Computer assignment

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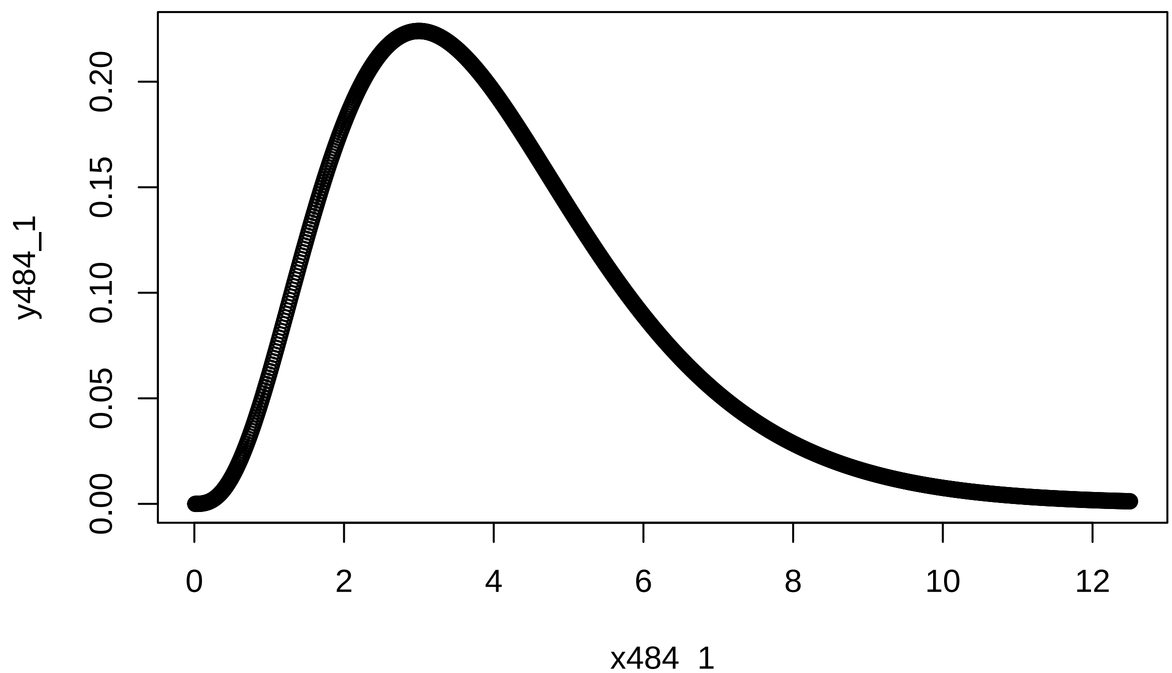
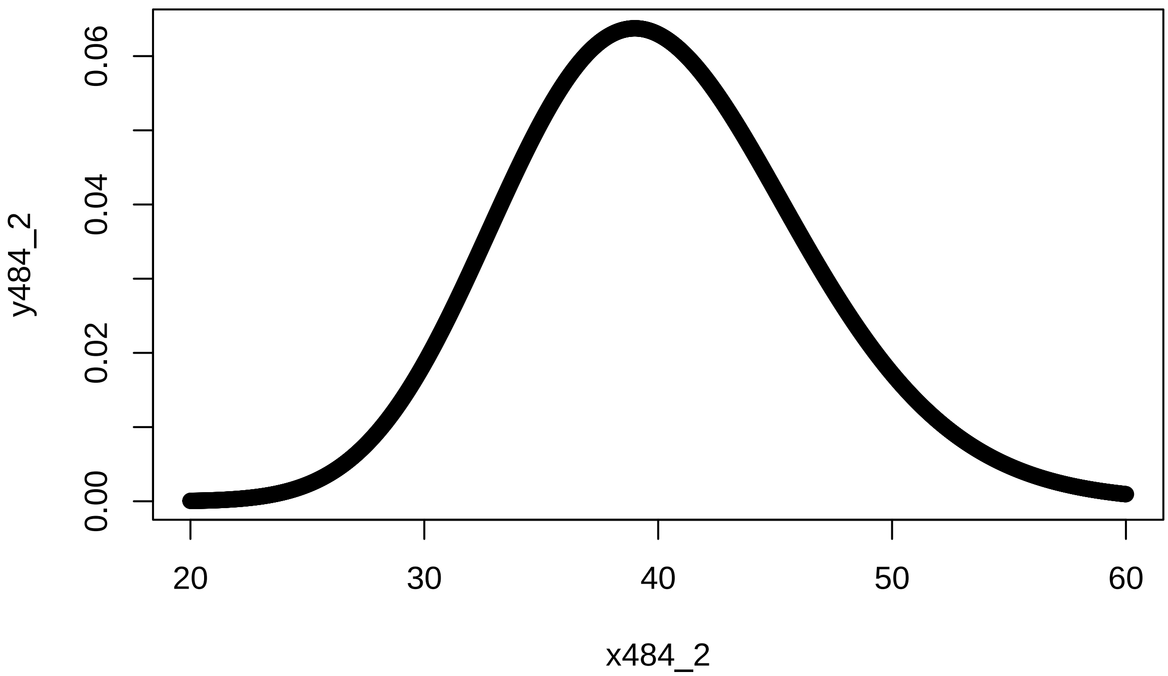
4.84

