HW 2

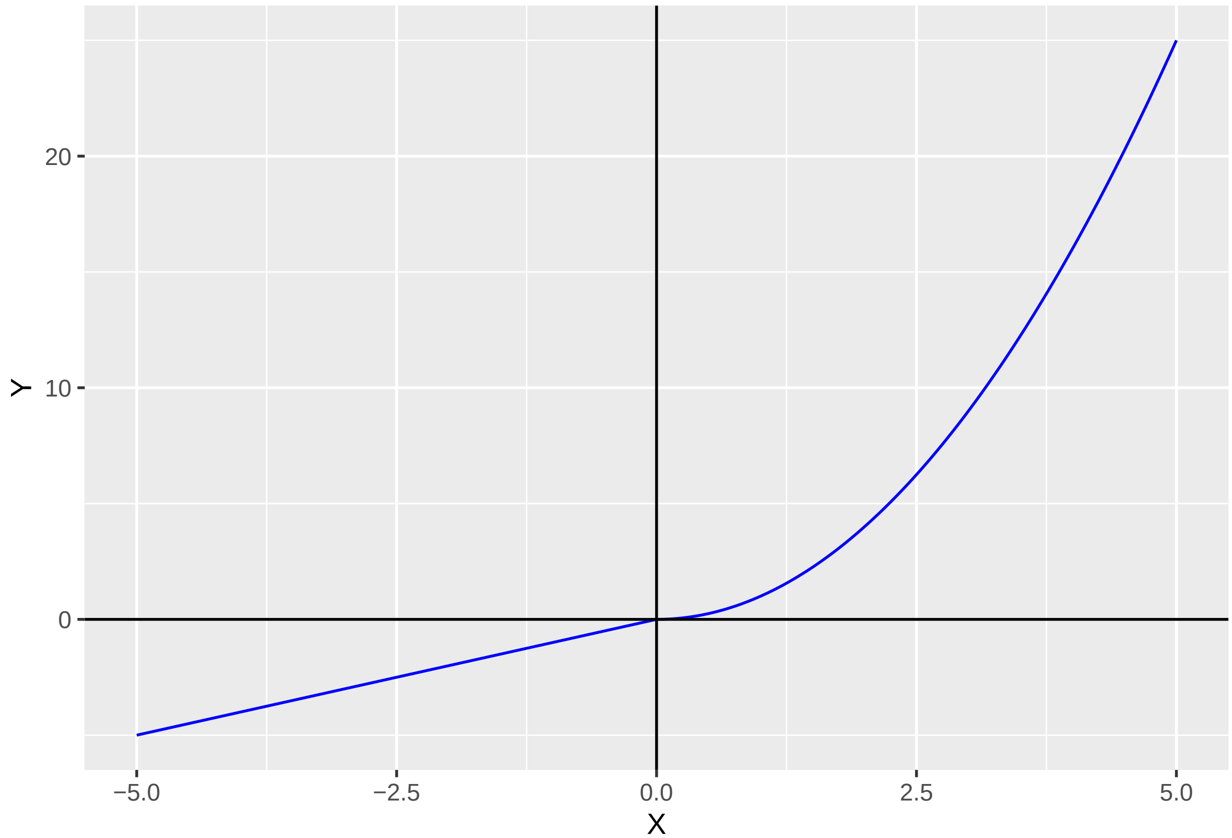
2023-02-05

WORKED WITH JOAN SHIM AND LUCAS YOSHIDA

P1

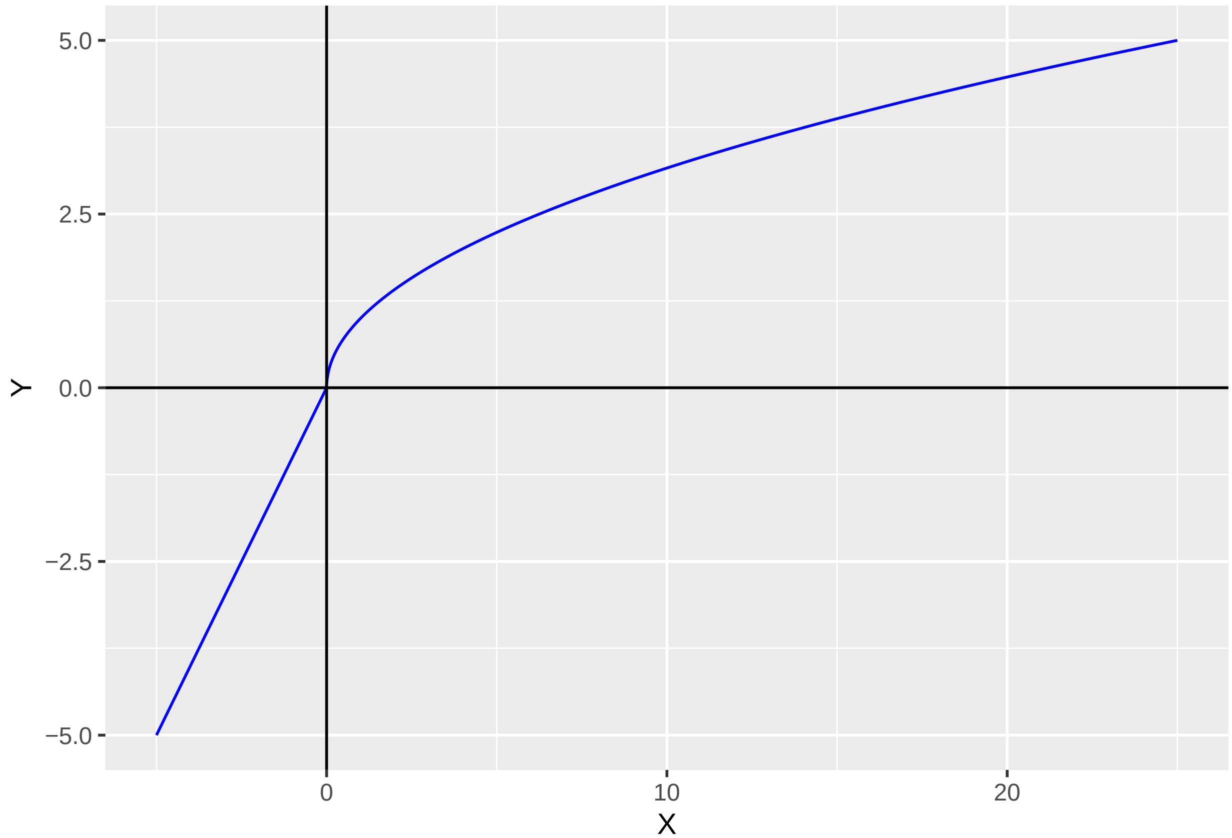
1

```
ya <- tibble(X = seq(-5,5, length = 1000)) %>% #prob 1.1
  mutate(Y = case_when(X < 0 ~ X,
                       X >= 0 ~ X^2)) %>%
  ggplot() +
  geom_line(aes(x=X,y=Y), color = "blue") +
  geom_hline(yintercept = 0) +
  geom_vline(xintercept = 0)


ya
```



