Regression

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```
## loading the necessary libraries
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.6     v purrr   0.3.4
## v tibble  3.1.8     v dplyr   1.0.9
## v tidyr   1.2.0     v stringr 1.4.1
## v readr   2.1.2     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

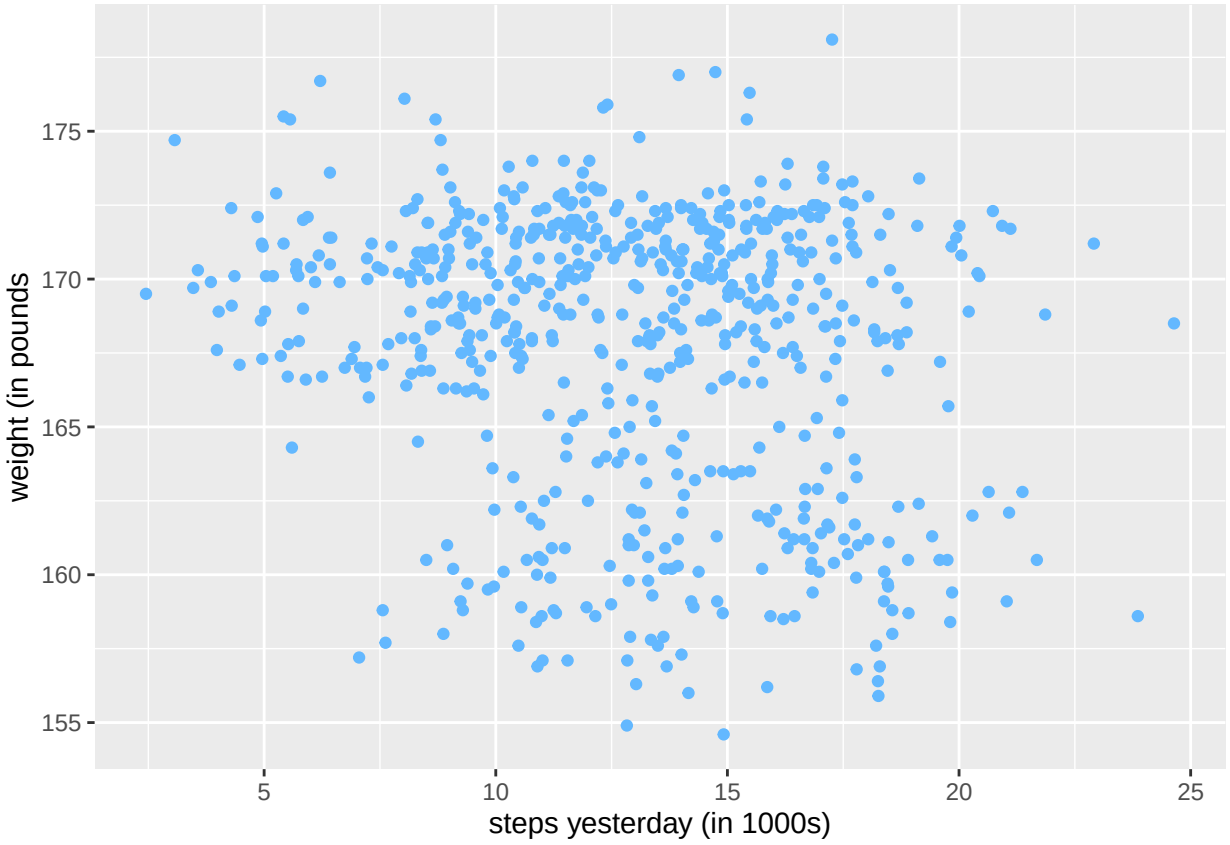
```
library(gov50data)
```

Looking at the data

```
health
```

