ECON 7300: Problem Set 2

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```
library(dplyr)
library(ggplot2)
library(purrr)
```

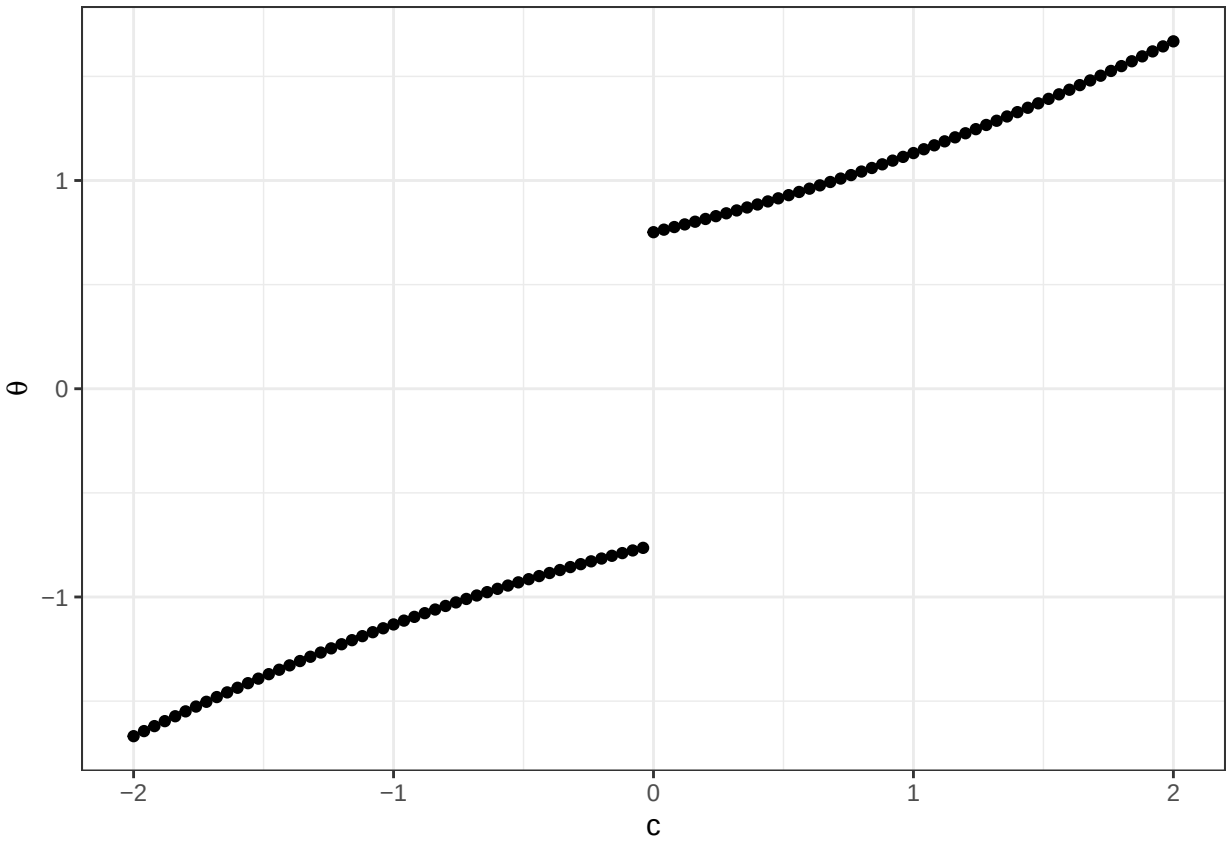
Question 1 (a)

Maximize θ as a function of c:

```
theta_max <- function(c) {
  optimize(
    \(theta) {
      case_when(
        theta > 0 ~ theta * pnorm(c - theta),
        theta == 0 ~ 0,
        theta < 0 ~ - theta * (1 - pnorm(c - theta))
      )
    },
    interval = c(-5, 5),
    maximum = TRUE
  )$maximum
}

c_theta <- tibble(c = seq(-2, 2, length.out = 101)) |>
  mutate(theta = map_dbl(c, theta_max))

ggplot(c_theta, aes(x = c, y = theta)) +
  geom_point() +
  labs(
    x = "c",
    y = expression(theta)
  ) +
  theme_bw()
```



For $c = 0$, θ^* can be any combination of $\theta^*(+0)$ and $\theta^*(-0)$.

```
theta_max(1e-12)
```

```
## [1] 0.7518043
```

```
theta_max(-1e-12)
```

```
## [1] -0.7518043
```