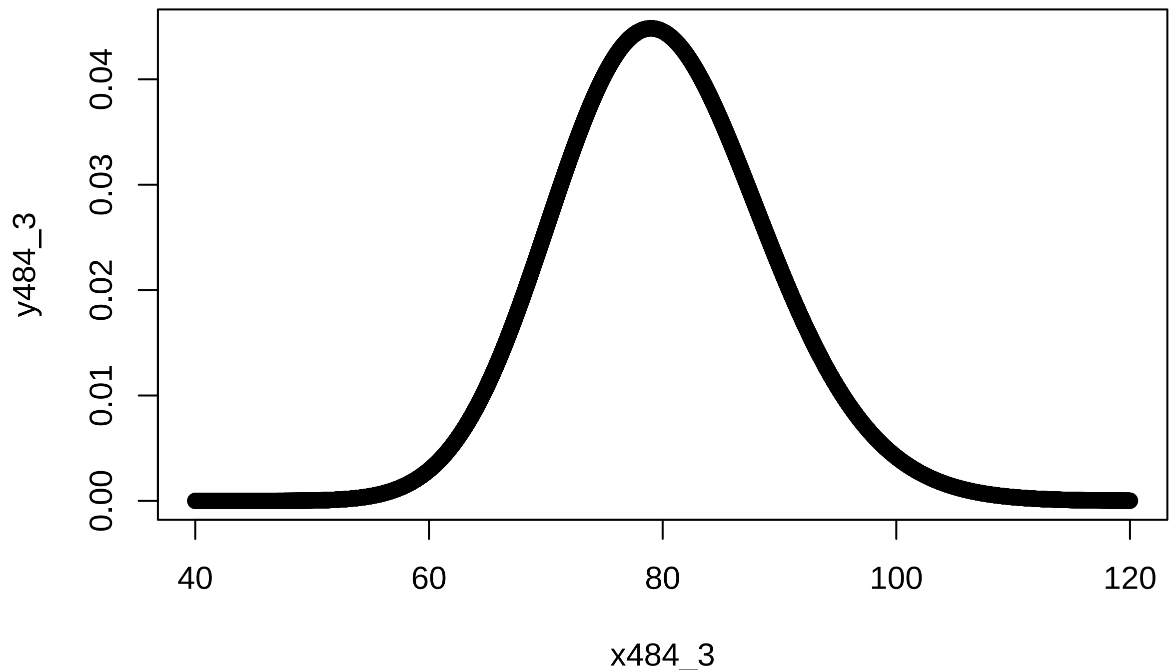
```
x484_1<-(1:1000)/80
y484_1 <- dgamma(x484_1,shape = 4,scale = 1)
plot(x484_1,y484_1)
```




```
x484_2<-(1000:3000)/50
y484_2 <- dgamma(x484_2,shape = 40,scale = 1)
plot(x484_2,y484_2)
```




```
x484_3<-(2000:6000)/50
y484_3 <- dgamma(x484_3,shape = 80,scale = 1)
plot(x484_3,y484_3)
```



a)

As alpha increases, so does the abscissa of the highest point, and the width of the bulge decreases.When alpha=4,the shape is more skewed.When alpha = 80, the shape is more symmetric.