```
## # A tibble: 644 x 6
##    date       active_calories steps weight steps_lag calorie_lag
##    <date>               <dbl> <dbl>  <dbl>     <dbl>       <dbl>
##  1 2015-08-09            480  17.5    168      NA           NA
##  2 2015-08-10            996. 18.4    169.     17.5         480
##  3 2015-08-11           1127. 19.6    168      18.4         996.
##  4 2015-08-12            522. 10.4    167.     19.6        1127.
##  5 2015-08-13            844. 18.7    168.     10.4         522.
##  6 2015-08-14            396.  9.14   168.     18.7         844.
##  7 2015-08-15            423.  8.69   166.      9.14        396.
##  8 2015-08-16            958. 13.8    168.      8.69        423.
##  9 2015-08-17            597. 11.9    169      13.8         958.
## 10 2015-08-18           1378. 24.6    169.     11.9         597.
## # ... with 634 more rows
```

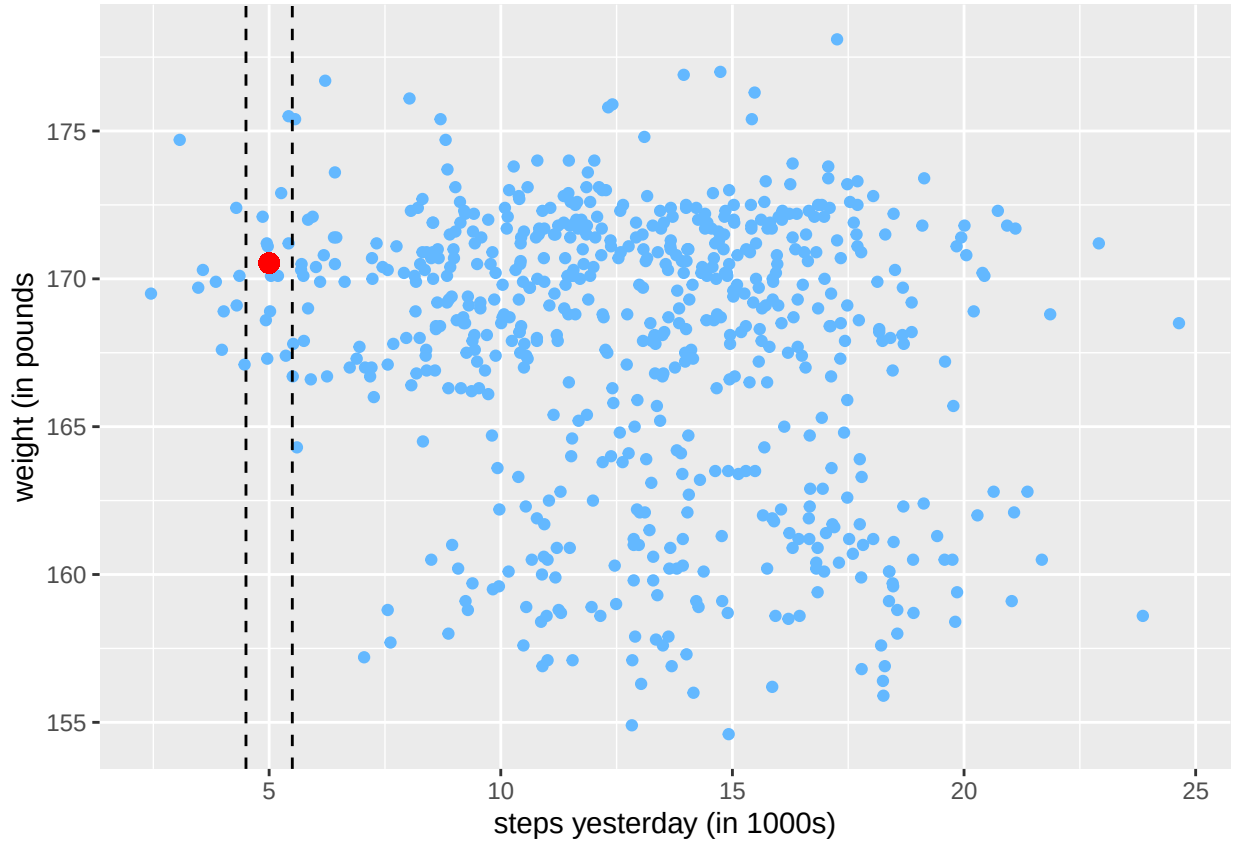
```
health <- health %>%
  drop_na()
health %>%
