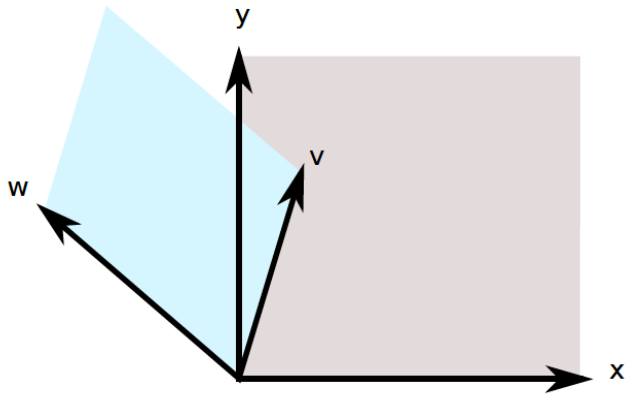
18.06 2020 HW#0 (no credit)

Submit your homework through gradescope by Wednesday 11:59pm to get into good habits, though you can submit this hw (only!) later.

1. Written assignment -- worth thinking about

(Inspired by Strang 1.1 problem 18 page 9) Draw two non-colinear vectors v and w, and the region that consists of all combinations cv+dw where $0 \le c \le 1$ and $0 \le d \le 1$. Now consider the linear transformation of the unit square (all points (c,d) with $0 \le c \le 1$ and $0 \le d \le 1$) by the 2x2 matrix with first column v and second column w. Are these two regions the same?

ANSWER:
They are the same.



The region consisting of all cv+dw with $0 \le c \le 1$ and $0 \le d \le 1$ is drawn in blue which is the same as the image of the unit square (gray) under the linear transformation [v w]. One way to see this is to consider the "column view" of matrix multiply described in GS section 1.3.

2. Download Julia (1.3.1). (choose from windows, mac, linux). Please let us know if it takes more than 2 or 3 minutes. Start up the Julia application, type 1 + 1 and see if you can get 2. (This is called a "hello world"). Please let us know if we should make julia available on athena workstations for any reason. (e.g., you don't have a laptop of your own, or a friend's you can borrow. You prefer athena. Any reason at all.)

   (Nothing to hand in, if there are no issues)

REMARK:
Not a single student reported an issue!

3. Let's learn some linear algebra words by executing Julia commands (without knowing what they are! It is not a good idea to look these ideas up at this time.) The purpose of this is to simply "hear" the words in your inner mind. First load the LinearAlgebra package.

julia> using Pkg
julia> Pkg.add("LinearAlgebra")
julia> using LinearAlgebra

Next define a matrix

julia> A = [1 2 ; 3 4]

and tell us which commands below return a 2x2 matrix and which a vector of length 2.

julia> inv(A)

julia> eigvals(A)

julia> svdvals(A)

julia> A*A
Please include a screen copy of your execution of the above four commands.

ANSWER:
We include a screen copy on the next page. We see that the commands inv(A) and A*A return a 2x2 matrix while eigvals and svdvals each return a vector of length 2.

```
julia> A=[1 2;3 4]
2×2 Array{Int64,2}:
 1  2
 3  4

julia> inv(A)
2×2 Array{Float64,2}:
 -2.0   1.0
  1.5  -0.5

julia> eigvals(A)
2-element Array{Float64,1}:
 -0.3722813232690143
  5.372281323269014

julia> svdvals(A)
2-element Array{Float64,1}:
 5.464985704219043
 0.36596619062625746

julia> A*A
2×2 Array{Int64,2}:
  7  10
 15  22
```

4. If you would like to try Jupyter notebooks do

julia> Pkg.add("IJulia")
julia> using("IJulia")
julia> notebook()

More on this at another time.

REMARK:
Many students tried and were able to run Jupyter notebooks. Fun fact: the name "Jupyter" refers to Julia, Python, and R.

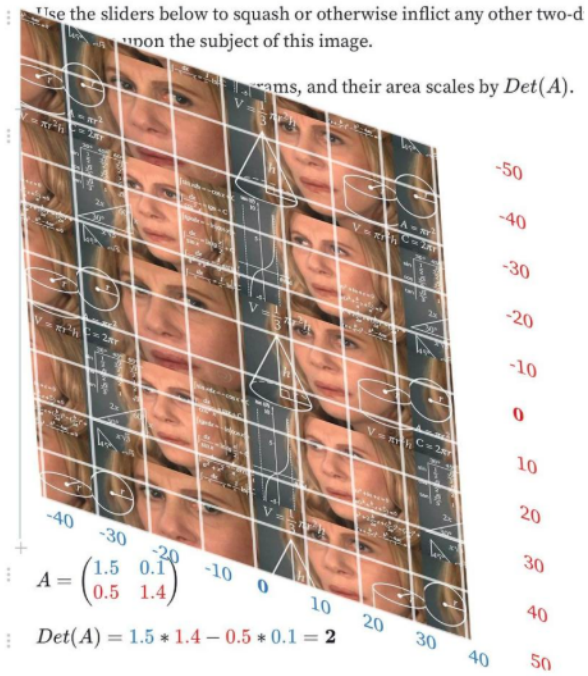
5. (late addition) Completely optional but fun:

Place your favorite photo, and pick a linear transformation on the class demo of 2d linear transformations and include in your submission. Best photo+transformation will be praised and honored in class.

