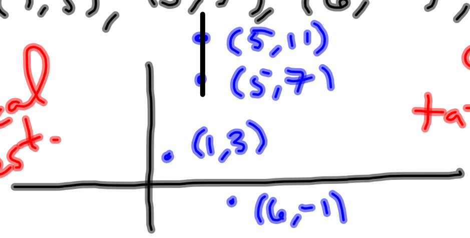
Function – A rule that assigns to each $x \in$ Domain to one $y \in$ Range.

A relation R is a collection (set) of ordered pairs.

$R = \{(1,3), (5,7), (6,-1), (5,11)\}$ is

Not a function. Flunks vertical line test.



Graphical representation of example from Friday.

$f = \{(1,3), (5,7), (6,-1)\}$ is a function

$f(x) = 3x + 1 \implies$

$f(☺) = 3☺ + 1$

$f(7x-11) = 3(7x-11) + 1$

$= 21x - 33 + 1$

$= 21x - 32$

$f(r) = 3r + 1$

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

$f(x+h) = 2(x+h)^2 + 5(x+h) - 2$

$= 2(x^2 + 2xh + h^2) + 5x + 5h - 2$

$= 2x^2 + 4xh + 2h^2 + 5x + 5h - 2$

$1x^2h^0 + 2x^1h^1 + 1x^0h^2$

$(x+h)^2 = \underline{x^2 + 2xh + h^2}$

$x^2 + 2xh + h^2$

$\frac{2h}{2} = h \rightsquigarrow h^2$

$49 \times 7 = 343$

$-49 \quad 294$

Pascal's Triangle.

1

1 1

$\boxed{1 \quad 2 \quad 1}$

1 3 3 1

1 4 6 4 1

$(x+h)^3 = 1x^3h^0 + 3x^2h^1 + 3x^1h^2 + 1x^0h^3$

$= x^3 + 3x^2h^1 + 3xh^2 + h^3$

$(2x+7)^3 = 1(2x)^3(7)^0 + 3(2x)^2(7)^1 + 3(2x)^1(7)^2 + (2x)^0(7)^3$

$= 2^3x^3 \cdot 1 + 3(2^2x^2)(7) + 3 \cdot 2x \cdot 49 + 343$

$= 8x^3 + 84x^2 + 294x + 343$

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Examples of functions (families)

Func.	Basic Func.
(1) $g(x) = ax+b$ linear function	$f(x) = x$ identity function
(2) $g(x) = ax^2+bx+c$ quadratic function	$f(x) = x^2$ squaring function, square ..
(3) $g(x) = ax^3+bx^2+cx+d$ cubic function	$f(x) = x^3$ cube function, cubing ..
(4) $g(x) = a\sqrt{bx+c} + d$ square root function	$f(x) = \sqrt{x}$ square root function
(5) $g(x) = a\sqrt[3]{bx+c} + d$	$f(x) = \sqrt[3]{x}$ cube root function
(6) $g(x) = a\lvert bx+c\rvert + d$	$f(x) = \lvert x\rvert$ absolute value.

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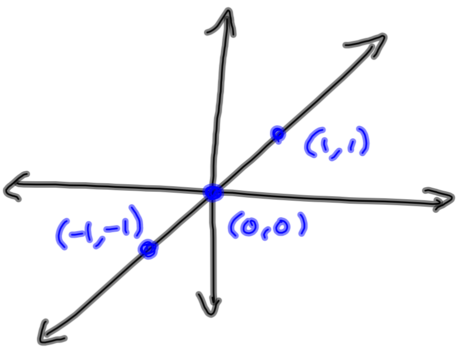
1. $f(x) = x$; identity

$y = x$

x	y
-1	-1
0	0
1	1



$f(x-3)$

Move right 3 units.

Delay by 3 units.

