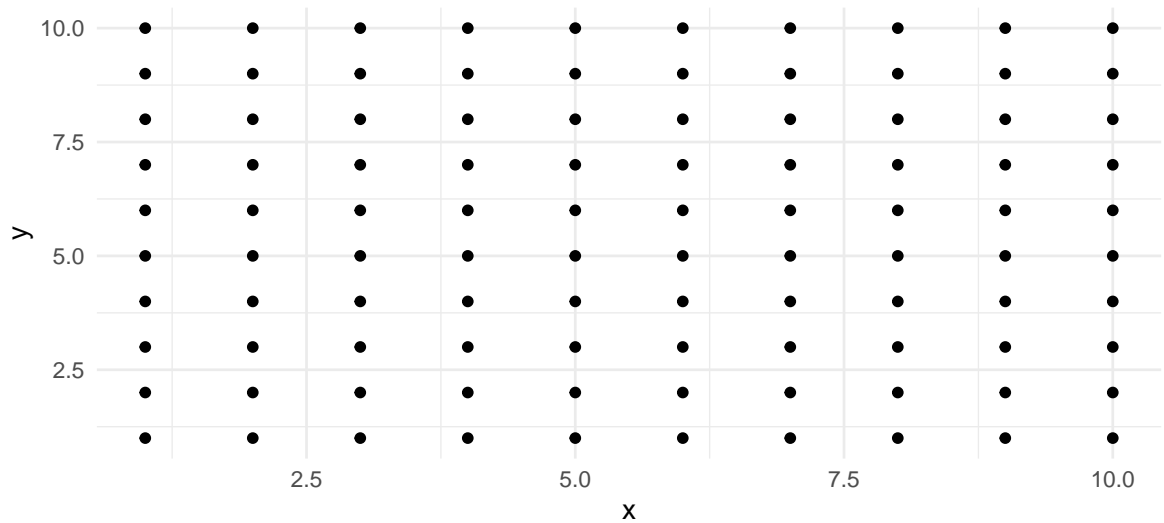


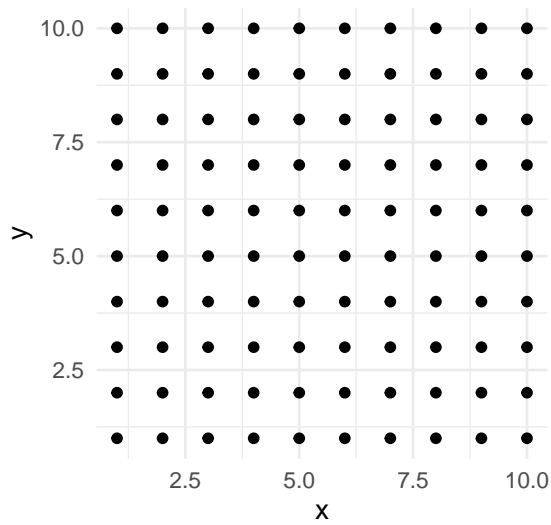
Question 1

a. `library("tidyverse")`

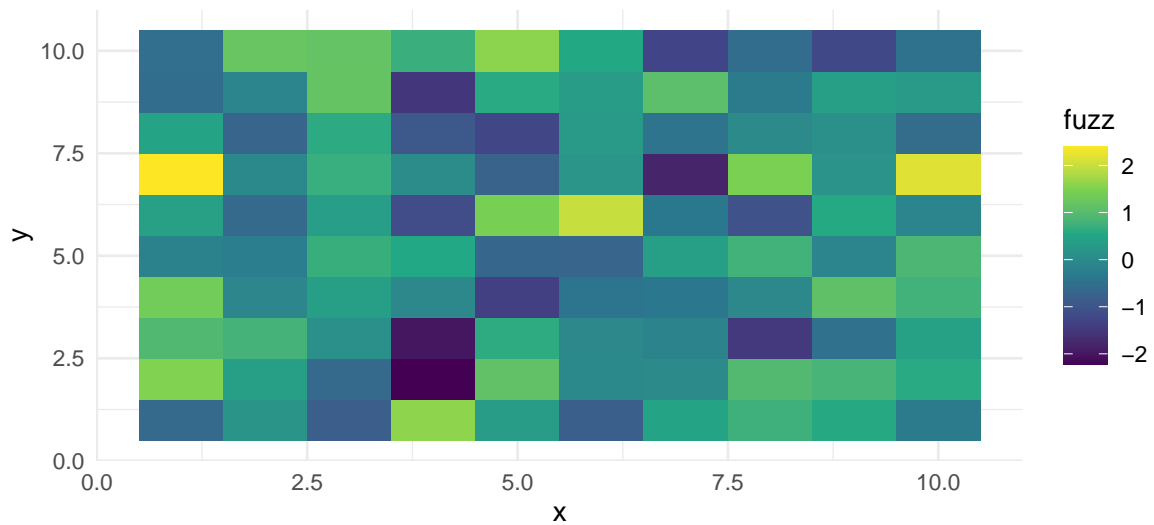
```
df <- expand_grid("x" = 1:10, "y" = 1:10)
ggplot(df, aes(x, y)) +
  geom_point() +
  theme_minimal()
```