b)

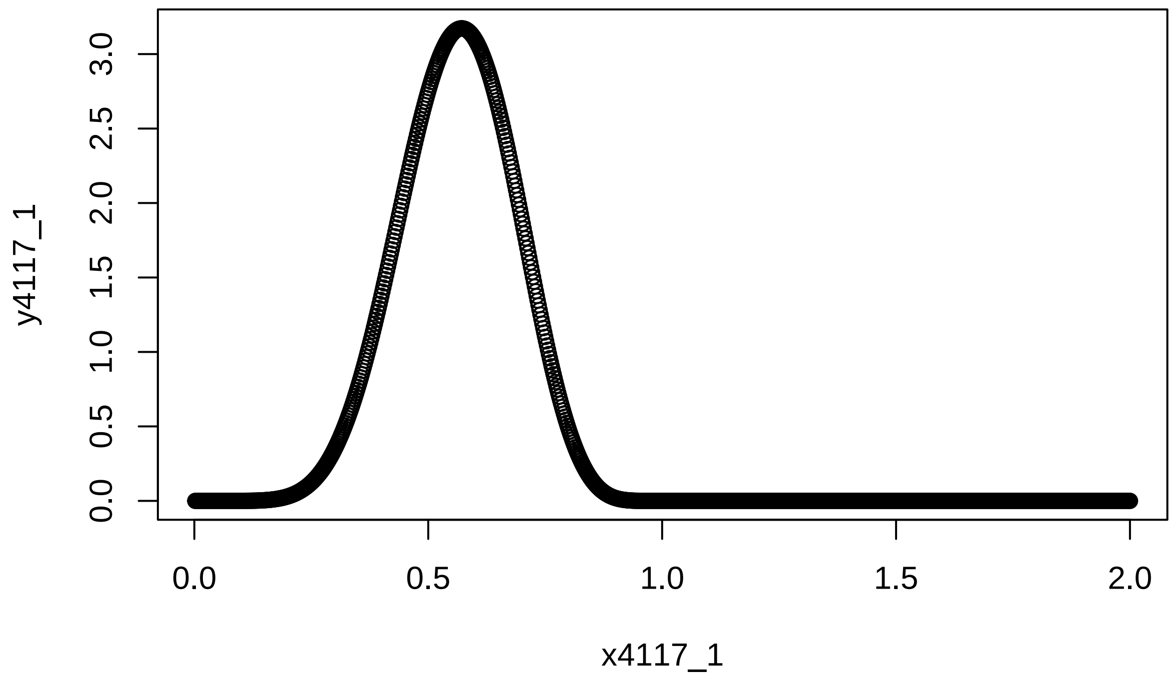
The center of each picture moves right as alpha increases.

c)

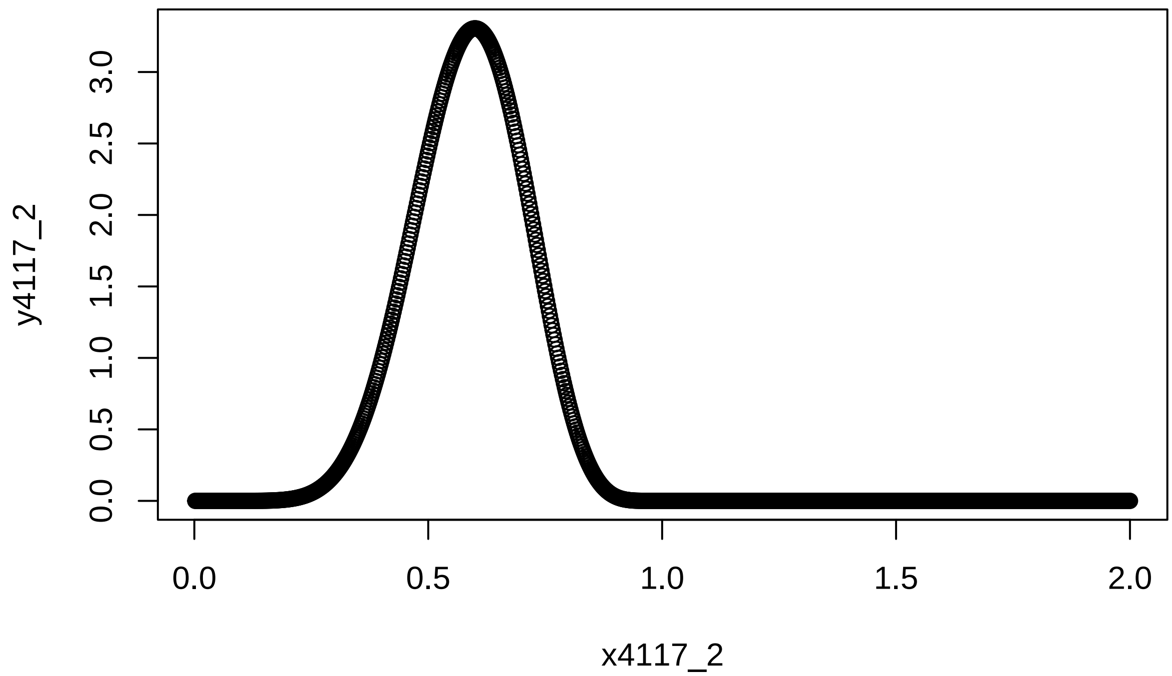
The parameter alpha is used to control the shape of gamma distribution, so change the value of alpha will change the shape.