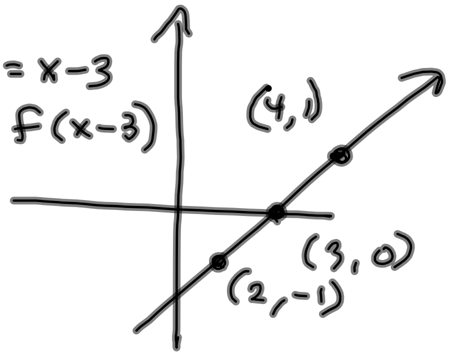
Add 3 to every x-coord!

$y = x - 3$

$f(x) = x$

$f(x-3) = x - 3$

$g(x) = x - 3$
$= f(x-3)$



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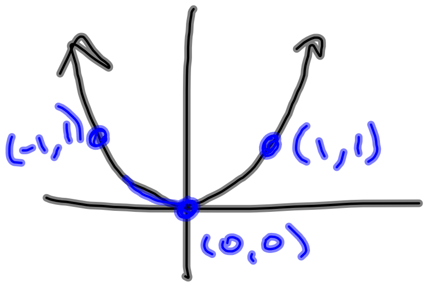
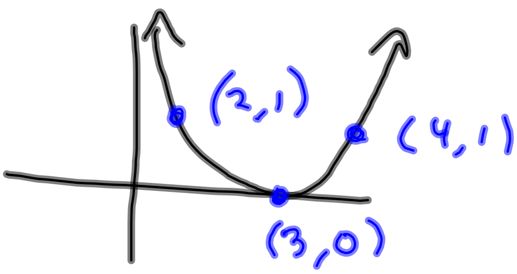
(2) Same deal with $f(x)=x^2$



x	$y=x^2$
-1	1
0	0
1	1

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



$f(x+3)$ left 3

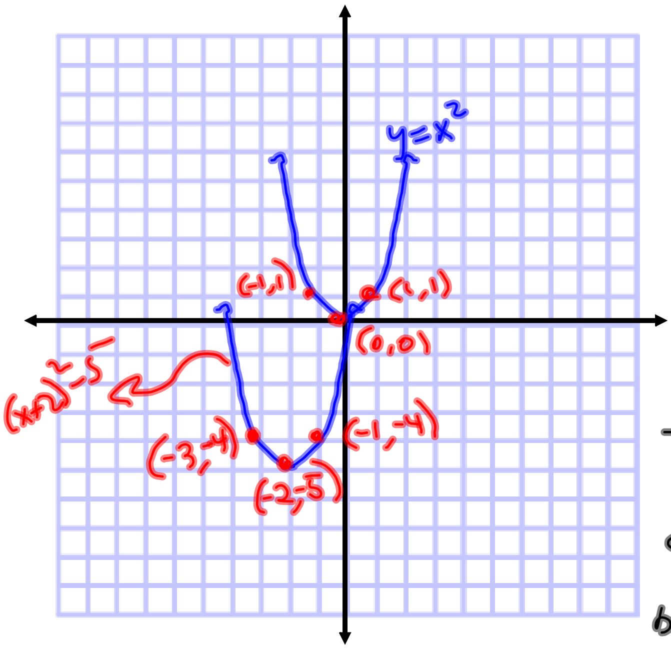
$f(x)-3$ down 3

$f(x)+3$ up 3

Vertical (rigid) shifts.

Rigid transformations

2



$f(x)=x^2$

$g(x)=(x+2)^2-5$

$=f(x+2)-5$

Left 2 Down 5

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graph $g(x)=x^2+4x-1$ by shifting/~~stretching~~ $f(x)=x^2$

Didn't involve a stretch.

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

$=x^2+4x+2^2-4-1$

$\frac{4}{2}=2\rightarrow 2^2=4$

$=(x+2)^2-5$ See graph.