  ggplot(aes(x = steps_lag, y = weight)) +
  geom_point(color = "steelblue1") +
  labs(x = "steps yesterday (in 1000s)",
       y = "weight (in pounds")
```



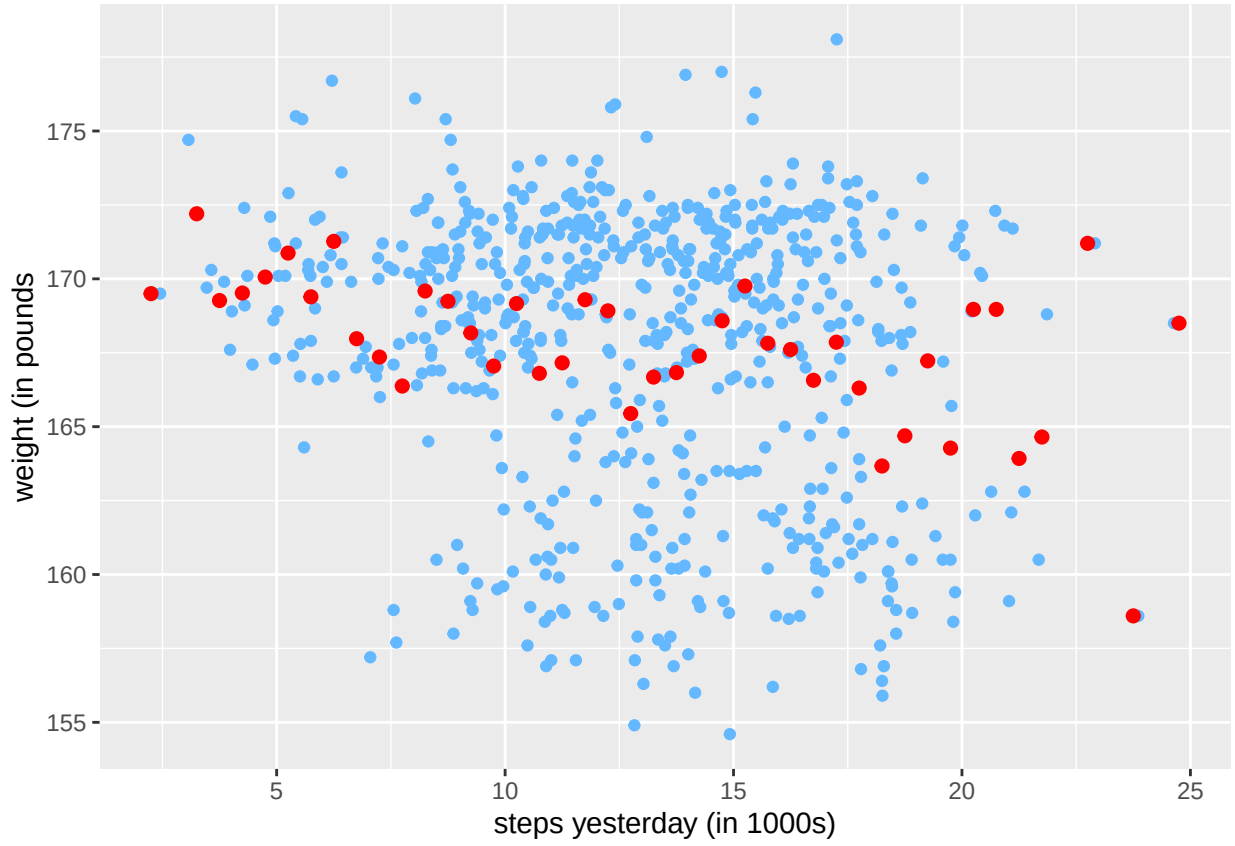

```
mean_wt_5ksteps <- health %>%
  filter(round(steps_lag) == 5) %>%
  summarize(mean(weight)) %>%
  pull()


mean_wt_5ksteps
```

```
## [1] 170.5333
```

```
health %>%
  ggplot(aes(x = steps_lag, y = weight)) +
  geom_point(color = "steelblue1") +
  labs(x = "steps yesterday (in 1000s)",
       y = "weight (in pounds") +
  geom_vline(xintercept = c(4.5, 5.5), linetype = "dashed") +
  geom_point(aes(x = 5, y = mean_wt_5ksteps), size = 3, color = "red")
```

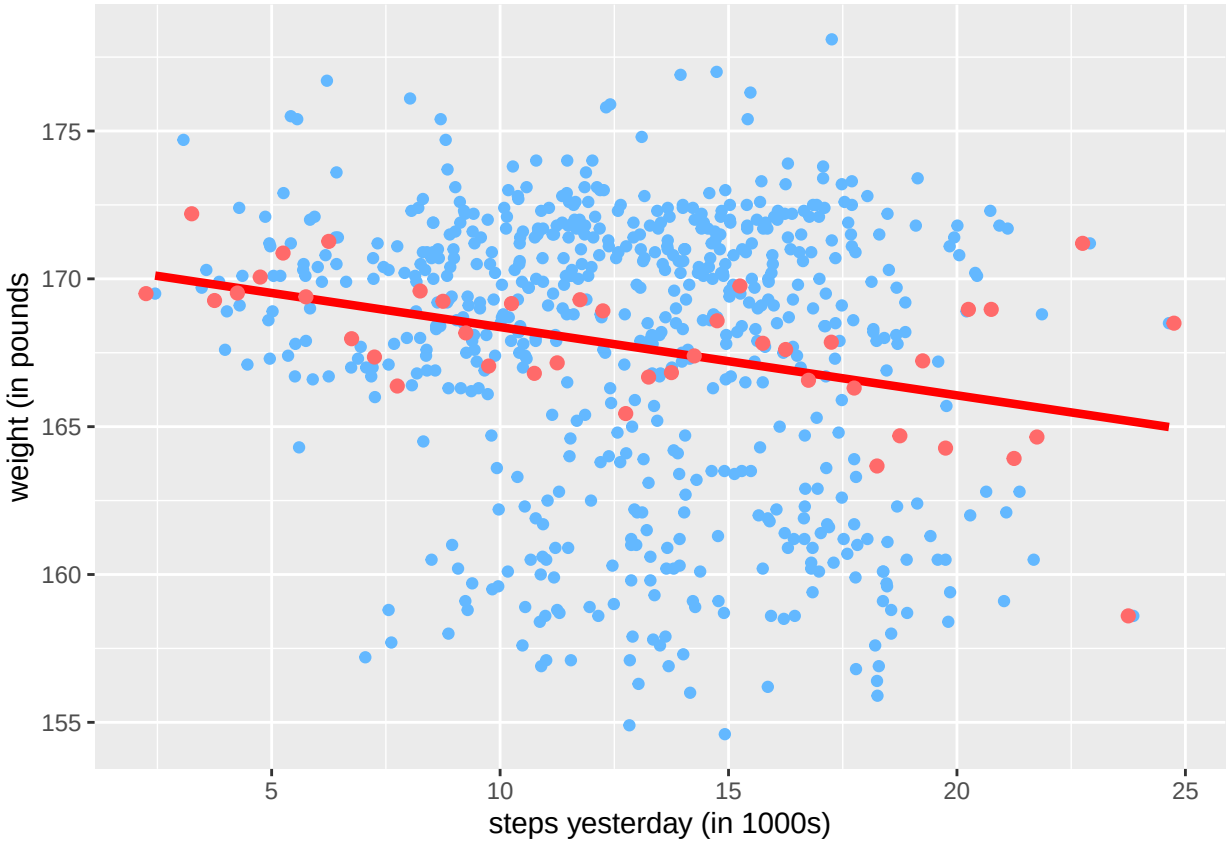



```
health %>%
  ggplot(aes(x = steps_lag, y = weight)) +
  geom_point(color = "steelblue1") +
  labs(x = "steps yesterday (in 1000s)",
       y = "weight (in pounds") +
  stat_summary_bin(fun = "mean", geom = "point", size = 2, color = "red", binwidth = 0.5)
```




```
health %>%
