Continuous Distributions

Math 122

Binomial and Poisson

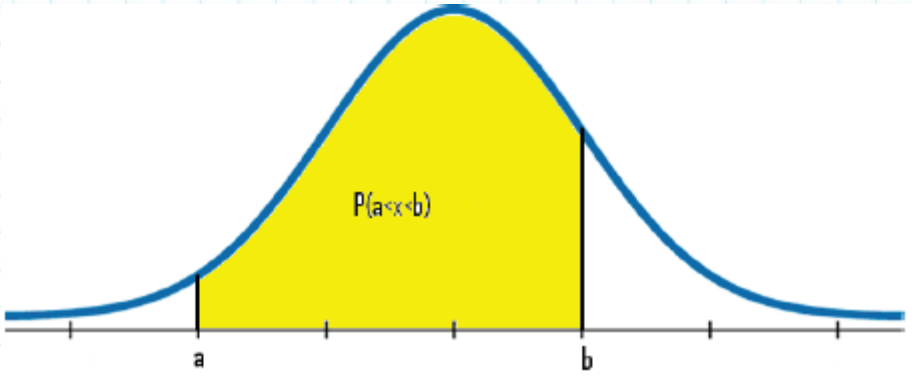
- Discrete Distributions
- Gaps between possible values
  - 0, 1, 2, 3, 4…
- Each possible value has nonzero probability

Continuous Random Variables

- Infinitely many possible values
- Possible values spread over a range with no gaps
- Probability of any single value 0
- Probability corresponds to area
- Consider $P(x \leq b)$ or $P(a<x)$ or $P(a<x<b)$

Continuous Random Variables
Probability = Area

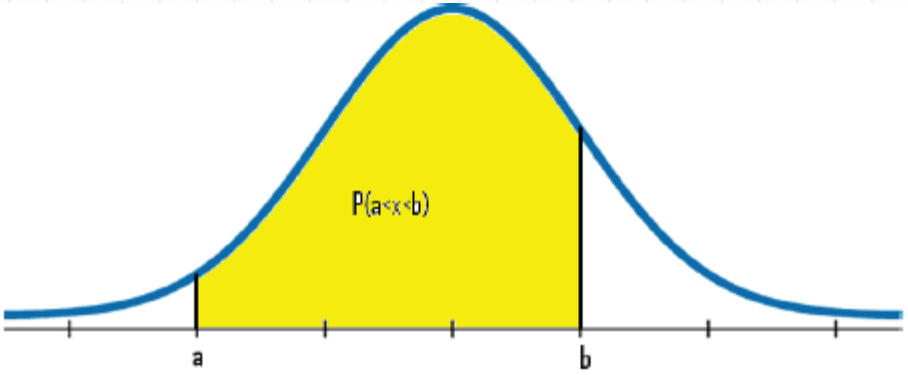
- Finding probabilities corresponds to finding areas under smooth curves such as



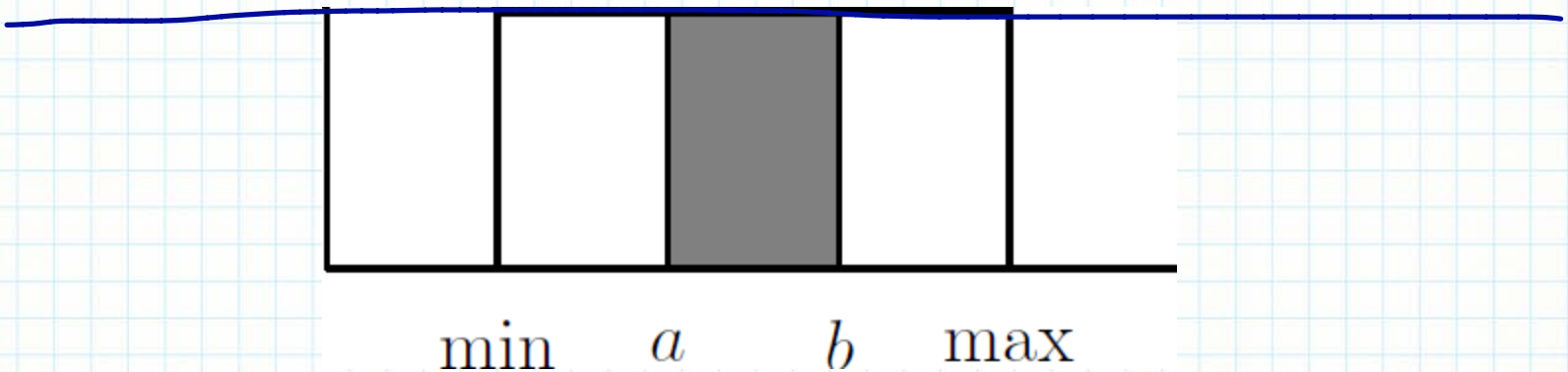
- The curve is called the **density curve** or **density function**

