# This is the work for ENVE 660 Final Exam

*Tyler Bradley*

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```
library(tidyverse)
```

## Probelm #4

Find k and n from the equation q = k*C$^n$, given the follwoing data

```
data <- tribble(
  ~c, ~q,
  1.9, 6.2,
  21, 22.5,
  42.3, 33
) %>%
  mutate(
    ln_q = log(q),
    ln_c = log(c)
  )

model <- lm(ln_q ~ ln_c, data = data) %>%
  broom::tidy()
```

the intercept of the model gives log(k)

```
exp(model$estimate[[1]])
```

```
## [1] 4.385541
```

the slope gives n

```
model$estimate[[2]]
```

```
## [1] 0.5382244
```

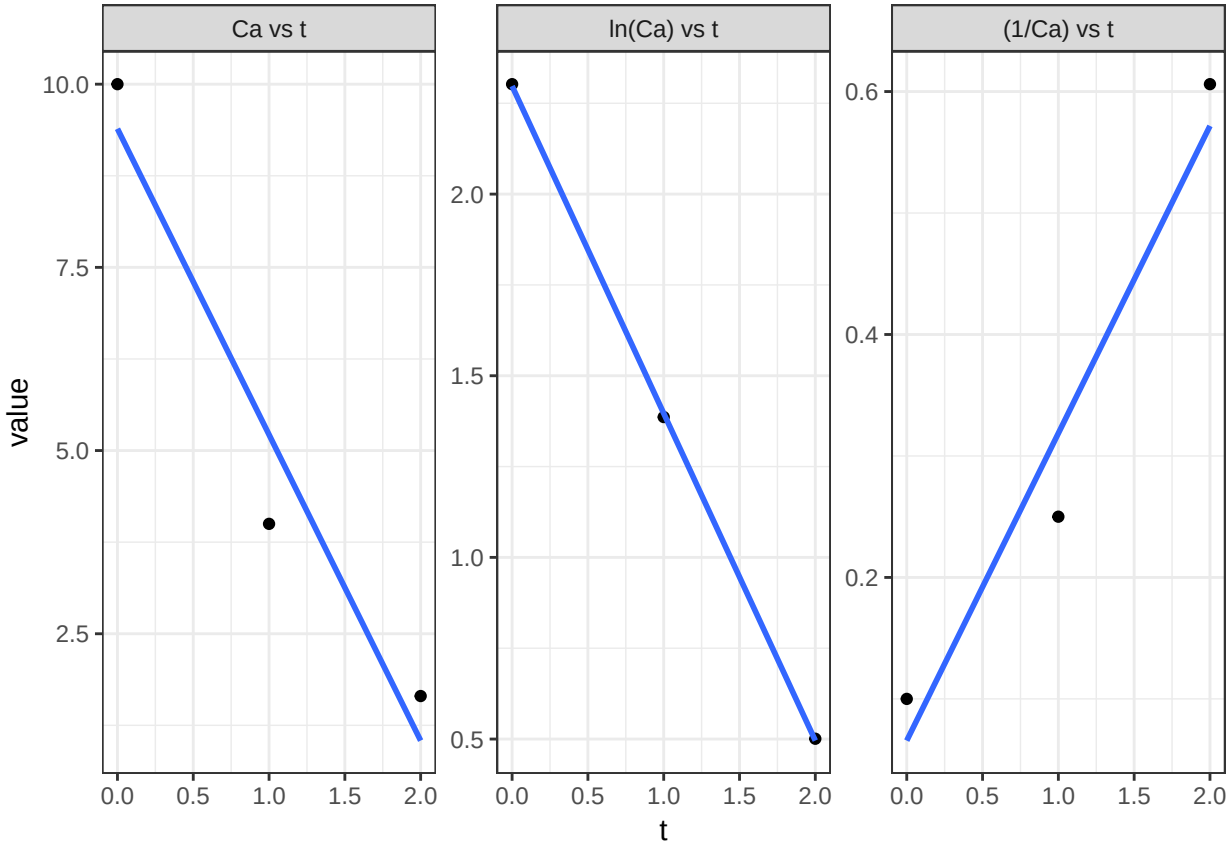
## Problem #6

find k (and units)

```
data_6 <- tribble(
  ~t, ~Ca,
  0, 10,
  1, 4.0,
  2, 1.65
) %>%
  mutate(
    ln_Ca = log(Ca), # log() function defaults to ln()
    Ca_inv = (1/Ca)
  )
```

Plotting zero, first, and second order relationships between Ca and t as Ca vs t, ln(Ca) vs t, and (1/Ca) vs t, respectively. Since the first order model is the closest to linear, I will you this for the reaction term.

```
data_6 %>%
  gather(key = order, value = value, Ca:Ca_inv) %>%
  mutate(order = factor(order, levels = c("Ca", "ln_Ca", "Ca_inv"),
                        labels = c("Ca vs t", "ln(Ca) vs t", "(1/Ca) vs t"))) %>%
  ggplot(aes(t, value)) +
  facet_wrap(~ order, scales = "free") +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  theme_bw()
```




k is given by the slope of the linear model

```
lm(ln_Ca ~ t, data = data_6)$coefficients[[2]]
```

```
## [1] -0.9009049
```