  ggplot(aes(x = steps_lag, y = weight)) +
  geom_point(color = "steelblue1") +
  labs(x = "steps yesterday (in 1000s)",
       y = "weight (in pounds") +
  geom_smooth(method = "lm", se = FALSE, color = "red", size = 1.5) +
  stat_summary_bin(fun = "mean", geom = "point", size = 2, color = "indianred1", binwidth = 0.5)
```

```
## `geom_smooth()` using formula 'y ~ x'
```

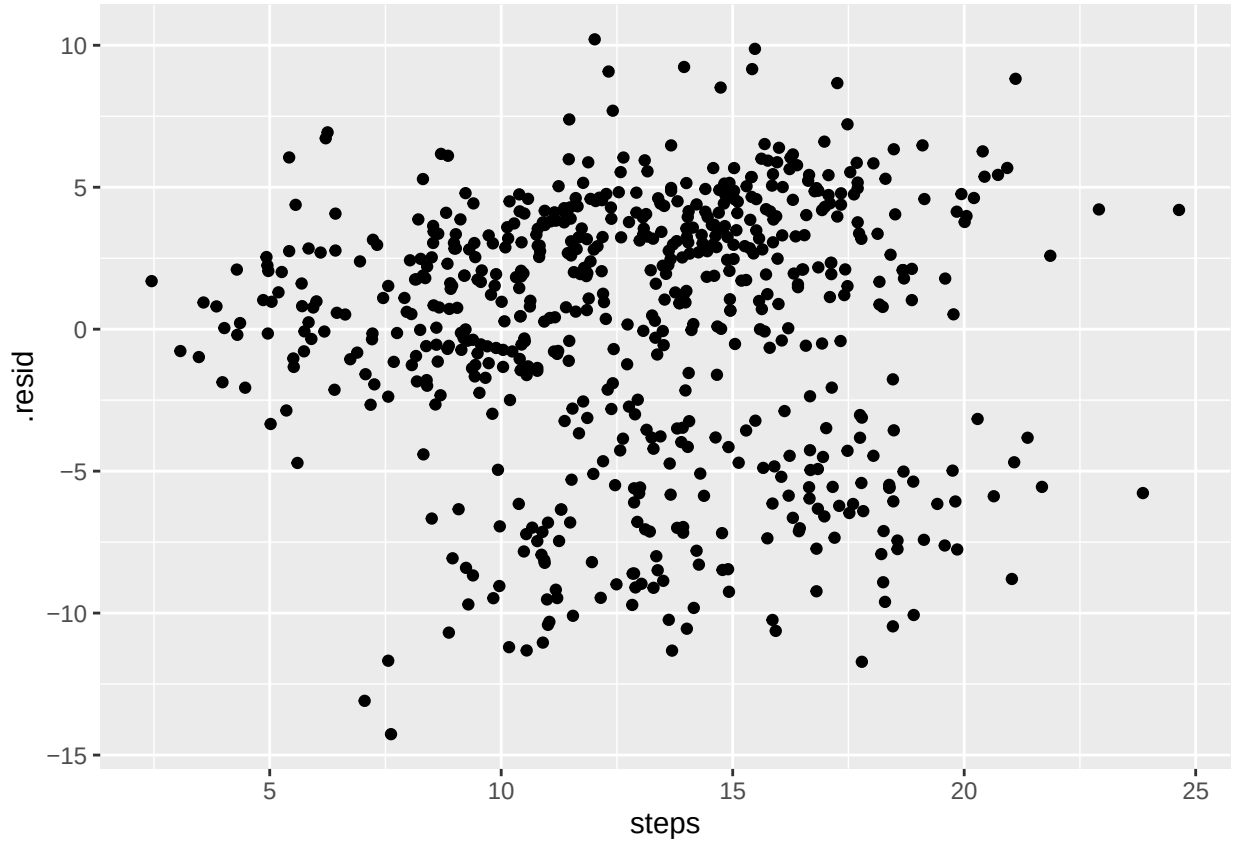


Lienar Models

```
fit <- lm(weight ~ steps, data = health)
fit
```

```
##
## Call:
## lm(formula = weight ~ steps, data = health)
##
## Coefficients:
## (Intercept)        steps
##    170.5493      -0.2212
```

```
library(broom)
augment(fit) %>%
  ggplot(aes(x = steps, y = .resid)) +
  geom_point()
```




```
coef(fit)
```

```
## (Intercept)       steps
## 170.5492866  -0.2211606
```

The coefficient on steps is -0.2211606

```
augment(fit) %>%
  summarize(mean(.resid))
```

```
## # A tibble: 1 x 1
##   `mean(.resid)`
##            <dbl>
## 1      -8.20e-14
```