Density Functions

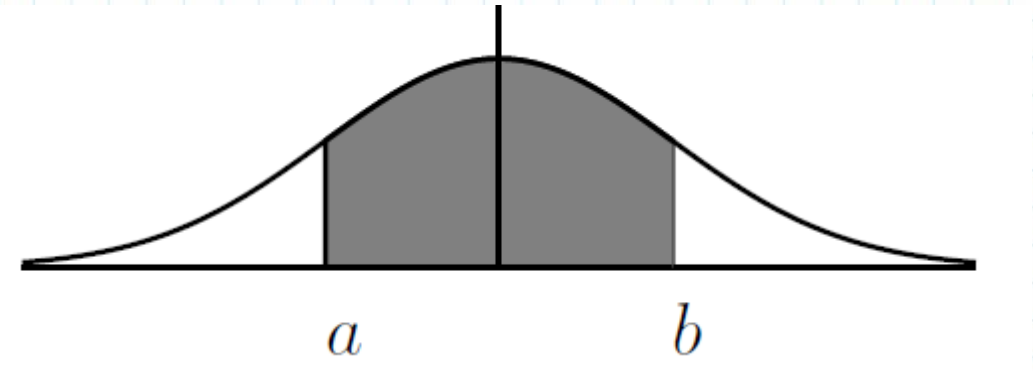
- Every continuous random variable has a density function
- The total area under the function is 1
- To find P(a<x<b), we find the area under the function between a and b