4.117

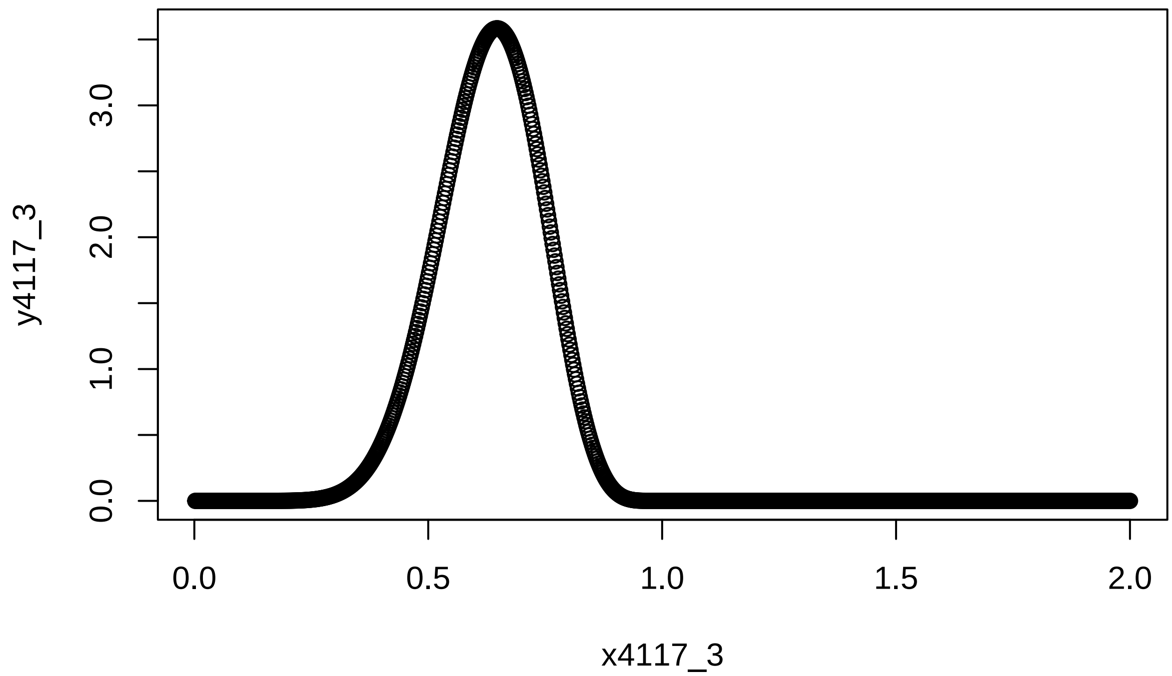
```
x4117_1<-(1:1000)/500
y4117_1 <- dbeta(x4117_1,shape1 = 9,shape2 = 7)
plot(x4117_1,y4117_1)
```




```r
x4117_2<-(1:1000)/500
y4117_2 <- dbeta(x4117_2,shape1 = 10,shape2 = 7)
plot(x4117_2,y4117_2)
```




```r
x4117_3<-(1:1000)/500
y4117_3 <- dbeta(x4117_3,shape1 = 12,shape2 = 7)
plot(x4117_3,y4117_3)
```



a)

