

HW1

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```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.2      v readr      2.1.4
## v forcats    1.0.0      v stringr   1.5.0
## v ggplot2    3.4.2      v tibble    3.2.1
## v lubridate  1.9.2      v tidyr     1.3.0
## v purrr      1.0.1
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
# Define points for the letter S
```

```
S_x = c(seq(-1,1,length.out=1000), seq(1,-1,length.out=1000), seq(-1,1,length.out=1000))
S_y = c(seq(1,-1,length.out=1000), rep(-1,1000), seq(-1,1,length.out=1000))
S_points = cbind(S_x, S_y)
```

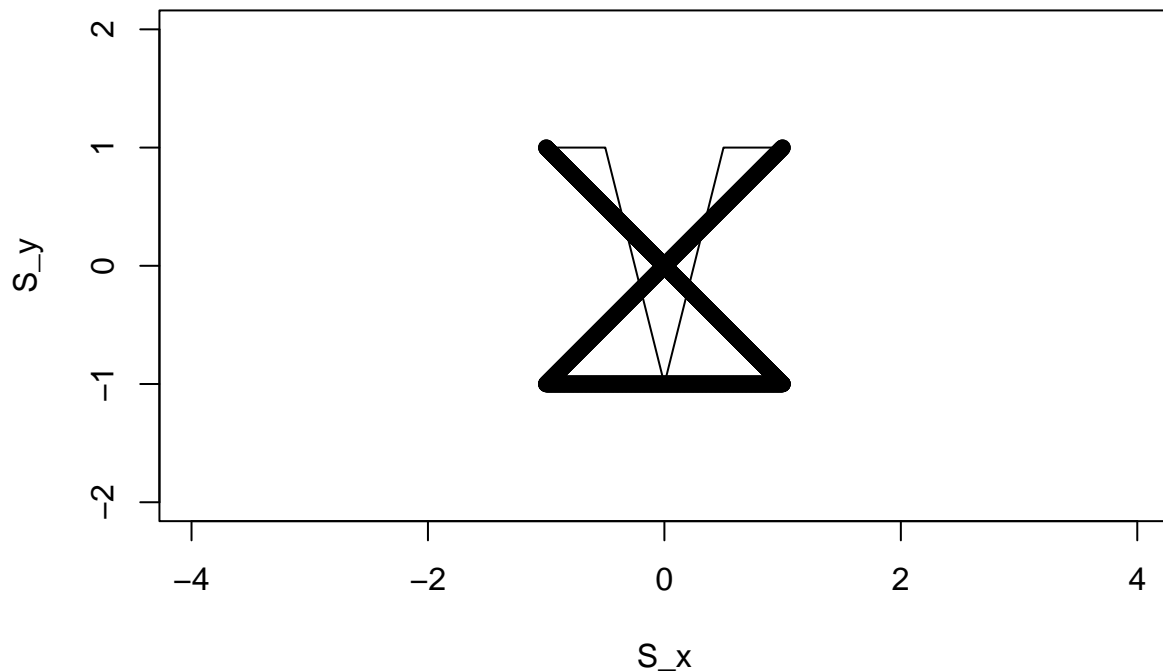
```
# Define points for the letter M
```

```
M_x1 = seq(-1, -0.5, length.out=500)
M_y1 = rep(1, 500)
M_x2 = seq(-0.5, 0, length.out=500)
M_y2 = seq(1, -1, length.out=500)
M_x3 = seq(0, 0.5, length.out=500)
M_y3 = seq(-1, 1, length.out=500)
M_x4 = seq(0.5, 1, length.out=500)
M_y4 = rep(1, 500)
M_x = c(M_x1, M_x2, M_x3, M_x4)
M_y = c(M_y1, M_y2, M_y3, M_y4)
M_points = cbind(M_x, M_y)
```

```
# Plot initial letters
```

```
plot(S_y~S_x, xlim=c(-2,2), ylim=c(-2,2), asp=1, main="Initial Letters")
lines(M_y~M_x)
```

Initial Letters



```
# Define transformation matrices
shear_matrix = matrix(c(1,0.5,0,1), nrow=2)
scale_matrix = matrix(c(1.02,0,0,1.02), nrow=2)
rotation_matrix = matrix(c(cos(pi/18),-sin(pi/18),sin(pi/18),cos(pi/18)), nrow=2)
projection_matrix = matrix(c(1,0,0.5,0), nrow=2)