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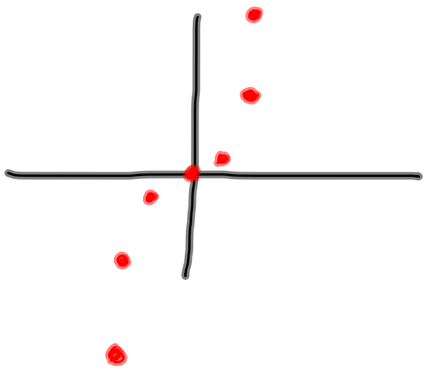
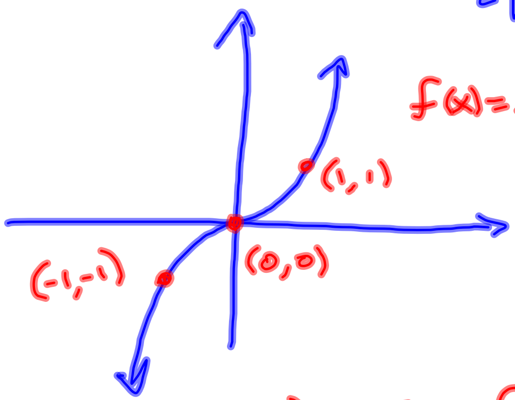
③ Cubic $f(x) = x^3$

x	y
-2	$(-2)^3 = -8$
-1	-1
0	0
1	1
2	8

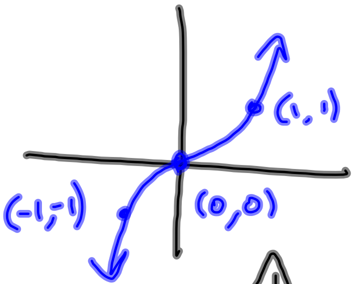




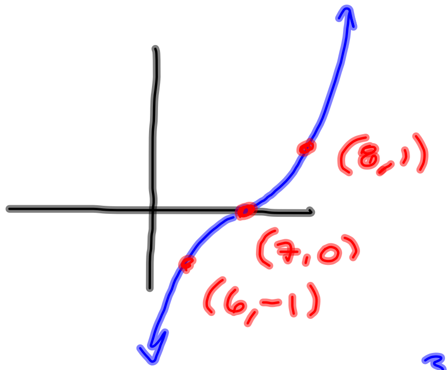
$f(x) = x^3$

$g(x) = (x-7)^3 + 5 = f(x-7) + 5$ for $f(x) = x^3$

Right 7 up 5

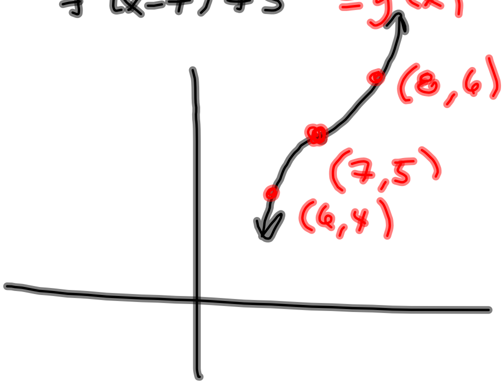


$f(x) = x^3$



$f(x-7) = (x-7)^3$

$f(x-7) + 5 = g(x)$



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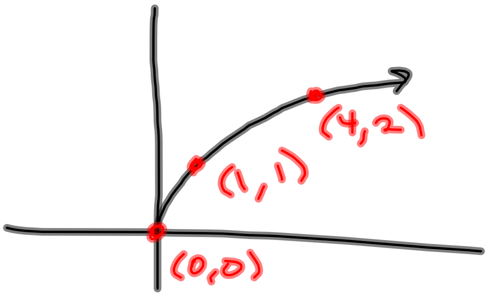
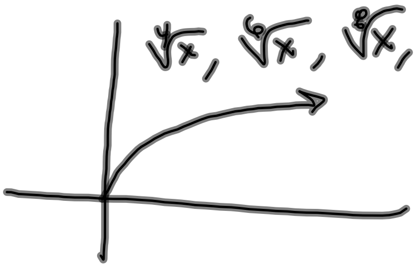
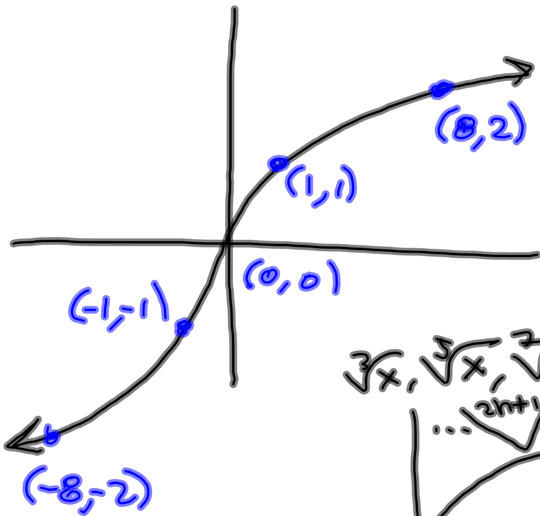
4 $f(x) = \sqrt{x}$