These densities are skewed right.

b)

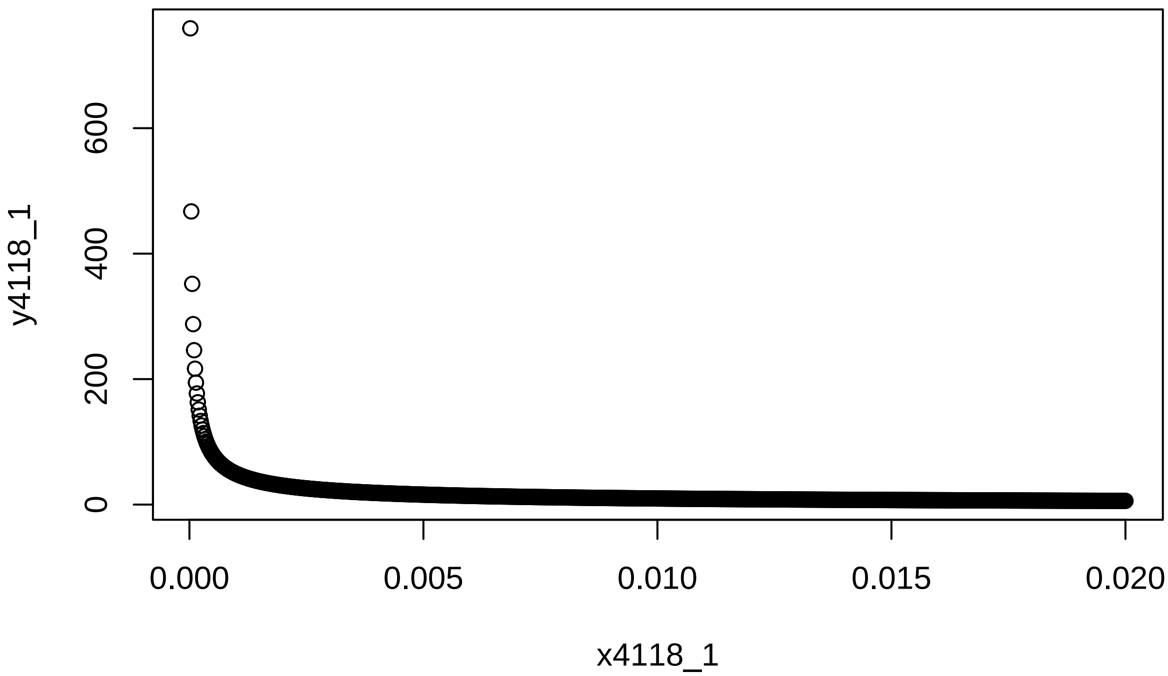
the center of densities moves to right.

c)