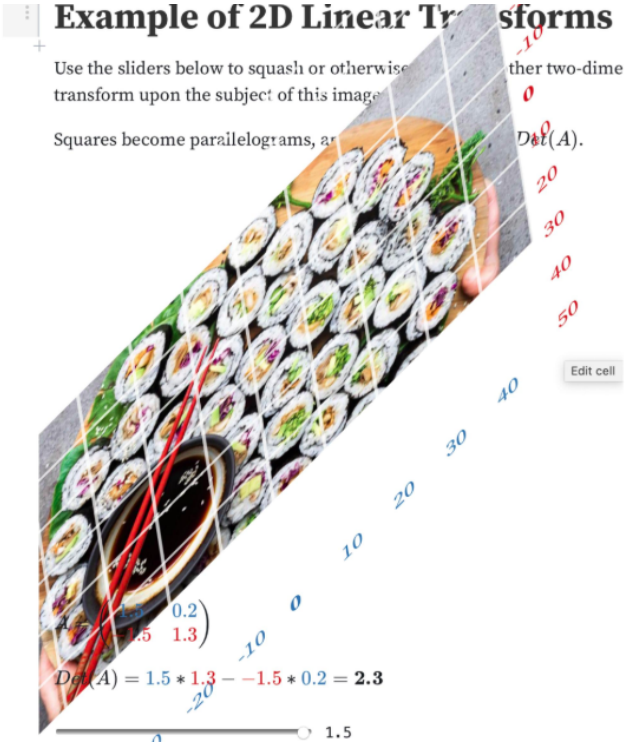
Some fun linear transformations are included in the next pages.

FUN TRANSFORMATIONS

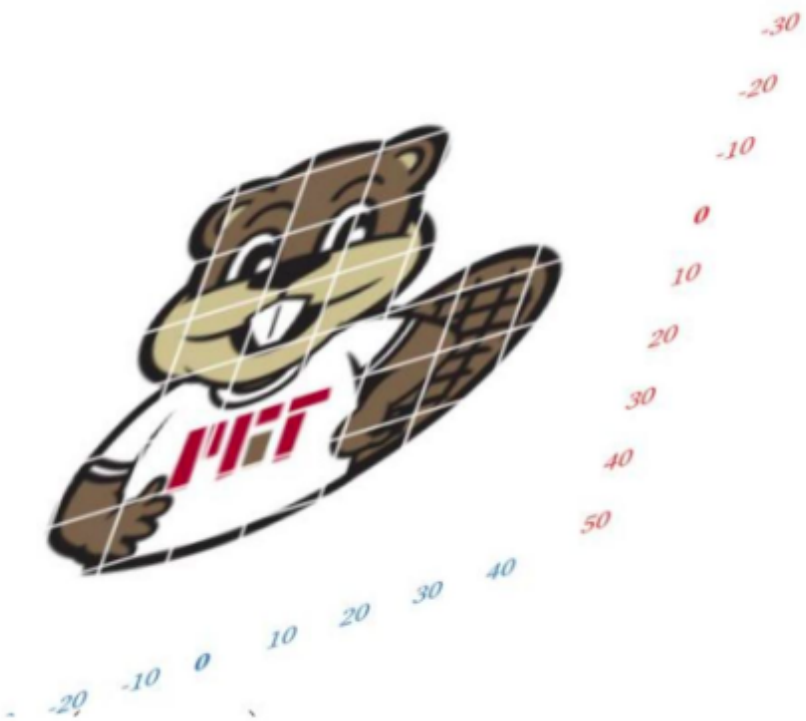
1. Confused Math Person



2. Sushi

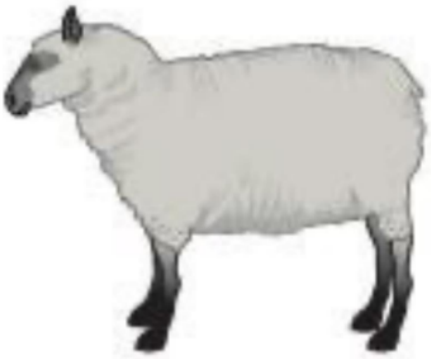

Example of 2D Linear Tr sforms
Use the sliders below to squash or otherwise ther two-dime
transform upon the subject of this image
Squares become parallelograms, a Det(A).
Edit cell
0.2
1.5 1.3
Det(A) = 1.5 * 1.3 − −1.5 * 0.2 = 2.3
1.5