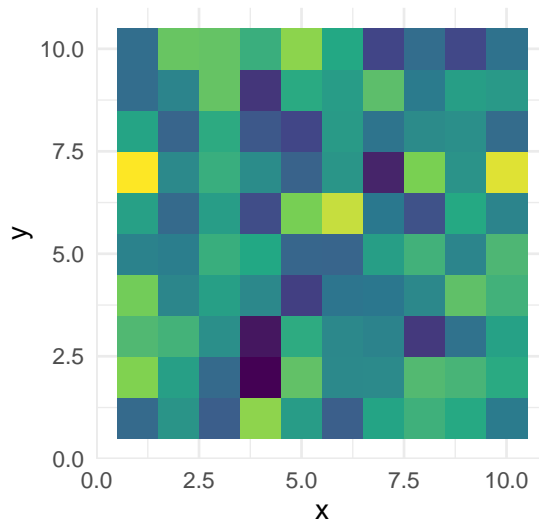
b. `ggplot(df, aes(x, y)) +`
`geom_point() +`
`theme_minimal() +`
`coord_equal()`



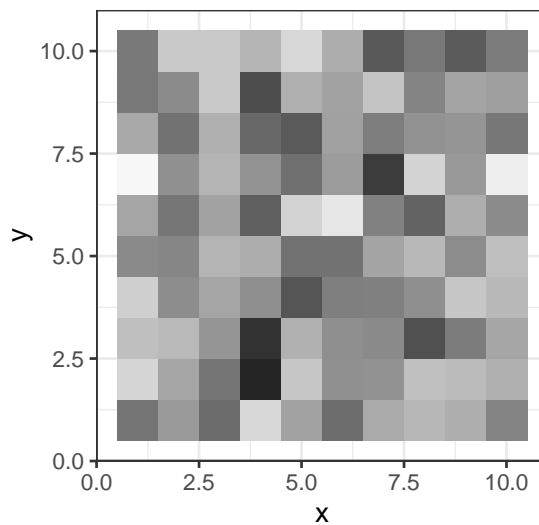
```
c. set.seed(1)
fuzz <- rnorm(nrow(df))
ggplot(df, aes(x, y, fill = fuzz)) +
  theme_minimal() +
  geom_tile()
```



```
d. set.seed(1)
fuzz <- rnorm(nrow(df))
ggplot(df, aes(x, y, fill = fuzz)) +
  theme_minimal() +
  geom_tile() +
  theme(legend.position = "none") +
  coord_equal()
```



```
e. set.seed(1)
fuzz <- rnorm(nrow(df))
ggplot(df, aes(x, y, fill = fuzz)) +
  theme_bw() +
  geom_tile() +
  coord_equal() +
  theme(legend.position = "none") +
  scale_fill_distiller(palette = "Greys")
```