2

```
ya_inv <- tibble(X = seq(-5,25, length = 1000)) %>% # prob 1.2
  mutate(Y = case_when(X < 0 ~ X,
                       X >= 0 ~ X^0.5)) %>%
  ggplot() +
  geom_line(aes(x=X,y=Y), color = "blue") +
  geom_hline(yintercept = 0) +
  geom_vline(xintercept = 0)


ya_inv
```



P2

1

- It can describe random events where we cannot (yet) possibly elucidate all possible deterministic factors that go into an event occurring or not. Because of this we can model the likelihood of some "random" event occurring or not using probability.

2

- Modeling Weather Outcomes.

3

- Modeling the change in position with respect to time of a ball tossed straight into the air.

P3

1

- $P(A \cap B) = P(A) + P(B) - P(A \cup B)$

2

- When A and B are disjoint events relative to each other. As such, both conditional probabilities would equal zero. Or when $P(A) = P(B)$ since $P(A|B) = \frac{P(A \cap B)}{P(B)}$ and $P(B|A) = \frac{P(A \cap B)}{P(A)}$ and with both denominators being equal we would have equivalent expressions for both.

3

- $P(A) \leq P(B)$

P4

1

1. The number of thunderstorm asthma events in the Minneapolis-St. Paul metro area from 2007-2018.
2. The number of asthma related emergency room visits in the Minneapolis-St. Paul metro area from 2007-2018.
3. The amount of pollen in the air in the Minneapolis-St. Paul metro area from 2007-2018.
4. The number of lightning counts in the Minneapolis-St. Paul metro area from 2007-2018.

P5

1

- $P(X > a) = P(Y > a)$

P6

1

```
# table
univ_probX <- tibble(w = seq(0,1, length = 1000), #6.1
                     x = w^2) %>%
  mutate(inside_1 = (x >= 0.2 & x <= 0.3),
         inside_2 = (x >= 0.9 & x <= 1))
# First X condition
answer_p6.X1 <- univ_probX %>%
  count(inside_1) %>%
  mutate(prob = n/sum(n))


answer_p6.X1 <- pull(answer_p6.X1[2,3])

answer_p6.X1
```

```
## [1] 0.101
```

```r
# Second X condition
answer_p6.X2 <- univ_probX %>%
  count(inside_2) %>%
  mutate(prob = n/sum(n))


answer_p6.X2 <- pull(answer_p6.X2[2,3])

answer_p6.X2
```

```
## [1] 0.052
```

2

```r
# table
univ_probY <- tibble(w = seq(0,1, length = 1000), #6.1
                     y = (1-w)^2) %>%
  mutate(inside_1 = (y >= 0.2 & y <= 0.3),
         inside_2 = (y >= 0.9 & y <= 1))
# First Y condition
answer_p6.Y1 <- univ_probY %>%
  count(inside_1) %>%
  mutate(prob = n/sum(n))


answer_p6.Y1 <- pull(answer_p6.Y1[2,3])

answer_p6.Y1
```

```
## [1] 0.101
```

```r
# Second Y condition
answer_p6.Y2 <- univ_probY %>%
  count(inside_2) %>%
  mutate(prob = n/sum(n))


answer_p6.Y2 <- pull(answer_p6.Y2[2,3])

answer_p6.Y2
```

```
## [1] 0.052
```

3

```r
#6.3
funk <- function(w) {
  w^2
```

```r
}

probability <- function(a,b,X) {
  prob <- tibble(w = seq(0,1, length =1000),
                 Fx = X(w)) %>%
    mutate(inside = Fx >= a & Fx <= b) %>%
    count(inside) %>%
    mutate(prob = n/sum(n))
    return(pull(prob[2,3]))
    #return(prob)
}

probability(.9,1,funk)
```

```
## [1] 0.052
```