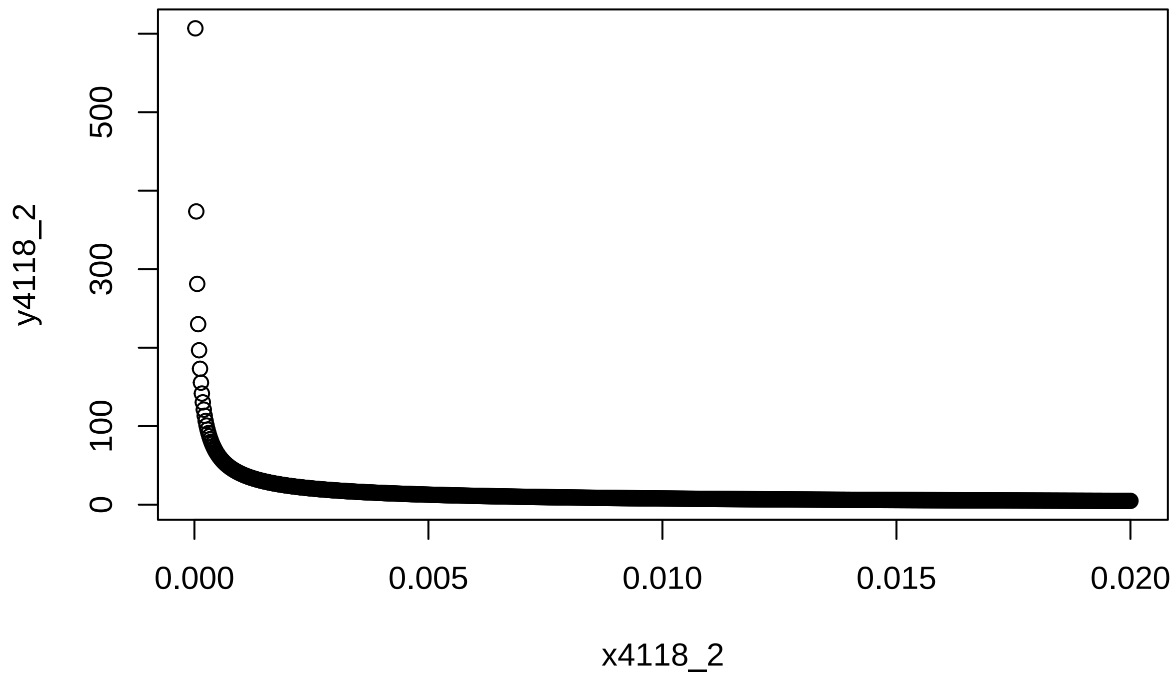
if alpha > beta, then densities will be skewed right. As alpha/beta increases,the center point on the x-coordinate gradually close to 1. Further, I think The center point on the x-coordinate is equal to alpha/(alpha+beta).

4.118

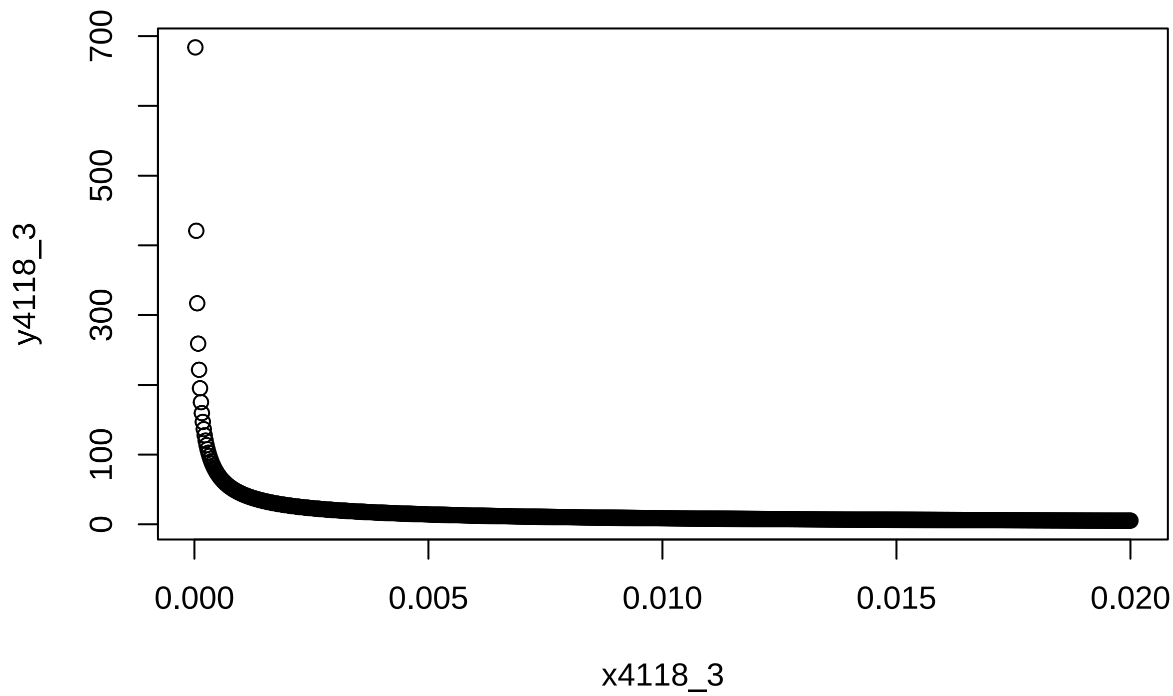
```
x4118_1<-(1:1000)/50000
y4118_1 <- dbeta(x4118_1,shape1 = 0.3,shape2 = 2)
plot(x4118_1,y4118_1)
```




```
x4118_2<-(1:1000)/50000
y4118_2 <- dbeta(x4118_2,shape1 = 0.3,shape2 = 1.1)
plot(x4118_2,y4118_2)
```




```
x4118_3<-(1:1000)/50000
y4118_3 <- dbeta(x4118_3,shape1 = 0.3,shape2 = 1.5)
plot(x4118_3,y4118_3)
```



a)

