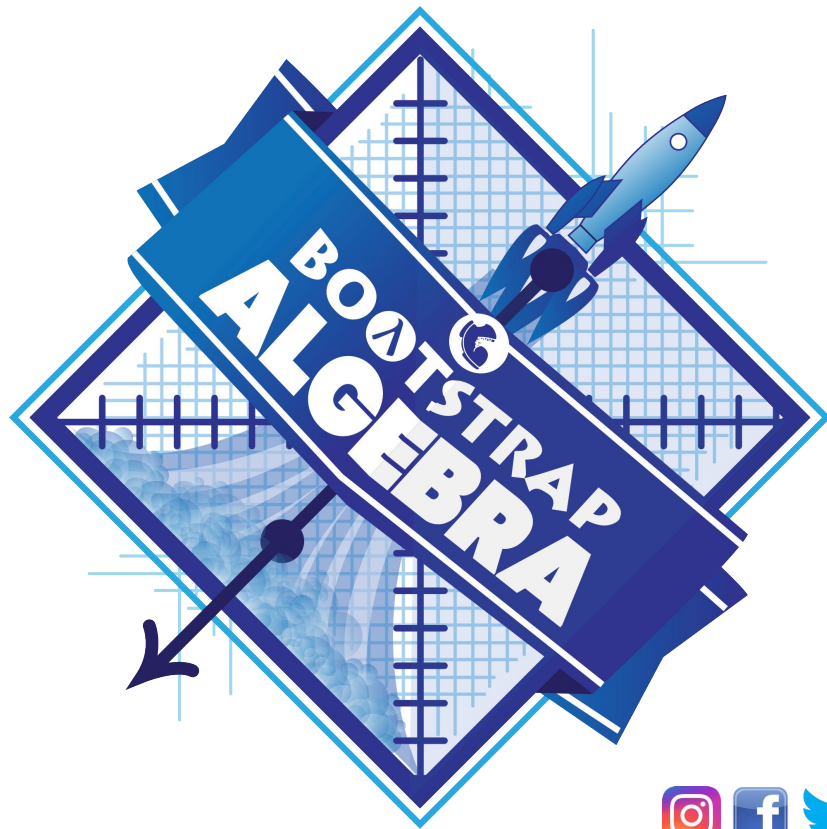


Function Composition



@BootstrapWorld



Composing Functions

Each **function card** has a Contract (Name, Domain, Range), and a description of what it does.

Starting with 4,

- you could play the `add1` card to turn it into 5.
- you could play `add6` to turn it into 10.

What other cards could you play to get from 4 to 10?



Students, write your response!



Composing Functions

For each of the starting numbers below, select the cards you would play to get to the ending number!

Starting from...	Ending with...
4	26
-22	13
64	0

Let's try some more numbers from [this random integer generator](#)! It's set for 1 to 10. Are we ready to try numbers from -50 to 50?



Students, write your response!



Diagramming Function Composition

$$f(x) = 3 * x$$

$$g(x) = x + 6$$

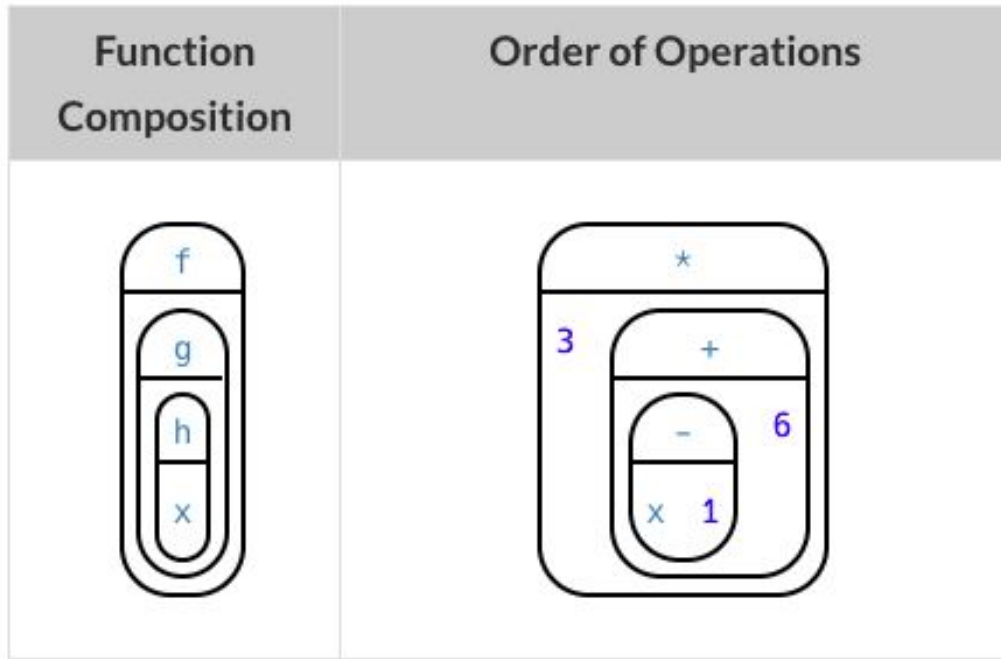
$$h(x) = x - 1$$

- `f` multiplies its input by 3
- `g` adds six to its input
- `h` subtracts one from its input



Diagramming Function Composition

The circles of evaluation for **$f(g(h(x)))$** would look like this:





Diagramming Function Composition

Complete Diagramming Function Composition with your partner(s).



Diagramming Function Composition

Do $f(g(h(x)))$ and $g(h(f(x)))$
evaluate to the same thing?



Students, write your response!



Composing Functions in Code

Your job as a programmer is to figure out how to compose functions to get where you want to go, in the most clever or elegant way possible.



Composing Functions in Code

- Log into code.pyret.org (CPO) & open a new program
- Type `include image` in the definitions area
- Save the file as “Function Composition”.
- Then complete the following:
 - [Function Composition — Green Star](#)
 - When you're done, change the color of all of the stars in the file to gold.
 - [Function Composition — Your Name](#)
- If you have time, work on
 - [Function Composition — scale-xy](#)
 - [Function Composition Matching Activity \(Desmos\)](#)



Composing Functions in Code

- What do all of these functions have in common?
- Does using one of these functions change the original image?
- What does the number in `scale` represent?
- What does the number in `rotate` represent?
- The Domain and Range for `flip-horizontal` is `Image -> Image`.

Why can I use the *output* of the `text` function as an *input* for `flip-horizontal`?



Students, write your response!



Composing Multiple Ways

As is often true with solving math problems, there is more than one way to get the same composed image!

Suppose I wrote the code:

```
scale(3, star(50, "solid", "red")).
```

What's another line of code I could write that would produce the exact same image?



Students, write your response!



Composing Multiple Ways

Complete [More than one way to Compose an Image!](#)

There is a special function in `code.pyret.org` (CPO) that let's us test whether or not two images are equal.

```
images-equal :: Image, Image -> Boolean
```

Use it to test whether all of the expressions you wrote successfully build the same images.



Students browse: code.pyret.org/editor#share=12HvvQ1ik36_6bvG9jj0OoyNH-VVDHLKL&v=04...

Pear Deck Interactive Slide
Do not remove this bar



Composing Multiple Ways

- Could we have written more expressions to create the same images?
- Are all of the ways to write the code equally efficient?



Students, write your response!

Additional Exercises:



If you didn't get to these already, you may want to try:

- [Function Composition — scale-xy](#)
- [Function Composition Matching Activity \(Desmos\)](#)