3. Beaver


MIT

4. Emoji

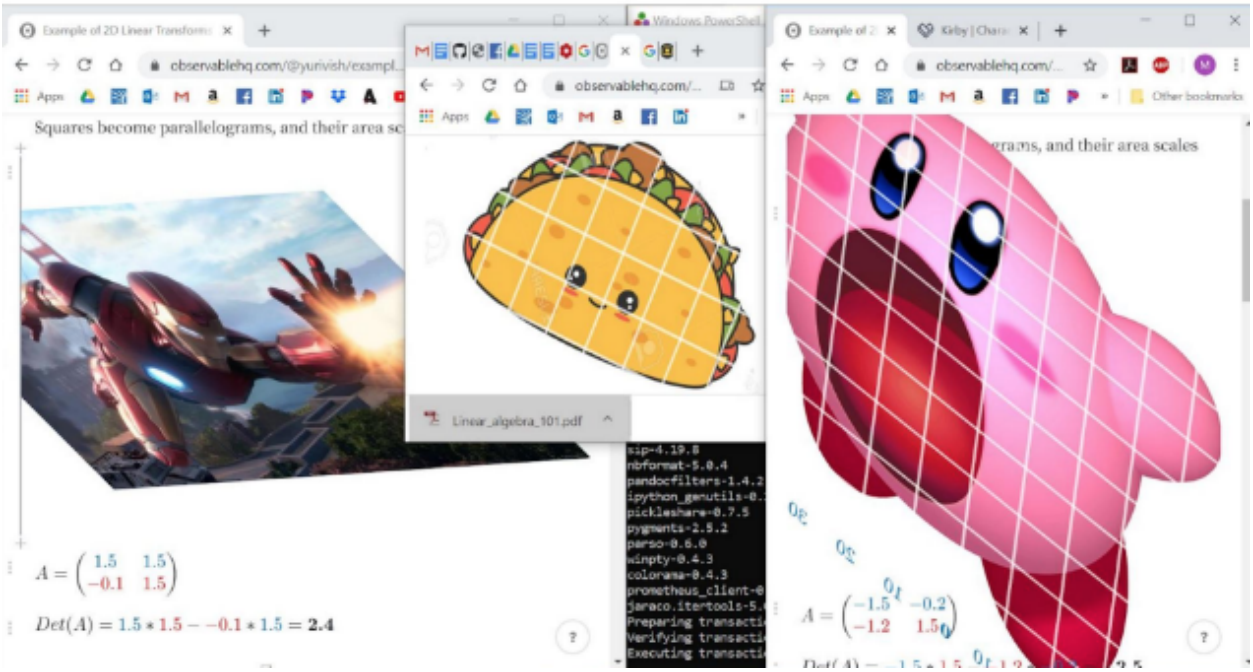
5. Sheared Sheep (get it?)



