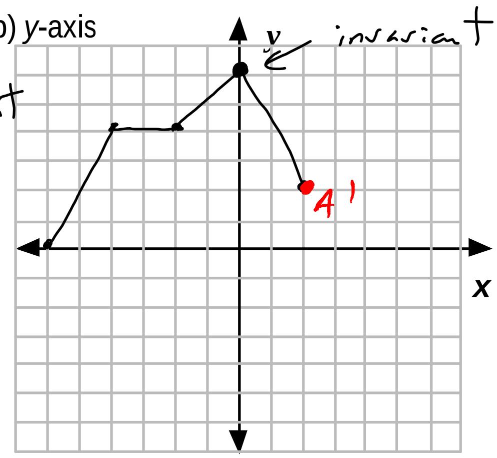
a) *x*-axis



$A(-2,2) \rightarrow A'(-2,-2)$

* vertical reflection

b) *y*-axis



$A(-2,2) \rightarrow A'(2,2)$

* horizontal reflection

Mapping: $(x,y) \rightarrow (x,-y)$ $(x,y) \rightarrow (-x,y)$

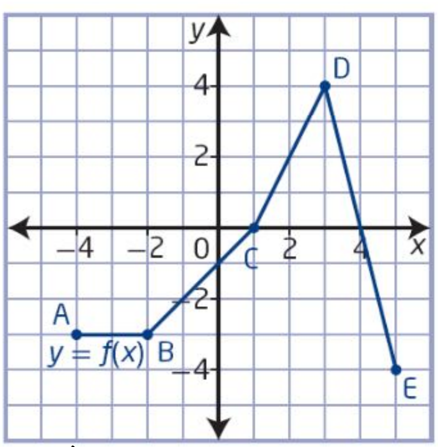
Function notation: $y = -f(x)$ $y = f(-x)$

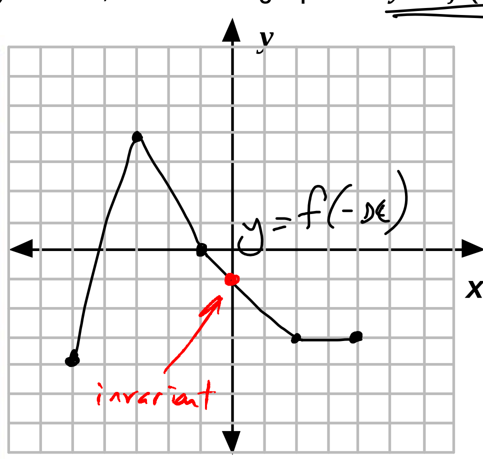
Reflection: A transformation where each point of the original graph has an image point resulting from a reflection in a line (line of reflection). Does not change the shape of the graph but may change its orientation.

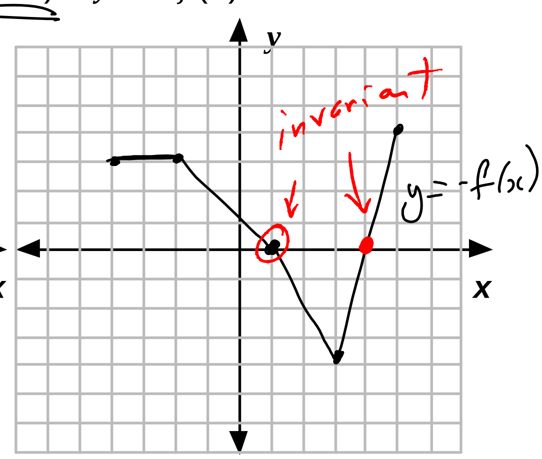
Invariant Point: A point on a graph that is unchanged after a transformation is applied to it.

