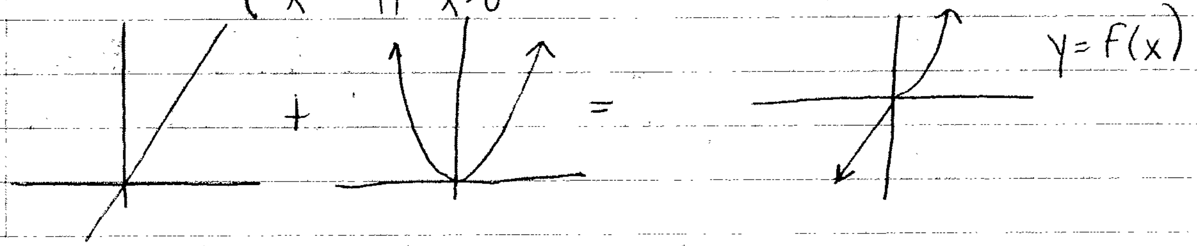
Outline

- What can we do with functions? (sec. 1.3)
- Tangents & Velocities (sec 2.1)

Piecewise-Defined Functions

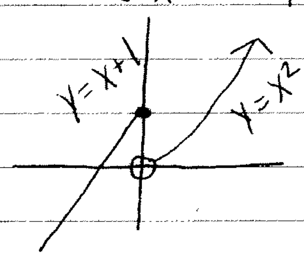
$$f(x) = \begin{cases} x & \text{if } x \le 0 \\ x^2 & \text{if } x > 0 \end{cases}$$



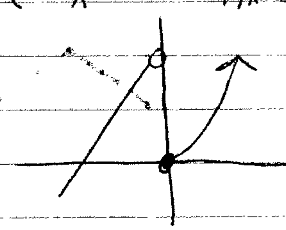
also could have defined f as:

$$f(x) = \begin{cases} x & \text{if } x < 0 \\ x^2 & \text{if } x \ge 0 \end{cases} \quad \text{or} \quad f(x) = \begin{cases} x & \text{if } x \le 0 \\ x^2 & \text{if } x \ge 0 \end{cases}$$

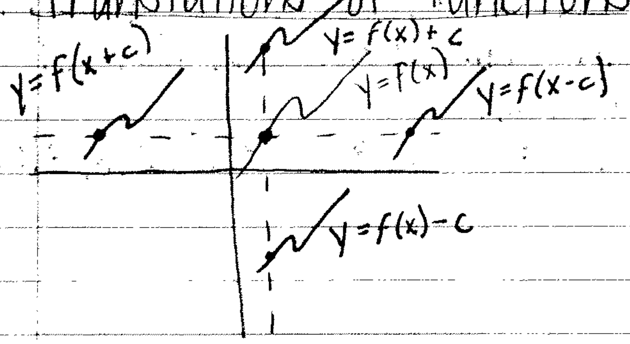
$$g(x) = \begin{cases} x+1 & \text{if } x \le 0 \\ x^2 & \text{if } x > 0 \end{cases} \qquad h(x) = \begin{cases} x+1 & \text{if } x < 0 \\ x^2 & \text{if } x \ge 0 \end{cases}$$



AS OPPOSED TO



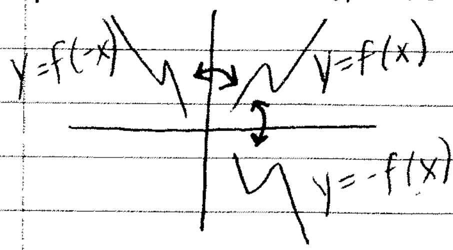
Translations of Functions



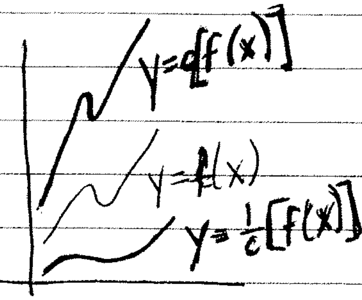
Let $c > 0$

- translate after putting in function
  vertical movement
- translate before getting output
  horizontal movemen

Reflection of Functions



- when negative is applied to input $\rightarrow$ reflection over y-axis
- when negative is applied to output $\rightarrow$ reflect over x-axis

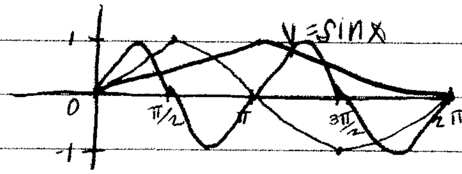


Let $c>1$

$c[F(x)] \rightarrow$ **stretch**

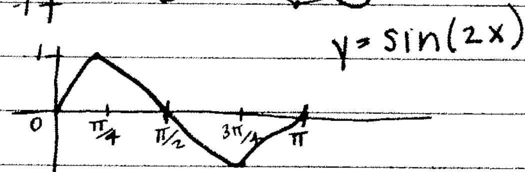
$\frac{1}{c}[F(x)] \rightarrow$ **compressed**

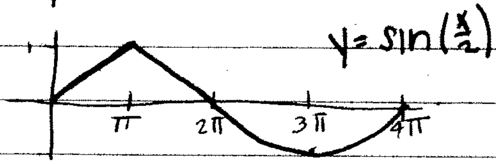
Horizontal Stretches



$f(cx)$

$f\left(\frac{x}{c}\right)$





Composition

If F and G are two functions, and the range of G is in the domain of F, then we can make a new function H.

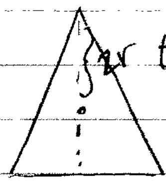
$$H(x) = F(G(x))$$

Definition of Composition: $x \rightarrow g \rightarrow F(g(x)) = H(x)$

ex] $g(x) = -x$
$f(☺) = \sqrt{☺}$ } Question: what is the domain of F composed with g?

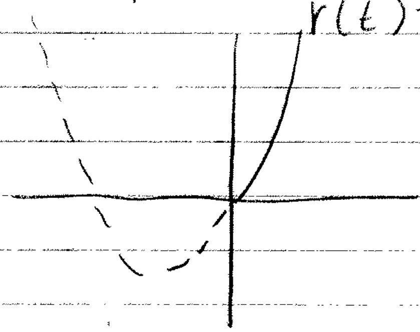
ex] $F(x) = x^2$, $g(x) = x-4$
$F(g(x)) = (x-4)^2$
$g(F(x)) = x^2 - 4$

Notation
$F(g(x)) = F \circ g(x)$

ex]  r equilateral Δ

Area of Δ in terms of r
$A = 3\sqrt{3}\,(r^2)$

ex] Suppose that r is a function of time
$r(t) = t^2 + t$



as r increases with time, the area of the equilateral triangle with apothem r is $A(r(t)) = 3\sqrt{3}(t^2+t)$
"transfer of dependence"

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find $f \circ g \circ h$
$f(x) = \sqrt{x-3}$, $g(x) = x^2$, $h(x) = x^3 + 2$

$g(h) = (x^3+2)^2$
$f(g(h)) = \sqrt{(x^3+2)^2 - 3}$