These densities are skewed left.

b)

the densities become more steep.

c)

the densities where beta = 12.

d)

the bigger beta/alpha is the steeper density will be.

10.19

The output voltage for an electric circuit is specified to be 130. A sample of 40 independent readings on the voltage for this circuit gave a sample mean 128.6 and standard deviation 2.1. Test the hypothesis that the average output voltage is 130 against the alternative that it is less than 130. Use a test with level .05.

Solution: For this test, the deviation is already known, so we can use the T = (128.6-130)/(2.1/squt(40)), the reject region is less than -z0.5 = -1.645

H0: the average voltage is not less than 130; Ha: the average voltage is less than 130

```
t <- (128.6-130)/(2.1/(sqrt(40)))
t
```

```
## [1] -4.21637
```

t < -1.645, so reject H0

10.21

Shear strength measurements derived from unconfined compression tests for two types of soils gave the results shown in the following table (measurements in tons per square foot). Do the soils appear to differ with respect to average shear strength, at the 1% significance level?

Solution: H0: appear same ; Ha: appear to differ with respect to average shear strength.

```
t <- (1.65-1.43)/sqrt((0.26**2)/30+(0.22**2)/35)
t
```

```
## [1] 3.648374
```

t > 2.576, so we reject H0.

11.31

According to the problem, we set H0: beta1 = 0 against Ha: beta1 != 0, since the p-value is quite small, we reject H0.

Solution:

x is 19.1, 38.2, 57.3, 76.2, 95, 114, 131, 150, 170 y is .095, .174, .256, .348, .429, .500, .580, .651, .722

```
x_1131 <- c(19.1, 38.2, 57.3, 76.2, 95, 114, 131, 150, 170)
y_1131 <- c(.095, .174, .256, .348, .429, .500, .580, .651, .722)
summary(lm(y_1131~x_1131))
```

```
##
## Call:
## lm(formula = y_1131 ~ x_1131)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -0.0133264 -0.0042777 -0.0000231  0.0080557  0.0098107
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.875e-02  6.129e-03   3.059   0.0183 *
## x_1131      4.215e-03  5.771e-05  73.040 2.37e-11 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.008376 on 7 degrees of freedom
## Multiple R-squared:  0.9987, Adjusted R-squared:  0.9985
## F-statistic:  5335 on 1 and 7 DF,  p-value: 2.372e-11
```

the fitted liner model is y^ = .01875 + .004215x,p-value is quite small(2.372e-11), so we reject H0, thus peak current increases as nickel concentrations increase

11.69

Solution: x is -7, -5, -3, -1, 1, 3, 5, 7 y is 18.5, 22.6, 27.2, 31.2, 33.0, 44.9, 49.4, 35.0 x^2 is 49, 25, 9, 1, 1, 9, 25, 49

```
x_1169 <- c(-7, -5, -3, -1, 1, 3, 5, 7)
y_1169 <- c(18.5,22.6,27.2,31.2,33.0,44.9,49.4,35.0)
x2_1169 <- x_1169**2
lm(y_1169~x_1169)
```

```
##
## Call:
## lm(formula = y_1169 ~ x_1169)
##
## Coefficients:
## (Intercept)       x_1169
##      32.725        1.812
```

```
lm(y_1169~x_1169+x2_1169)
```

```
##
## Call:
## lm(formula = y_1169 ~ x_1169 + x2_1169)
##
## Coefficients:
## (Intercept)       x_1169      x2_1169
##     35.5625       1.8119      -0.1351
```

a) the fitted liner model is y = 32.725 +1.812x
b) the fitted liner model is y = 35.5625 +1.8119x-0.1351x^2