Basic R

Common new users frustrations

1. **Different versions of software**
2. **Data type problems (is that a character or a number?)**
3. Working directory problems: trying to read files that R "can't find"
   - RStudio can help, and so do RStudio Projects
   - discuss in Data Input/Output lecture
4. Typos (R is **case sensitive**, `x` and `X` are different)
   - RStudio helps with "tab completion"
   - discussed throughout

Explaining output on slides

In slides, a command (we'll also call them code or a code chunk) will look like this

```
print("I'm code")
```

```
[1] "I'm code"
```

And then directly after it, will be the output of the code.
So `print("I'm code")` is the code chunk and [1] "I'm code" is the output.

R as a calculator

```
2 + 2
```

```
[1] 4
```

```
2 * 4
```

```
[1] 8
```

```
2^3
```

```
[1] 8
```

Note: when you type your command, R inherently thinks you want to print the result.

R as a calculator

- The R console is a full calculator
- Try to play around with it:
  - +, -, /, * are add, subtract, divide and multiply
  - ^ or ** is power
  - parentheses – (and) – work with order of operations
  - %% finds the remainder

R as a calculator

```
2 + (2 * 3)^2
```

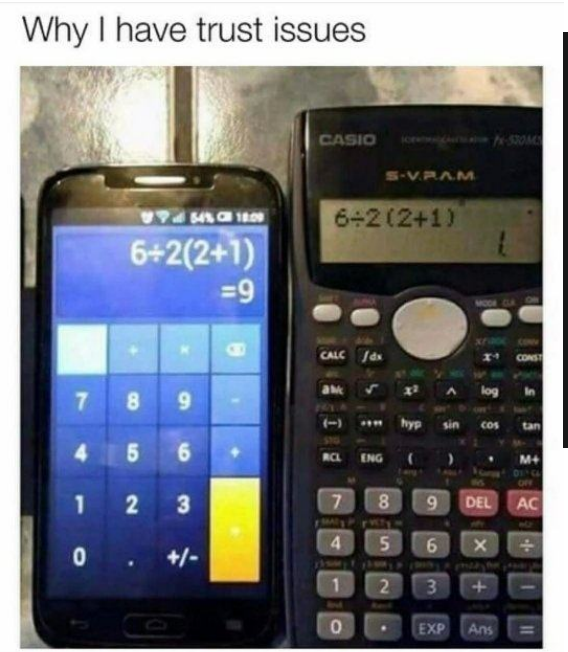
```
[1] 38
```

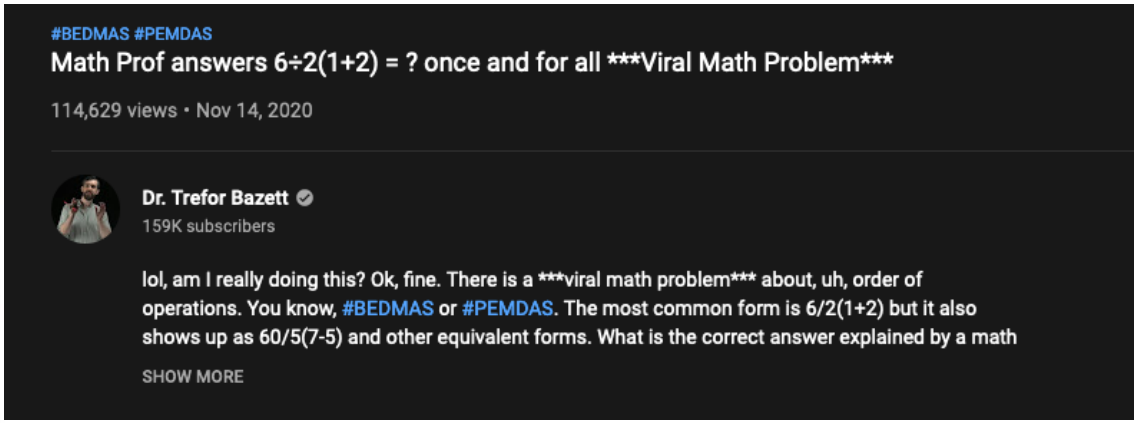
```
(1 + 3) / 2 + 45
```

```
[1] 47
```

```
6 / 2 * (1 + 2)
```

```
[1] 9
```





R as a calculator

Try evaluating the following:

- `2 + 2 * 3 / 4 -3`
- `2 * 3 / 4 * 2`
- `2^4 - 1`

Commenting in Scripts

`#` creates a comment in R code

```
# this is a comment

# nothing to its right is evaluated

# this # is still a comment
### you can use many #'s as you want

1 + 2 # Can be the right of code
```

```
[1] 3
```

In an `.Rmd` file, you can write notes outside the R chunks.