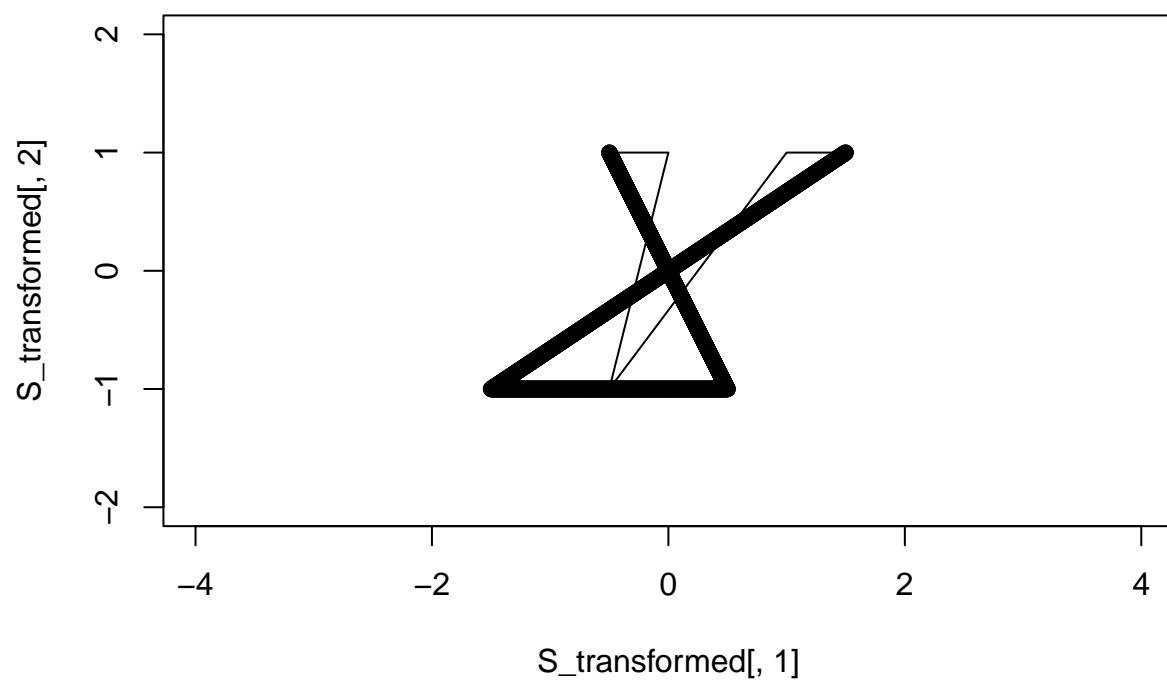
# Define list of transformation matrices
matrix_list = list(shear_matrix, scale_matrix, rotation_matrix, projection_matrix)

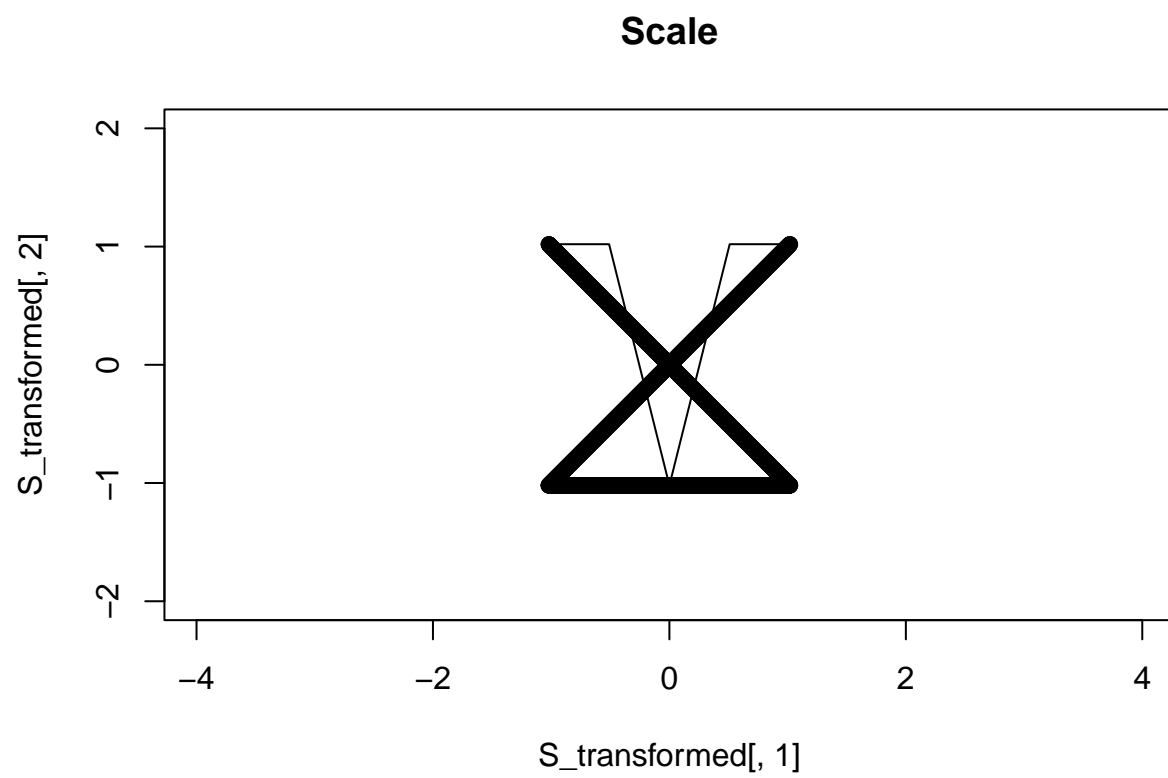
# Define list of names for transformations
name_list = c("Shear", "Scale", "Rotation", "Projection")

# Apply transformations to letters and plot
for (i in seq_along(matrix_list)) {
  S_transformed = S_points %*% matrix_list[[i]]
  M_transformed = M_points %*% matrix_list[[i]]

  plot(S_transformed[,2]~S_transformed[,1], xlim=c(-2,2), ylim=c(-2,2), asp=1,
       main=name_list[i])
  lines(M_transformed[,2]~M_transformed[,1])
}
```

Shear





Rotation