```
augment(fit) %>%
  summarize(mean(.resid))
```

```
## # A tibble: 1 x 1
##   `mean(.resid)`
##            <dbl>
## 1      -8.20e-14
```

```
library(gov50data)
midterms
```

```
## # A tibble: 20 x 6
##     year president  party approval seat_change rdi_change
##    <dbl> <chr>      <chr>    <dbl>       <dbl>      <dbl>
##  1  1946 Truman     D           33         -55     NA
##  2  1950 Truman     D           39         -29      8.2
##  3  1954 Eisenhower R           61          -4      1
##  4  1958 Eisenhower R           57         -47      1.1
##  5  1962 Kennedy    D           61          -4      5
##  6  1966 Johnson    D           44         -47      5.3
##  7  1970 Nixon      R           58          -8      6.6
##  8  1974 Ford       R           54         -43      6.4
##  9  1978 Carter     D           49         -11      7.7
## 10  1982 Reagan     R           42         -28      4.8
## 11  1986 Reagan     R           63          -5      5.1
## 12  1990 H.W. Bush  R           58          -8      5.6
## 13  1994 Clinton    D           46         -53      3.9
## 14  1998 Clinton    D           66           5      5.6
## 15  2002 W. Bush    R           63           6      2.6
## 16  2006 W. Bush    R           38         -30      5.7
## 17  2010 Obama      D           45         -63      3.5
## 18  2014 Obama      D           40         -13      4.6
## 19  2018 Trump      R           38         -42      4.1
## 20  2022 Biden      D           42          NA     -0.003
```

```
fit <- lm(seat_change ~ approval, data = midterms)
fit
```

```
##
## Call:
## lm(formula = seat_change ~ approval, data = midterms)
##
## Coefficients:
## (Intercept)     approval
##      -96.58         1.42
```

```
fit_rdi <- lm(seat_change ~ rdi_change, data = midterms)
fit_rdi
```

```
##
## Call:
## lm(formula = seat_change ~ rdi_change, data = midterms)
##
## Coefficients:
## (Intercept)   rdi_change
##     -29.413        1.215
```

