Pg 1 10.1 - Composition of functions

$\boxed{4:30-4:45}$ This section is a revisit of composite functions from the beginning

We're going to focus more now on the tabular and graphical aspects of understanding these functions as well as decomposing functions

Concept of Composition of Functions

Let's say we have some coffee beans and use them as the input to a coffee grinder.

Then, we take the output from the coffee grinder and use this as the input to a coffee maker

We can state this in mathematical terms:

Let's define:

$$g = b(z)$$

as the dry measurement (in tablespoons) of coffee grounds that are made when grinding z ounces of coffee beans

Now define:

$$v = f(g)$$

as the volume of coffee brewed from g tablespoons of coffee grounds

Can we find the volume of coffee that can be made with z ounces of coffee beans?

Yes, since we can find g from z

$g = b(z)$ $\quad$ $v = f(g)$

Then we can compose the two functions to find this out

$$v = f(b(z))$$

Important Note: Our input is z, not b(z). Our output is v.

Assign #24 pg 401 - Interpretation Problem
- Remember that we usually ignore the intermediate output

Composition of Functions (Tables) $\boxed{4:45 - 5:00}$

Let's go through an example and then move onto some more challenging problem

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x	0	1	2	3	4	5
p(x)	1	0	5	2	3	4
q(x)	5	2	3	1	4	8

$r(x) = p(q(x))$; Make a table for $r(x)$

Let's find $r(0)$ together and then work on it on our own

$r(0) = p(q(0))$; $q(0) = 5 \rightarrow p(5) = 4$
$r(0) = 4$

Fill out the rest and then let's compare answers

Assign # 28 pg 401
- This is fairly challenging

$\boxed{5:00-5:15}$ Composition of functions (Graphs)

To introduce this, let's work on an easier problem

Assign #26 pg 401

Assign: Let $f(x)$ and $g(x)$ be the functions in # 51 pg 402 and define:

$$h(x) = \begin{cases} x^3 & x < 1 \\ x^2+1 & x \geq 1 \end{cases}$$

Compute the following:

1.) a) $f(g(4))$ b) $g(f(4))$ c) $f(f(0))$
d) $g(g(0))$ e) $g(h(1))$ f) $f(h^{-1}(10))$ (graph)
g) $h(f(5))$

2) Solve the following eqns:
a) $g(g(x)) = 1$
b) $f(h(x)) = 0$

Decomposing Functions $\boxed{5:15 - 5:30}$

Again, we'll learn this through examples:
When we decompose a function, we want to split up the function into a combination of two functions

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$y = e^{-\sqrt{x}}$ decompose this into $u(v(x))$ given that:

$u(x) = e^x \Rightarrow v(x) = -\sqrt{x} \rightarrow u(v(x)) = e^{-\sqrt{x}}$

Now try,
$u(x) = \sqrt{x}$

Assign: #47, #48, #49