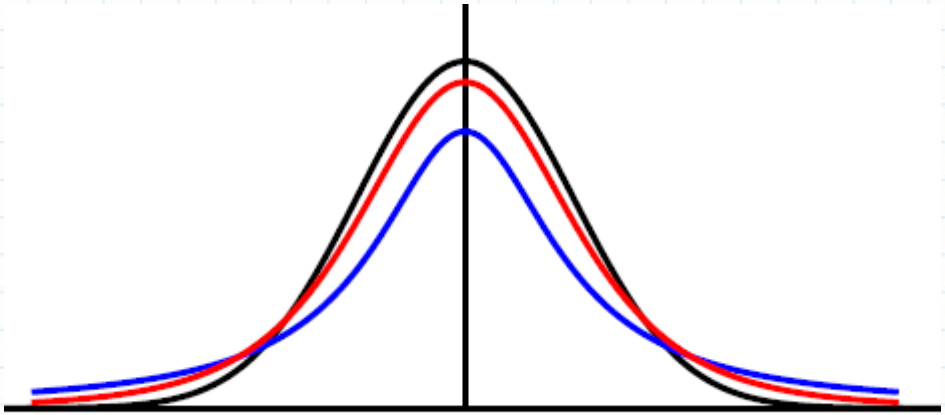
Uniform Distribution



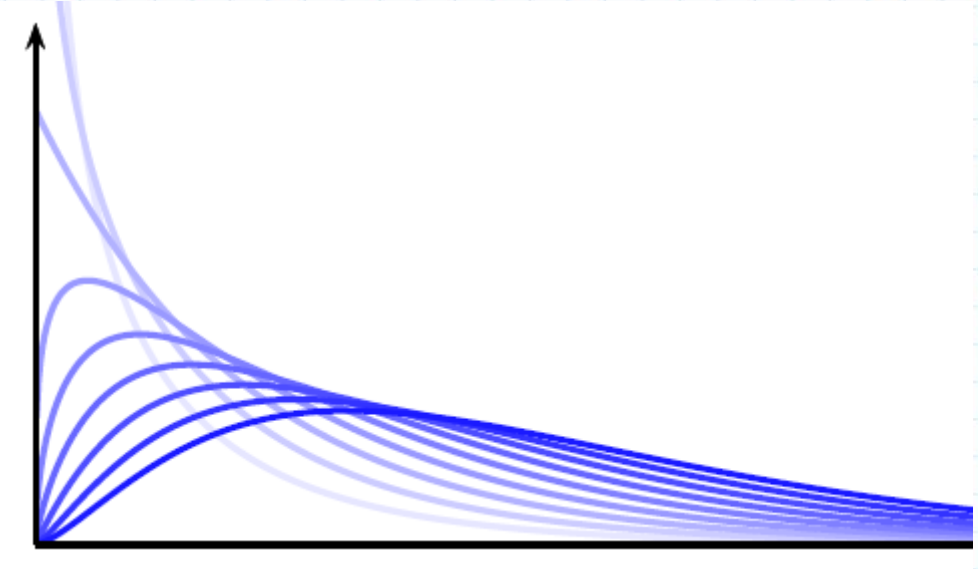
Normal Distribution



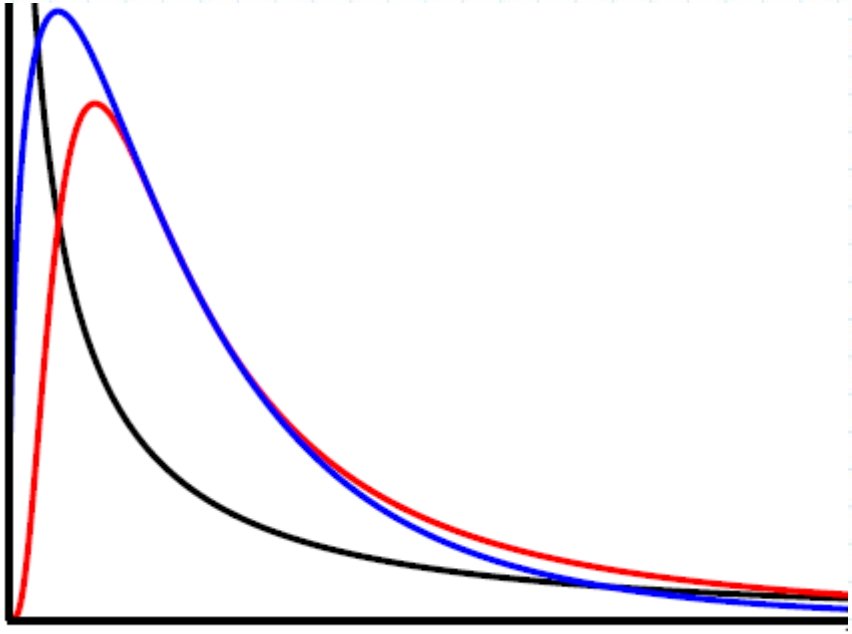
Student t Distributions



Chi-Squared Distributions

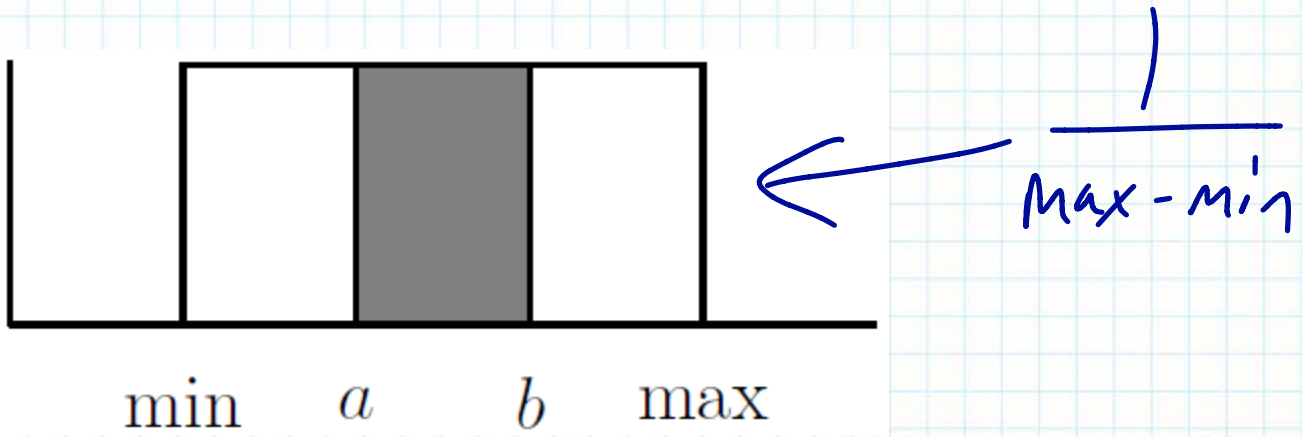


F Distributions



Uniform Distribution

- Density function is a horizontal line from the minimum value of the random variable to the maximum value.
- The height of the line is selected so that the total area under the curve is 1