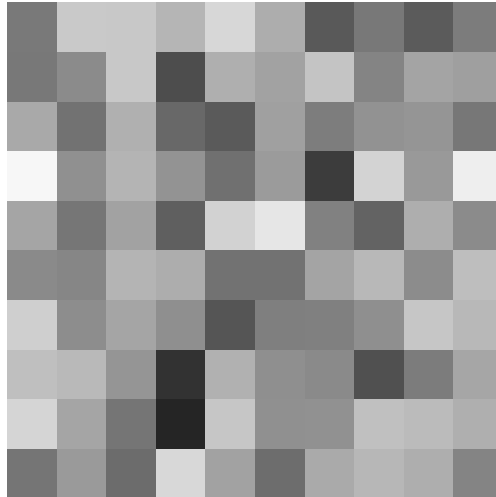


```
f. set.seed(1)
fuzz <- rnorm(nrow(df))
ggplot(df, aes(x, y, fill = fuzz)) +
  geom_tile() +
  coord_equal() +
  scale_fill_distiller(palette = "Greys") +
  ylab(NULL)
```

```

xlab(NULL) +
theme_void() +
theme(legend.position = "none")

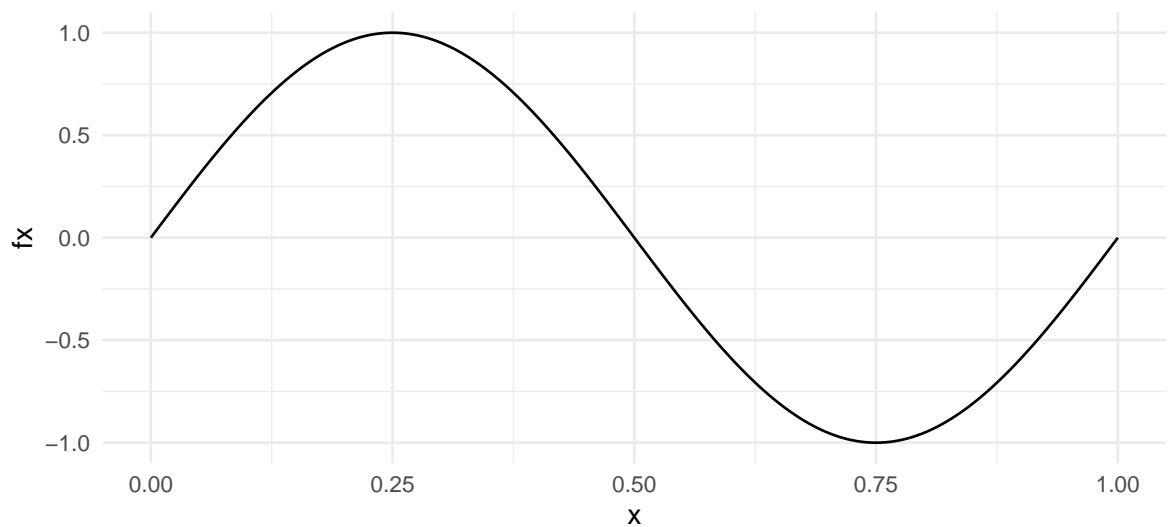
```



```

g. x <- seq(0, 1, 1e-4)
fx <- sin(2*pi*x)
sine <- data.frame("x" = x, "y" = fx)
ggplot(sine, aes(x, fx)) +
  theme_minimal() +
  geom_line()