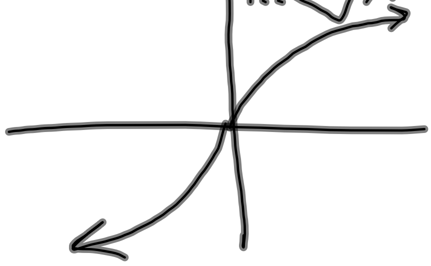
$\sqrt[4]{x}, \sqrt[6]{x}, \sqrt[8]{x}, \ldots, \sqrt[2n]{x}$



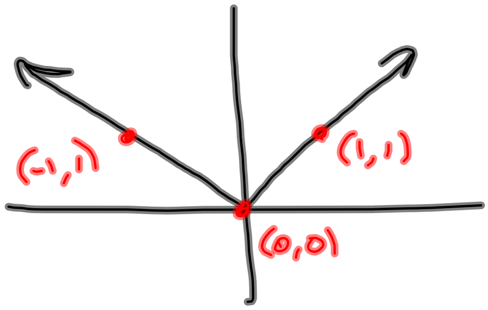
5 $f(x) = \sqrt[3]{x}$



$\sqrt[3]{x}, \sqrt[5]{x}, \sqrt[7]{x}, \ldots \sqrt[2n+1]{x}$



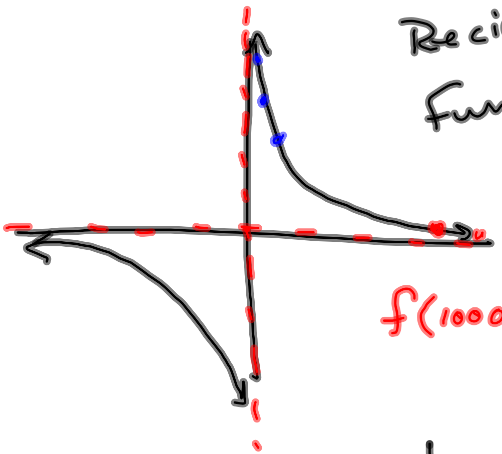
(6) $f(x) = |x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$ piecewise defin.



(7) $f(x) = \dfrac{1}{x}$ Reciprocal Function

x	y
-2	$-\frac{1}{2}$
-1	-1
$-\frac{1}{2}$	-2
0	$\cancel{\square}$
$\frac{1}{2}$	2
1	1
2	$\frac{1}{2}$

$\dfrac{1}{0}$



$y=0$

$f(1000) = \dfrac{1}{1000}$

$x=0$

x close to zero:

$x = \dfrac{1}{100} \Rightarrow f(x) = 100$

$x = \dfrac{1}{1000} \Rightarrow f(x) = 1000$

$\dfrac{1}{\frac{1}{100}}$

$\dfrac{1}{\frac{1}{100}} = \dfrac{\frac{1}{1}}{\frac{1}{100}} = \dfrac{1}{1} \cdot \dfrac{100}{1}$

$1 \div \dfrac{1}{100} = 1 \cdot \dfrac{100}{1}$

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