```
summary(fit)$r.squared
```

```
## [1] 0.4498696
```

```
summary(fit_rdi)$r.squared
```

```
## [1] 0.01202348
```

```
glance(fit)
```

```
## # A tibble: 1 x 12
##   r.squ~1 adj.r~2 sigma stati~3 p.value    df logLik   AIC   BIC devia~4 df.re~5
##     <dbl>   <dbl> <dbl>   <dbl>   <dbl> <dbl>  <dbl> <dbl> <dbl>   <dbl>   <int>
## 1   0.450   0.418  16.9    13.9 0.00167     1  -79.6  165.  168.   4852.      17
## # ... with 1 more variable: nobs <int>, and abbreviated variable names
## #   1: r.squared, 2: adj.r.squared, 3: statistic, 4: deviance, 5: df.residual
```

```
glance(fit)$r.squared
```

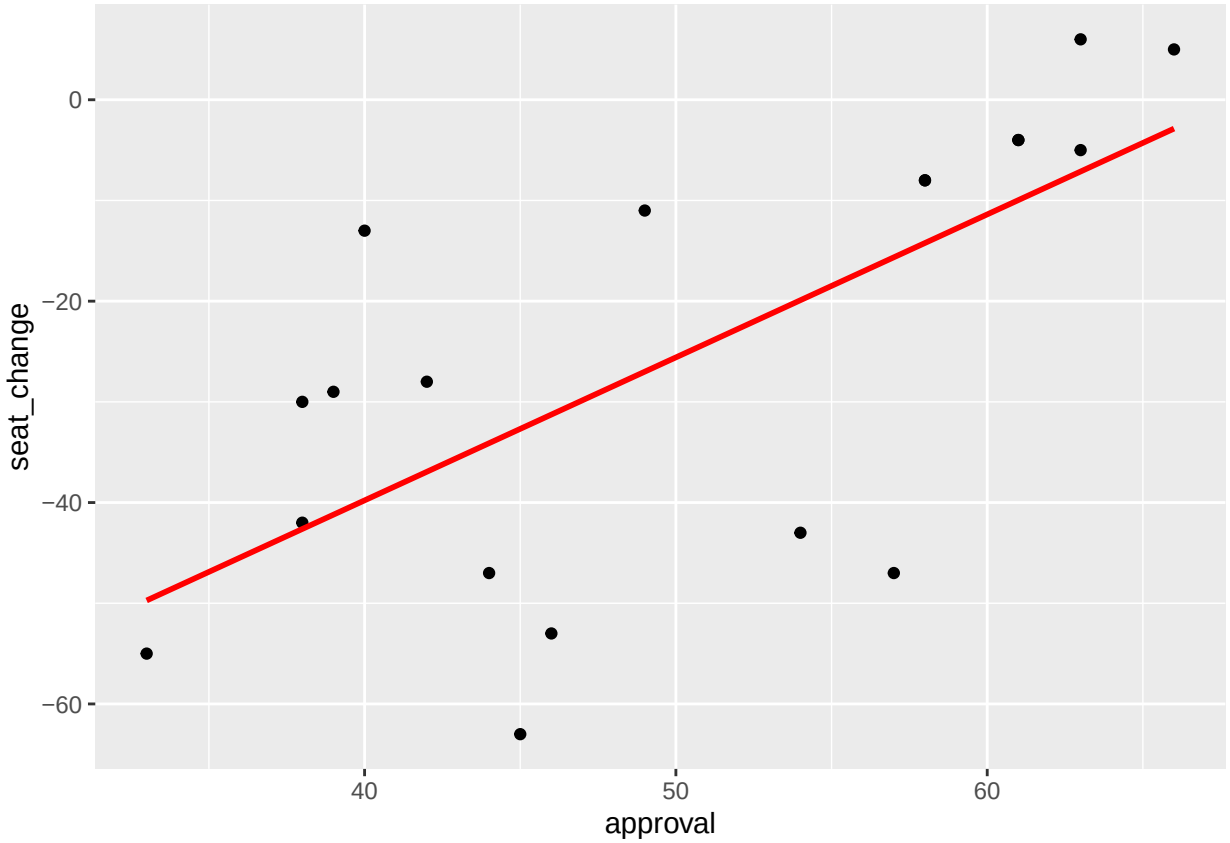
```
## [1] 0.4498696
```

```
midterms %>%
  ggplot(aes(x = approval, y = seat_change)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE, color = "red")
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 1 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 1 rows containing missing values (geom_point).