```

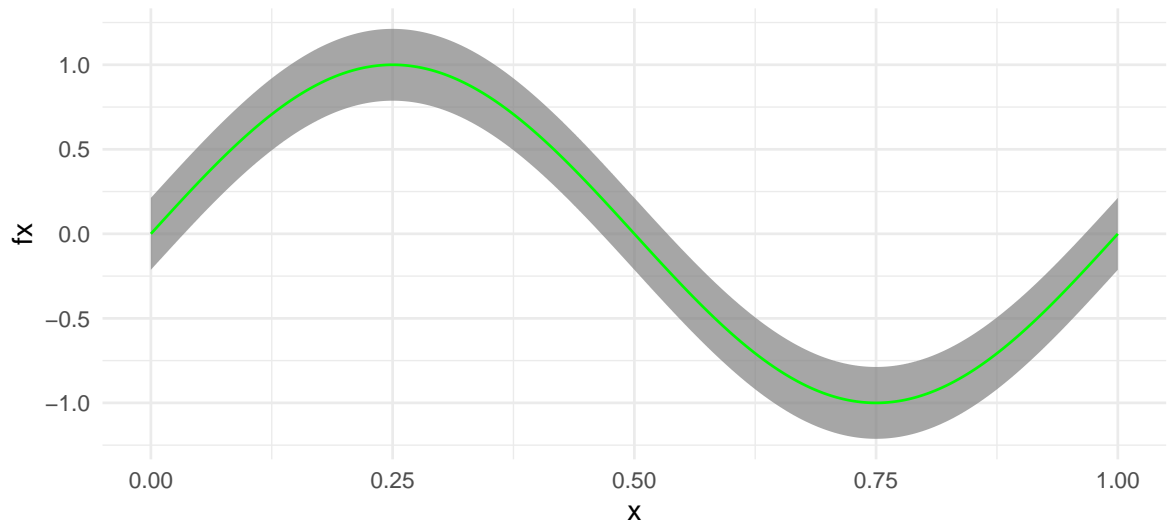


```

h. x <- seq(0, 1, 1e-4)
fx <- sin(2*pi*x)
sine <- data.frame("x" = x, "y" = fx)
ggplot(sine, aes(x, fx)) +

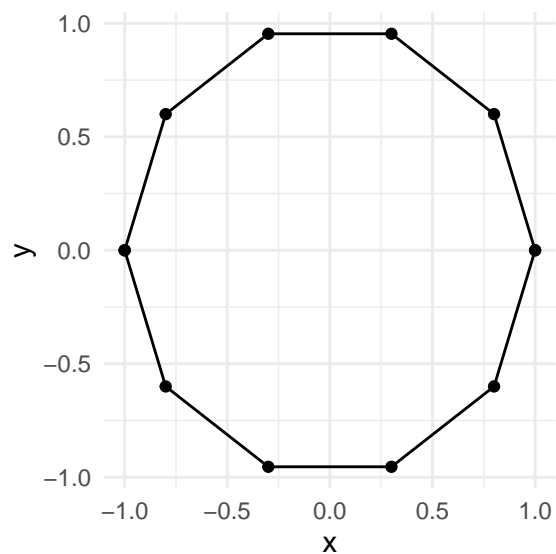
```

```
theme_minimal() +
geom_ribbon(aes(ymin = fx - 0.2125, ymax = fx + 0.2125), fill = "grey50", alpha = 0.7) +
geom_line(color = "green")
```



i.

```
x1 <- c(-1, -0.8, -0.3, 0.3, 0.8, 1)
decagon_top <- sqrt(1 - (x1)^2)
x2 <- c(1, 0.8, 0.3, -0.3, -0.8, -1)
decagon_bot <- -1*sqrt(1 - (x2)^2)
decagon <- data.frame(x = c(x1, x2), y = c(decagon_bot, decagon_top))
ggplot(decagon, aes(x, y)) +
  geom_point() +
  geom_path() +
  theme_minimal()
```



```
j. set.seed(1)
df <- data.frame(x = rnorm(1e3, mean = 3, sd = 2))
ggplot(df, aes(x)) +
  geom_density() +
  stat_function(fun = dnorm, args = list(mean = 3, sd = 2), color = "red") +
  geom_vline(xintercept = 8, color = "red", linetype = "twodash", size = 1) +
  theme_minimal()
```



Question 2

```
a. A <- matrix(c(
  -1, 3, 1,
  -7, 9, 1,
  -2, 3, 4),
  nrow = 3, byrow = TRUE)
I <- matrix(c(
  1, 0, 0,
  0, 1, 0,
  0, 0, 1),
  nrow = 3, byrow = TRUE)

r <- eigen(A)
V <- r$vector
lam <- r$values
Lambda <- lam*I

V %*% Lambda %*% solve(V)
```

```
##      [,1] [,2] [,3]
## [1,]  -1   3   1
## [2,]  -7   9   1
## [3,]  -2   3   4
```

```
b. A <- matrix(c(
  10, 2, -6,
  2, 7, 0,
  -6, 0, 2),
  nrow = 3, byrow = TRUE)
I <- matrix(c(
  1, 0, 0,
  0, 1, 0,
  0, 0, 1),
  nrow = 3, byrow = TRUE)

r <- eigen(A)
V <- r$vector
lam <- r$values
Lambda <- lam*I

zapsmall(crossprod(V))
```

```
##      [,1] [,2] [,3]
## [1,]    1    0    0
## [2,]    0    1    0
## [3,]    0    0    1
```

```
zapsmall(V %*% Lambda %*% t(V))
```

```
##      [,1] [,2] [,3]
## [1,]   10    2   -6
## [2,]    2    7    0
## [3,]   -6    0    2
```

c.

d.

e.

f.