Friday, September 9 - Fall '22
Lecture #5

Announcements / Reminders

* Turn in calculus pretest today
* WP HW 1 due tonight (11:59pm) — 1.1
* WP HW 2 due next Wed, 9/14 — 1.2, 1.3
* Q2 next Thursday, 9/15 — 1.2, 1.3, 1.4
* Office Hours! Help Desk!

* Office of Student Educational Services - Maddie

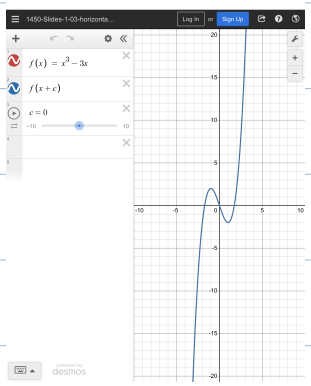
1.3 - New Functions From Old

$f(x) \pm c$ vertical shift

$f(x \pm c)$ horizontal shift

add a positive moves ←

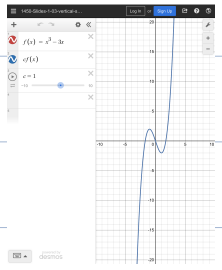
adding a neg. number moves →



(3) $c \cdot f(x)$

Multiplying by c causes a vertical stretch or shrink.

- If $c > 1$: vertical stretch
- If $c = 1$: no change
- If $0 < c < 1$: vertical shrink
- If $c = 0$: becomes the 0 function
- If $-1 < c < 0$: vertical shrink + vertical flip
- If $c = -1$: vertical flip
- If $c < -1$: vertical stretch + vert. flip



~~f(x)~~

(4) $f(c \cdot x)$

If $c > 1$: horizontal shrink
If $0 < c < 1$: horizontal stretch
If $-1 < c < 0$: horizontal stretch + hor. flip
If $c = -1$: hor. flip
If $c < -1$: hor. shrink + flip

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

Let $g(x) = f(5x)$

$f(2) = 2$

~~$(2,2)$ is a point on the graph of f.~~

$g(2) = f(5 \cdot 2)$

$= f(10) = 10^3 - 3 \cdot 10$

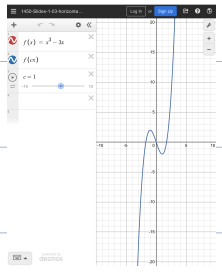
$= 970$

$(2, 970)$ is a point on g.

$(10, 970)$ is a point on f.

Then g "grabs" its values from further away.

$g(x) = f\left(\frac{1}{5} \cdot x\right)$



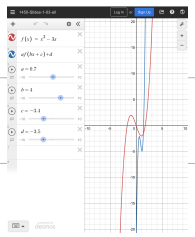
$g(10) = f(2)$

They can all be combined together.

Ex: $g(x) = -3f(4x-2)+7$

$g(1) = \underbrace{-3}_{3^{rd}} f(\underbrace{4 \cdot 1}_{1^{st}} \underbrace{-2}_{2^{nd}}) \underbrace{+7}_{4^{th}}$

(1) Start with f, hor. shrink by a factor of 4.
(2) Shift 2 to the right.
(3) vert. flip and stretch by a factor of 3
(4) shift ↑ by 7

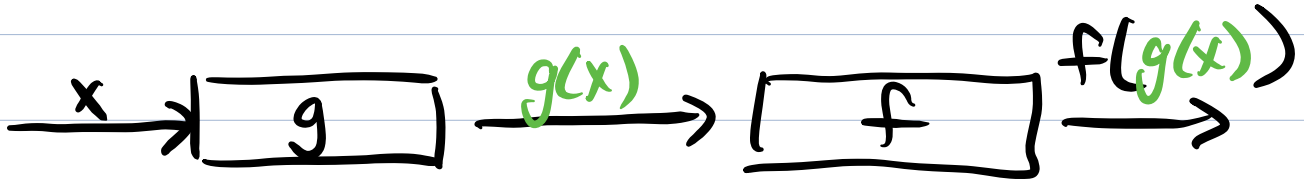


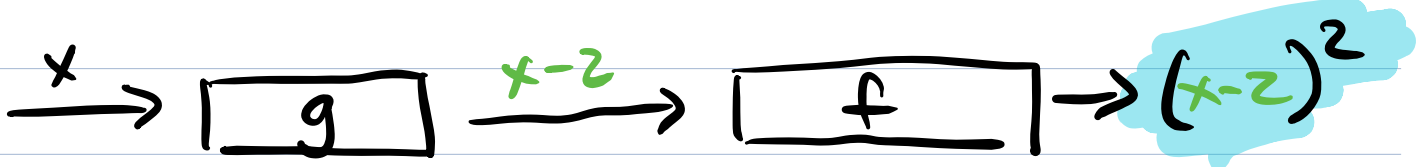
Composition of Functions.

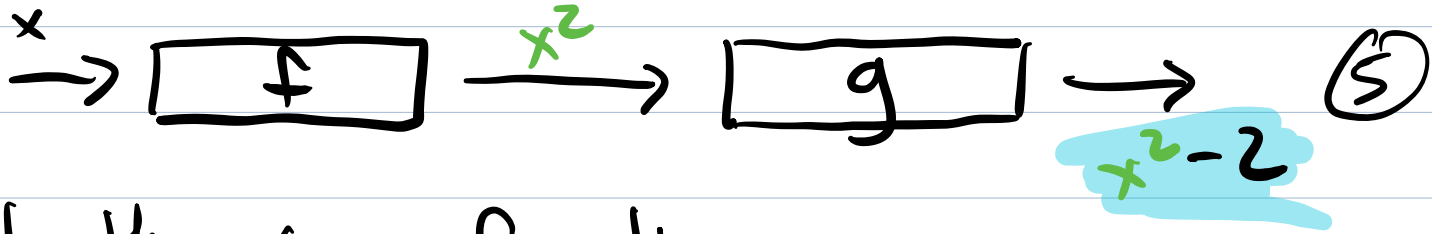
Compositions of two functions means one first, and then the other.

Ex: $f(x)=x^2$ "square" $g(x)=x-2$ "subtract 2"

$f(g(x))$ "f of g of x"







not the same function, so order matters (inside to outside)

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

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

Group Work: $f(t) = 2^{t+1}$

$g(t) = t^2 + t + 1$

Calculate $f(g(t))$, $g(f(t))$, $f(f(t))$

#1, $f(g(t))$ = (A) 2^{t^2+t+1} (B) 2^{t^2+t+2}

(C) $(2^{t+1})^2 + 2^{t+1} + 1$

(D) None of the above.

#2, $g(f(t))$ = (A) 2^{t^2+t+2} (B) $t^{2t+1} + t + 1$

(C) $t^2 + 2^t + 1$ (D) None of the above

#3, $f(f(t))$ (A) 2^{2t+1} (B) $2^{2^t+1} + 1$

(C) $2^{2^{t+1}+1}$ (D) None of the above