Week 1

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Chapter 4

E1

In the model below, which line is the likelihood:

$$y_i \sim Normal(\mu, \sigma)$$
$$\mu \sim Normal(0, 10)$$
$$\sigma \sim Exponential(1)$$

Top line (the other lines are priors).

E2

In the model definition above, how many parameters are in the posterior distribution?

Two. Mu and sigma

E3

Using the model definition above, write down the appropriate form of Bayes' theorem that includes the proper likelihood and priors.

$$Pr(\mu, \sigma | y_i) = \frac{Normal(y_1|\mu, \sigma).Normal(p|0, 10)}{\int Normal(y_1|\mu, \sigma).Normal(p|0, 10)d\mu}$$

I have no clue, to be honest

E4

In the model definition below, which line is the linear model?

$$y_i \sim Normal(\mu, \sigma)$$
$$\mu_i = \alpha + \beta x_i$$
$$\alpha \sim Normal(0, 10)$$
$$\beta \sim Normal(0, 1)$$
$$\sigma \sim Exponential(2)$$

Line two is the linear model.

E5

In the model above, how many parameters are in the posterior distribution? Three- α, β, and σ.

M1

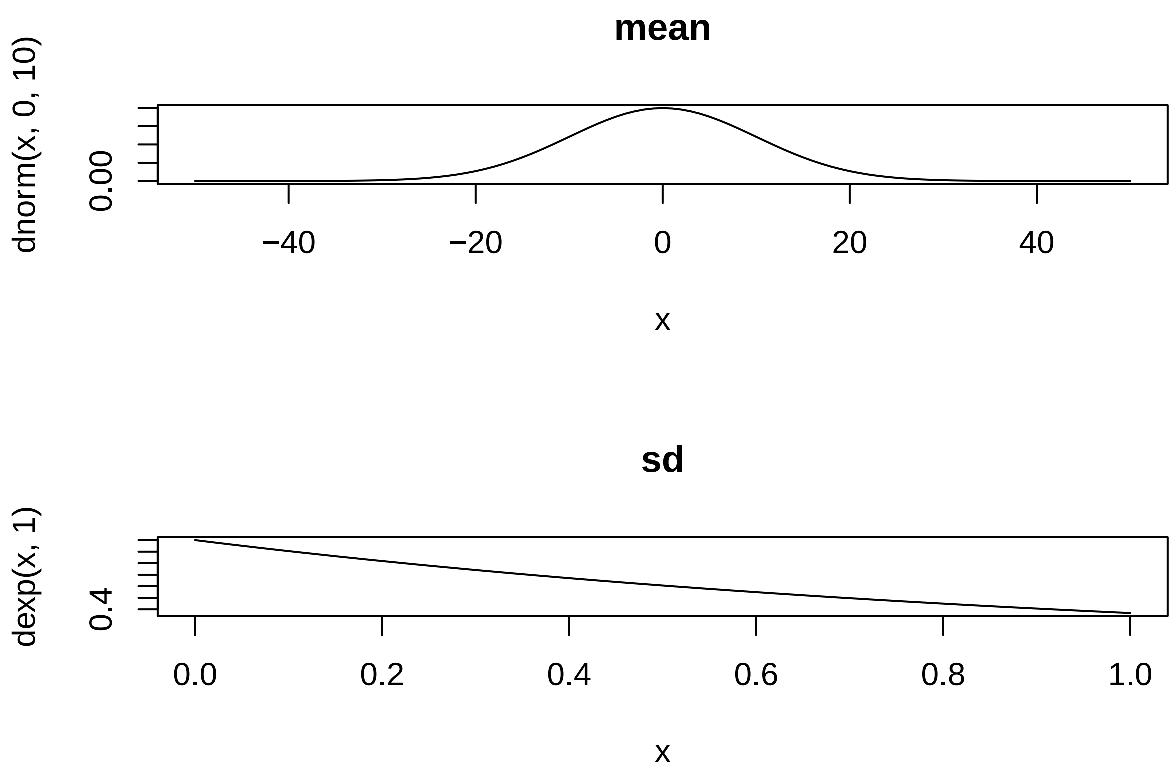
For the following model, simulate observed values from the prior:

$$y_i \sim Normal(\mu, \sigma)$$
$$\mu \sim Normal(0, 10)$$
$$\sigma \sim Exponential(1)$$