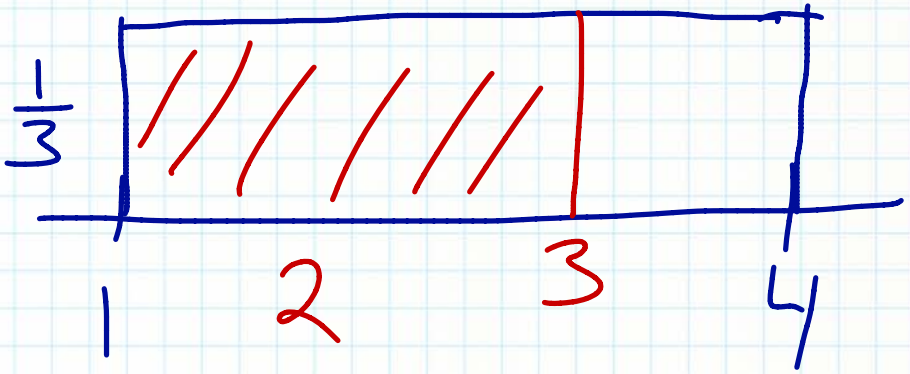
A random variable x is uniformly distributed from 1 to 4.

- Find P(x<3)

= area left of 3

$= 2 \times \frac{1}{3}$

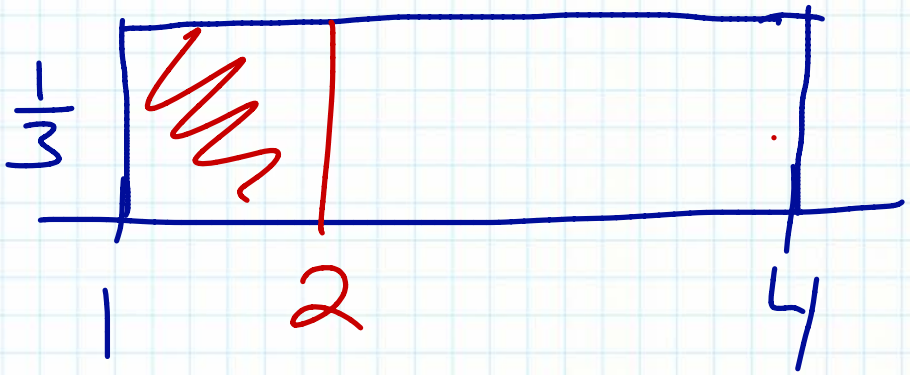
$= \frac{2}{3}$



- Find P(1<x<2)

$= 1 \times \frac{1}{3}$

$= \frac{1}{3}$



A random variable x is uniformly distributed from 11 to 24.