Assigning values to objects

- You can create objects from within the R environment and from files on your computer
- R uses `<-` to assign values to an object name (you might also see `=` used, but this is not best practice)
- Object names are case-sensitive, i.e. X and x are different

```
x <- 2
x
```

```
[1] 2
```

```
x * 4
```

```
[1] 8
```

```
x + 2
```

```
[1] 4
```

Assigning values to objects

- The most comfortable and familiar class/data type for many of you will be `data.frame`
- You can think of these as essentially spreadsheets with rows (usually subjects or observations) and columns (usually variables)
- `data.frame`s are somewhat advanced objects in R; we will start with simpler objects

Assigning values to objects

- Here we introduce “1 dimensional” classes; often referred to as ‘vectors’
- Vectors can have multiple sets of observations, but each observation has to be the same class.

```
class(x)
```

```
[1] "numeric"
```

```
y <- "hello world!"
print(y)
```

```
[1] "hello world!"
```

```
class(y)
```

```
[1] "character"
```

Simple object practice

Try assigning your full name to an R object called `name`

Simple object practice

Try assigning your full name to an R object called `name`

```
name <- "Ava Hoffman"
name
```

```
[1] "Ava Hoffman"
```

The 'combine' function

The function `c()` collects/combines/joins single R objects into a vector of R objects. It is mostly used for creating vectors of numbers, character strings, and other data types.

```
x <- c(1, 4, 6, 8)
x
```

```
[1] 1 4 6 8
```

```
class(x)
```

```
[1] "numeric"
```

The 'combine' function

Try assigning your first and last name as 2 separate character strings into a single vector called `name2`

The 'combine' function

Try assigning your first and last name as 2 separate character strings into a length-2 vector called `name2`

```
name2 <- c("Ava", "Hoffman")
name2
```

```
[1] "Ava"     "Hoffman"
```

Arguments inside R functions

- The contents you give to an R function are called “arguments”
- Here, R assumes all arguments should be objects contained in the vector
- We will talk more about arguments as we use more complicated functions!

```
name2 <- c("Ava", "Hoffman")
# Arg 1    ^^^^^
```

```
name2 <- c("Ava", "Hoffman")
# Arg 2            ^^^^^^^^^
```

`length` of R objects

`length()`: Get or set the length of vectors (including lists) and factors, and of any other R object for which a method has been defined.

```
length(x)
```

```
[1] 4
```

```
y
```

```
[1] "hello world!"
```

```
length(y)
```

```
[1] 1
```

`length` of R objects

What do you expect for the length of the `name` object? What about the `name2` object?

What are the lengths of each?

`length` of R objects

What do you expect for the length of the `name` object? What about the `name2` object?

What are the lengths of each?

```
length(name)
```

```
[1] 1
```

```
length(name2)
```

```
[1] 2
```

Math + vector objects

You can perform functions to entire vectors of numbers very easily.

```
x + 2
```

```
[1]  3  6  8 10
```

```
x * 3
```

```
[1]  3 12 18 24
```

```
x + c(1, 2, 3, 4)
```

```
[1]  2  6  9 12
```

Lab Part 1

- Lab

Math + vector objects

But things like algebra can only be performed on numbers.

```
name2 + 4
```

```
Error in name2 + 4: non-numeric argument to binary operator
```

Reassigning to a new object

Save these modified vectors as a new vector called `y`.

```
y <- x + c(1, 2, 3, 4)
y
```

```
[1]  2  6  9 12
```

Note that the R object `y` is no longer “hello world!” - It has been overwritten by assigning new data to the same name.

Reassigning to a new object

Reassigning allows you to make changes “in place”

```
# results not stored:
x + c(1, 2, 3, 4)

# x remains unchanged, results stored in `y`:
y <- x + c(1, 2, 3, 4)

# replace `x` in place
x <- x + c(1, 2, 3, 4)
```

R objects

You can get more attributes than just class. The function `str()` gives you the structure of the object.

```
str(x)
```

```
 num [1:4] 1 4 6 8
```

```
str(y)
```

```
 num [1:4] 2 6 9 12
```

This tells you that `x` is a numeric vector and tells you the length.

R objects

This is handy when we start dealing with bigger / more complex objects.

```
str(z)
```

```
 num [1:100] 12 12 6 6 2 12 9 2 2 6 ...
```

Summary

- R functions as a calculator
- Use `<-` to save (assign) values to objects
- Use `c()` to **combine** vectors
- `length()`, `class()`, and `str()` tell you information about an object

- Class Website
- Basic R Lab