Plot it first:

```
par(mfrow = c(2, 1))

curve(dnorm(x, 0, 10), from = -50, to = 50, main = "mean")
curve(dexp(x, 1), from = 0, to = 1, main = "sd")
```

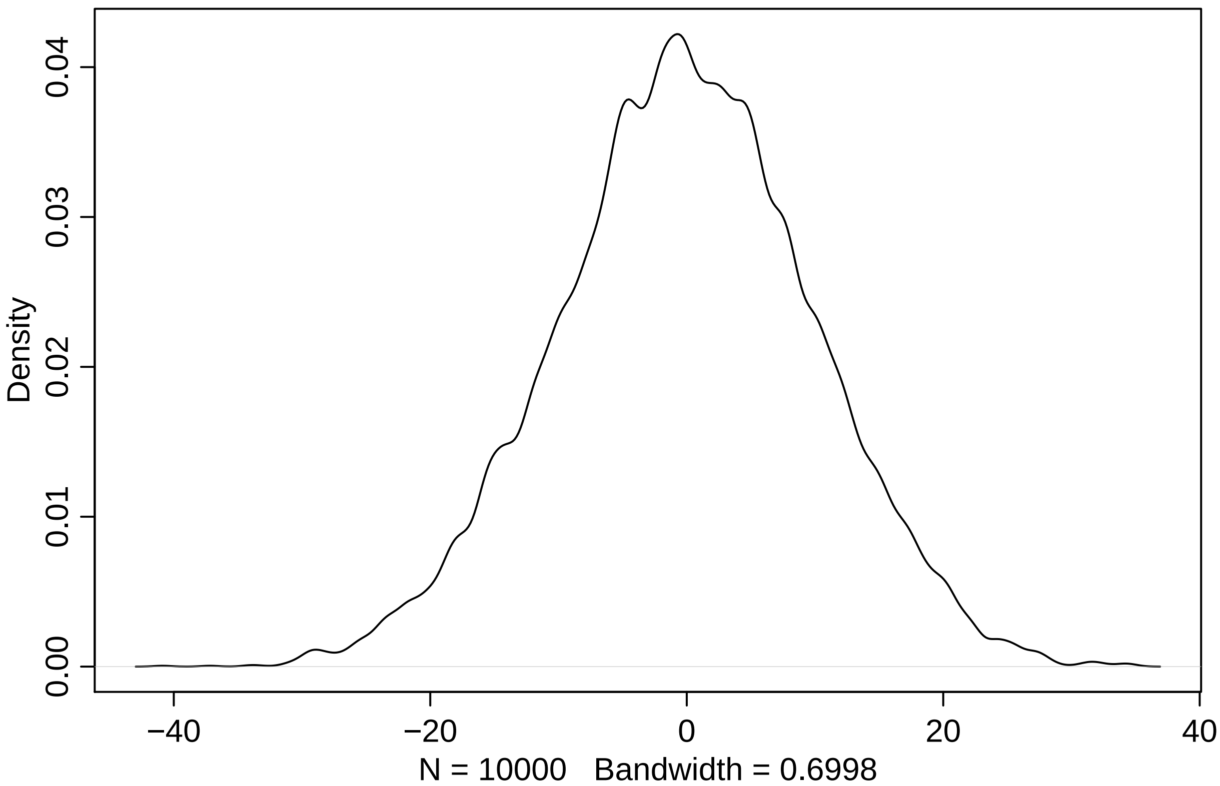



```
par(mfrow = c(1, 1))
```

Now sample from it

```
sample_mu <- rnorm(1e4, 0, 10)
sample_sigma <- rexp(1e4, 1)

prior <- rnorm(1e4, sample_mu, sample_sigma)
dens(prior)
```



M2

Translate the model above into a quap formula

```
flist <- alist(
  value ~ dnorm(mu, sigma),
  mu ~ dnorm(0, 10),
  sigma ~ dexp(1)
)
```

Translate the following code into a mathematical formula

```
y ~ dnorm(mu, sigma)
mu <- a + b * x
a ~ dnorm(0, 10)
b ~ dunif(0, 1)
sigma ~ dexp(1)
```

$$y_i \sim Normal(\mu, \sigma)$$

$$\mu = a + \beta x$$

$$a \sim Normal(0, 10)$$

$$b \sim Uniform(0, 1)$$

$$\sigma \sim Exponential(1)$$