- Find a so that P(x<a)=0.1

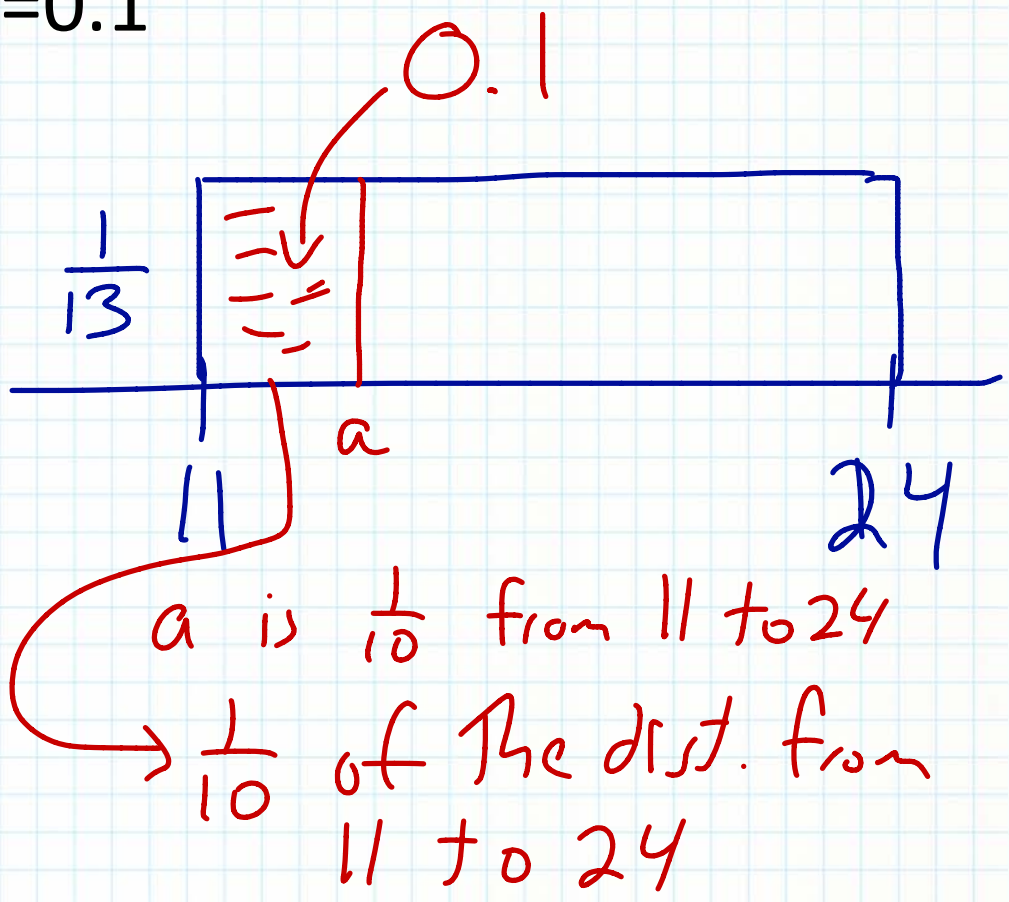
$a = .1 \times 13 + 11$

desired area

width

min

$a = 12.3$

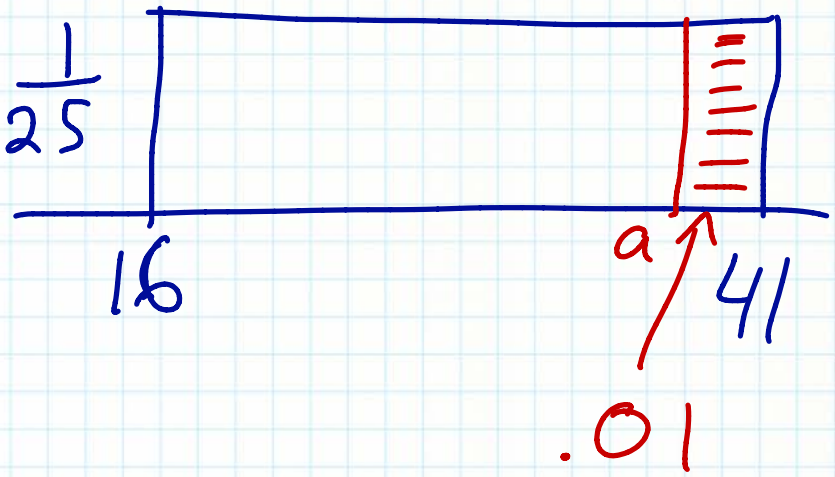


A random variable x is uniformly distributed from 16 to 41.