* any point on a line of reflection is invariant

Ex. Given the graph of $y = f(x)$ shown, sketch the graphs of $y = f(-x)$ & $y = -f(x)$







$f(x)$

x	y
-4	-3
-2	-3
1	0
3	4
5	-4

$f(-x)$

$-x$	y
4	-3
2	-3
-1	0
-3	4
-5	-4

$-f(x)$

x	$-y$
-4	3
-2	3
1	0
3	-4
5	4

Stretches: expanding or compressing the shape of the graph

Given a function $y = f(x)$

Vertical Stretch: $y = af(x)$ or $\frac{y}{a} = f(x)$

$|a| > 1$ expansion by factor (multiplier) of $|a|$

$0 < |a| < 1$ compression by factor (multiplier) of $|a|$

graphically: the y-values (distance from x-axis) are multiplied by a

ie. mapping notation: $(x, y) \rightarrow (x, ay)$

*note – if $a < 0$ then there is also a reflection in the x-axis

Horizontal Stretch: $y = f(bx)$

$|b| > 1$ compression by factor (multiplier) of $\frac{1}{|b|}$

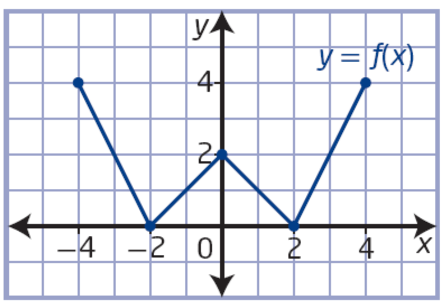
$0 < |b| < 1$ expansion by factor (multiplier) of $\frac{1}{|b|}$

graphically: the x-values (distance from y-axis) are multiplied by $\frac{1}{|b|}$

ie. mapping notation: $(x, y) \rightarrow (\frac{1}{b}x, y)$

*note – if $b < 0$ then there is also a reflection in the y-axis

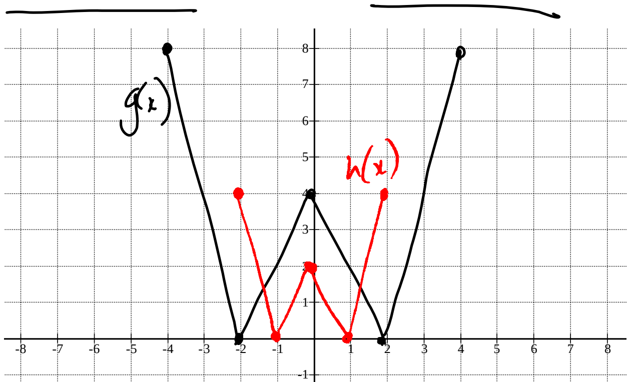
Ex. Given the graph of $y = f(x)$ shown, sketch:

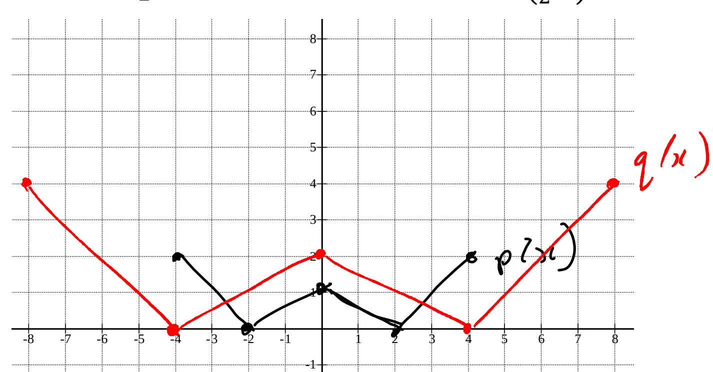


$f(x)$

x	y
-4	4
-2	0
0	2
2	0
4	4

$g(x) = 2f(x)$ $h(x) = f(2x)$ $p(x) = \frac{1}{2}f(x)$ $q(x) = f\left(\frac{1}{2}x\right)$





$g(x)$

x	$2y$
-4	8
-2	0
0	4
2	0
4	8

$h(x)$

$\frac{1}{2}x$	y
-2	4
-1	0
0	2
1	0
2	4

$p(x)$

x	$\frac{1}{2}y$
-4	2
-2	0
0	1
2	0
4	2

$q(x)$

$2x$	y
-8	4
-4	0
0	2
4	0
8	4

Practice: pg. 28/# 1 – 7, 9, 10, 14, 15, C3, C4