Lab 4: Key

Use a dataset containing homes in the Seattle, WA area http://www.math.montana.edu/ahoegh/teaching/stat408/datasets/SeattleHousing.csv for this question.

Estimate the posterior distribution for the probability that houses in Seattle have more than 2 bathrooms.

```
library(tidyverse)
library(scales)
seattle <- read_csv('http://www.math.montana.edu/ahoegh/teaching/stat408/datasets/SeattleHous
  mutate(more_than2baths = bathrooms > 2)

z <- sum(seattle$more_than2baths)
N <- nrow(seattle)
```

a. (2 pts)

Justify your prior distribution.

I have little knowledge of this parameter, and hence, will opt to use a uniform prior (Beta(1,1)). With a large data set, this will have minimal impact on the posterior distribution, relative to the data.

b. (2 pts)

State the probability model you will using. You can, but don't need, to write out the full functional form of the probability mass/distribution function.

We assume each house results in a Bernoulli trial with a probability term corresponding to having more than 2 bathrooms. Or alternatively, we could consider the collection of houses using a binomial distribution.

c. (2 pts)

What is the form of your posterior distribution?

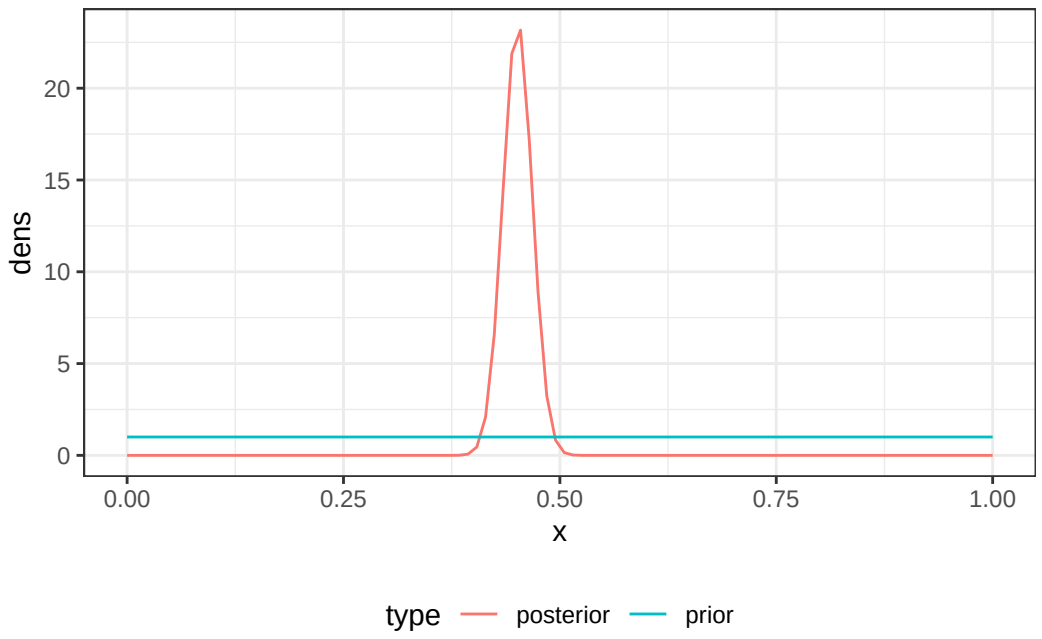
Given this prior distribution and probability model for our data, the resultant posterior distribution is also a beta distribution, with parameters 393 and 478

d. (2 pts)

Plot your prior and posterior distributions on the same figure.

```
num_x <- 100
x_seq <- seq(0,1, length.out = num_x)

tibble(dens = c(dbeta(x_seq, 1 + z, 1 + N - z),dbeta(x_seq, 1, 1)),
       x = c(x_seq, x_seq),
       type = c(rep('posterior', num_x), rep('prior', num_x))) %>%
  ggplot(aes(y=dens, x = x, color = type)) +
  geom_line() + theme_bw() + theme(legend.position = 'bottom')
```



e. (2 pts)

Pretend your cousin has recently accepted a new job that requires relocating to Seattle. Summarize your findings (with regard to probability of finding a house with more than 2 bathrooms) in a non-technical manner avoiding statistical lingo.

Hello Hans,

Congratulations on the new job - and the new baby girl. You are going to need extra bathrooms when those kids become teenagers. I did a quick analysis and found that you should be able to find a place with more than two bedrooms, roughly 42% to 48% of houses have more than 2 bathrooms. On the other hand, I hope the job pays well, because Seattle is very expensive.