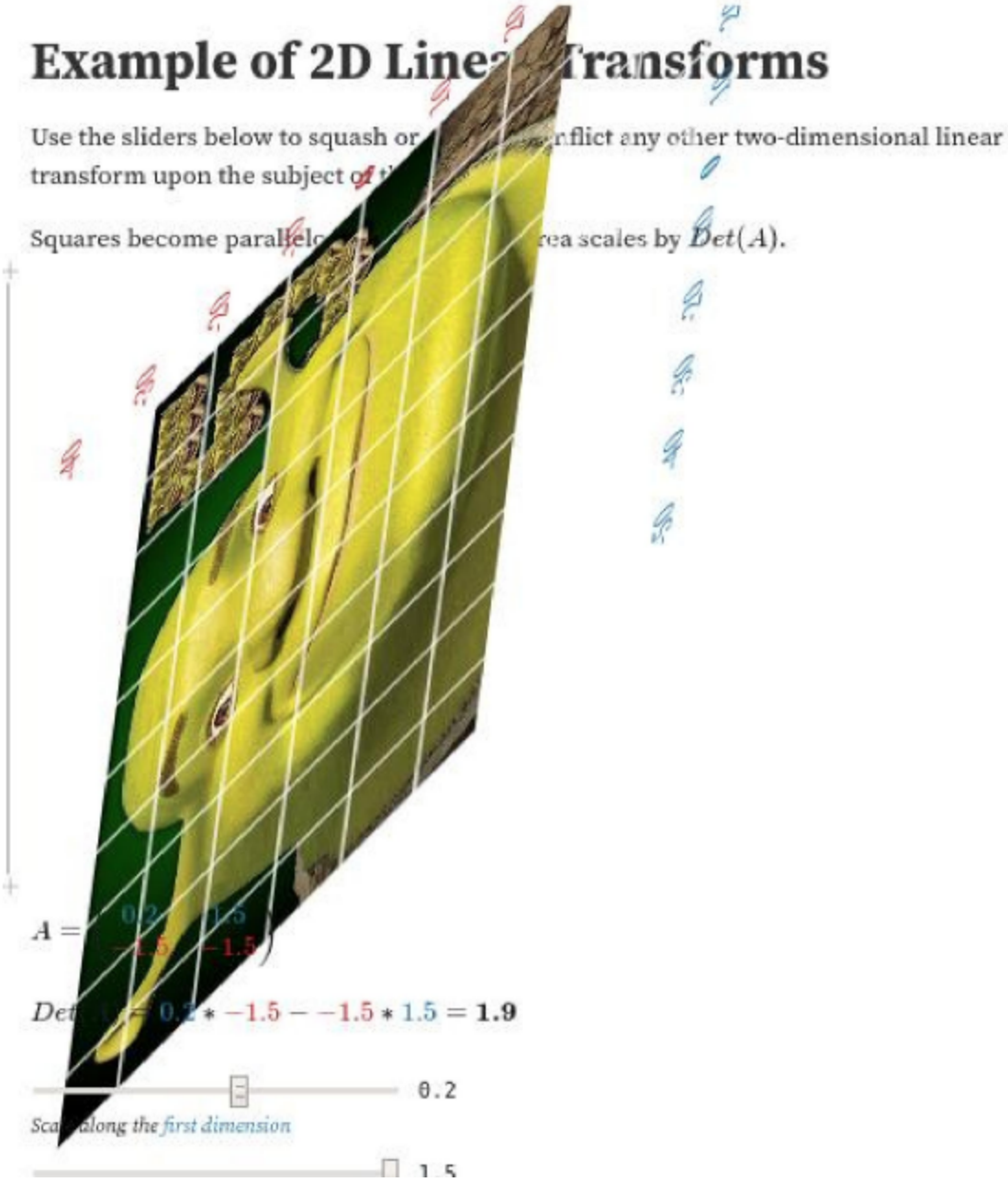
sheep

sheared sheep

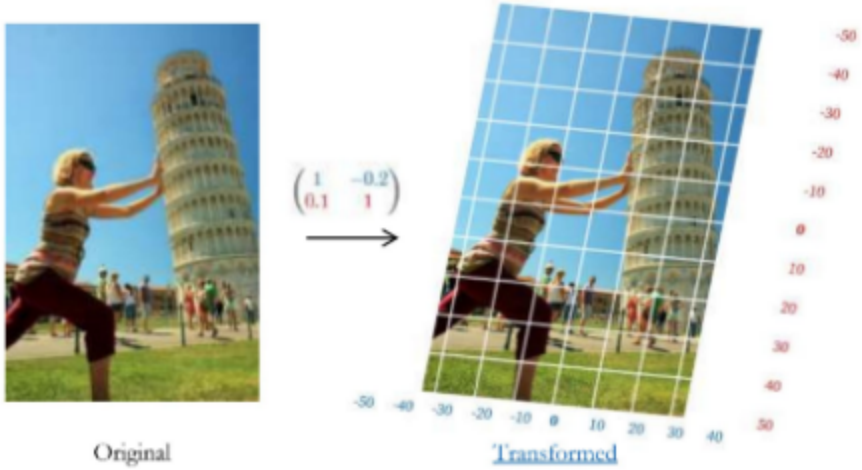
6. Ironman blasting a taco to Kirby



7. Shrek

8. 

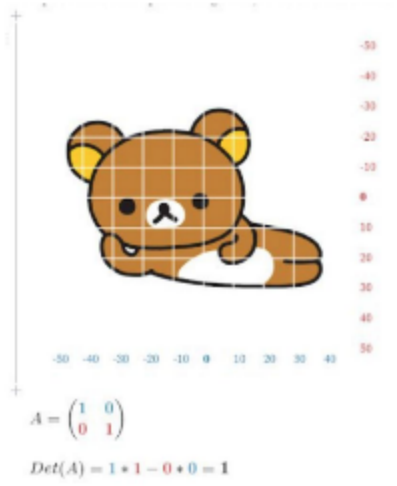
9. Righting Pisa



Original Transformed

10. Anime Bear

5.



^reclining bear ^superhero bear (imagine a cape!!)