```

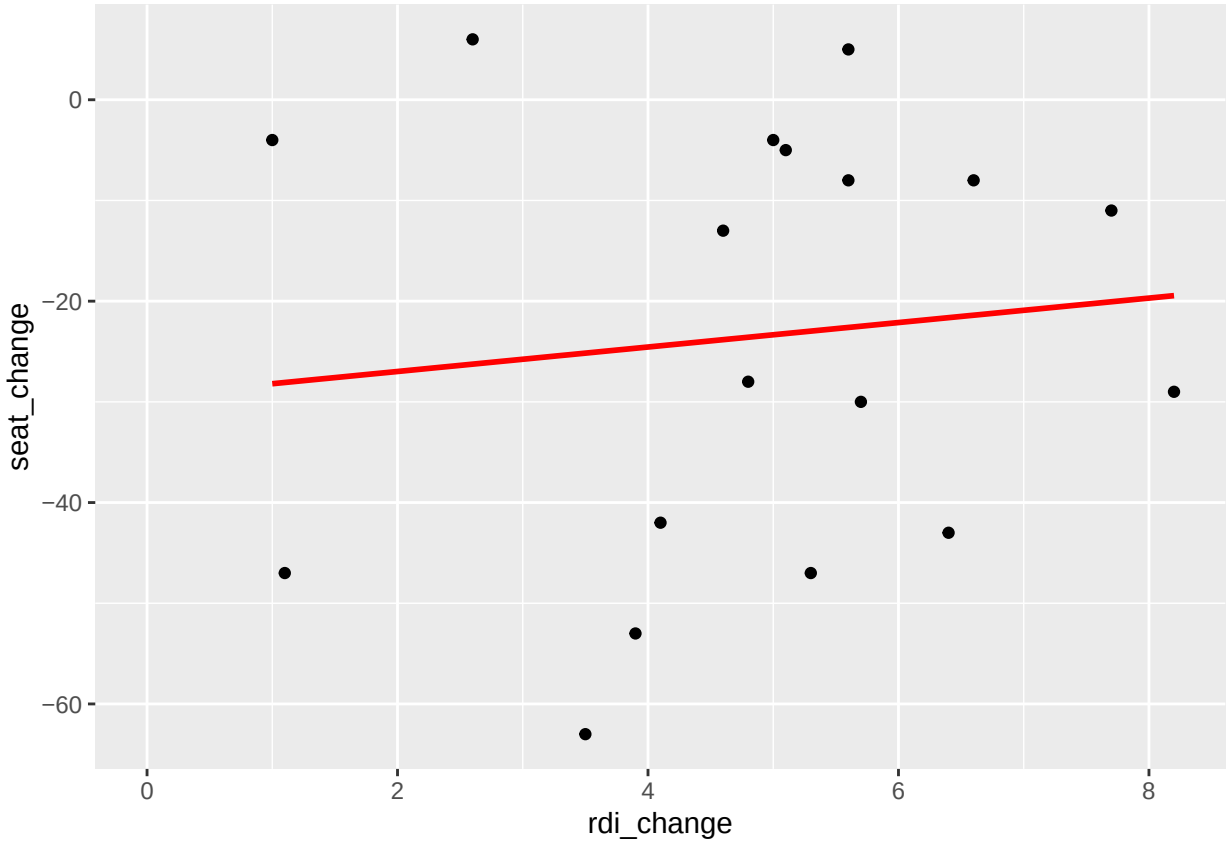



```
midterms %>%
  ggplot(aes(x = rdi_change, y = seat_change)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE, color = "red")
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 2 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 2 rows containing missing values (geom_point).
```


0
−20
−40
−60
seat_change
0
2
4
6
8
rdi_change