- Find a so that P(x>a)=0.01

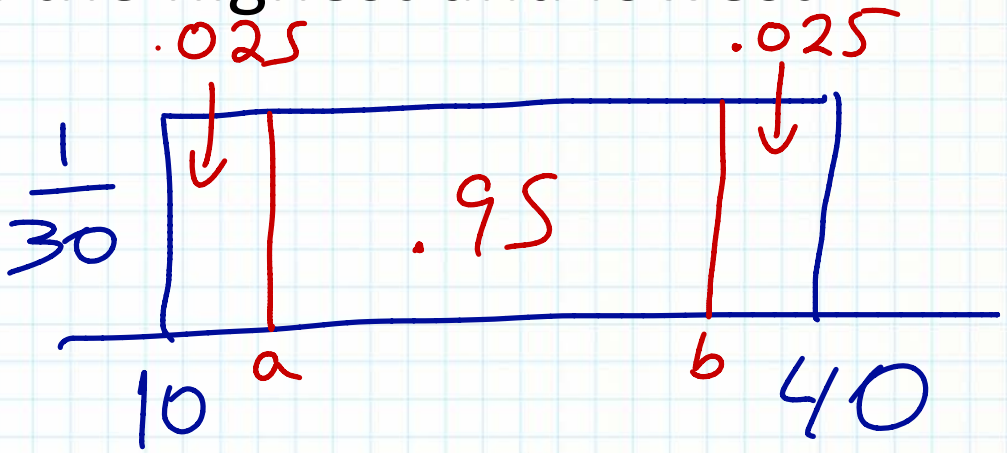
$a = 41 - .01 \times 25$

$= 40.75$



A random variable x is uniformly distributed from 10 to 40.

- Find a and b which separate the middle 95% of values of x from the highest and lowest values.



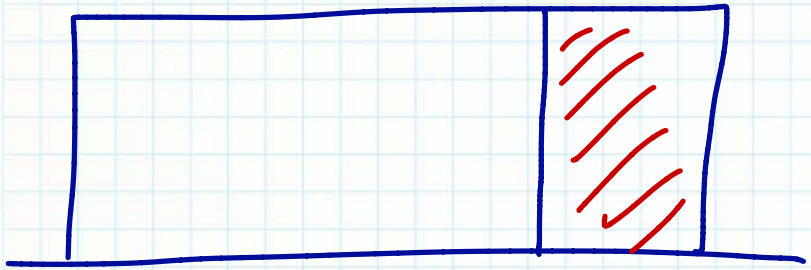
width = .025 × 30
= .75

a = 10 + .75
10.75

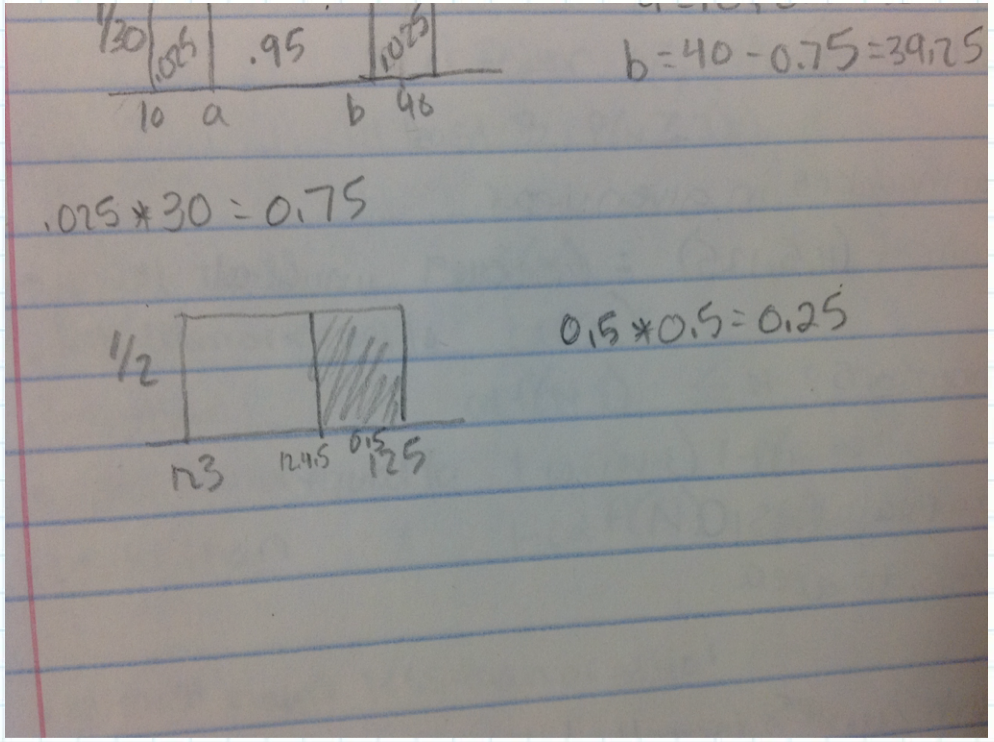
b = 40 − .75
39.25

- The Newport Power and Light Company provides electricity with voltages uniformly distributed between 123 and 125 volts.

- Find the probability that a random voltage is greater than 124.5



Find area



- The Newport Power and Light Company provides electricity with voltages uniformly distributed between 123 and 125 volts.

- Find a voltage which is greater than 99% of all voltages.