

What is a likelihood function? Also add a formula and explain what it means.

Likelihoods are the Y-axis values for any fixed data points where the distribution can be moved.

For example, we can consider a simple distribution of the weight of mice (plural of mouse). At first, we take a mouse and weigh it, which is 34 gram for example.

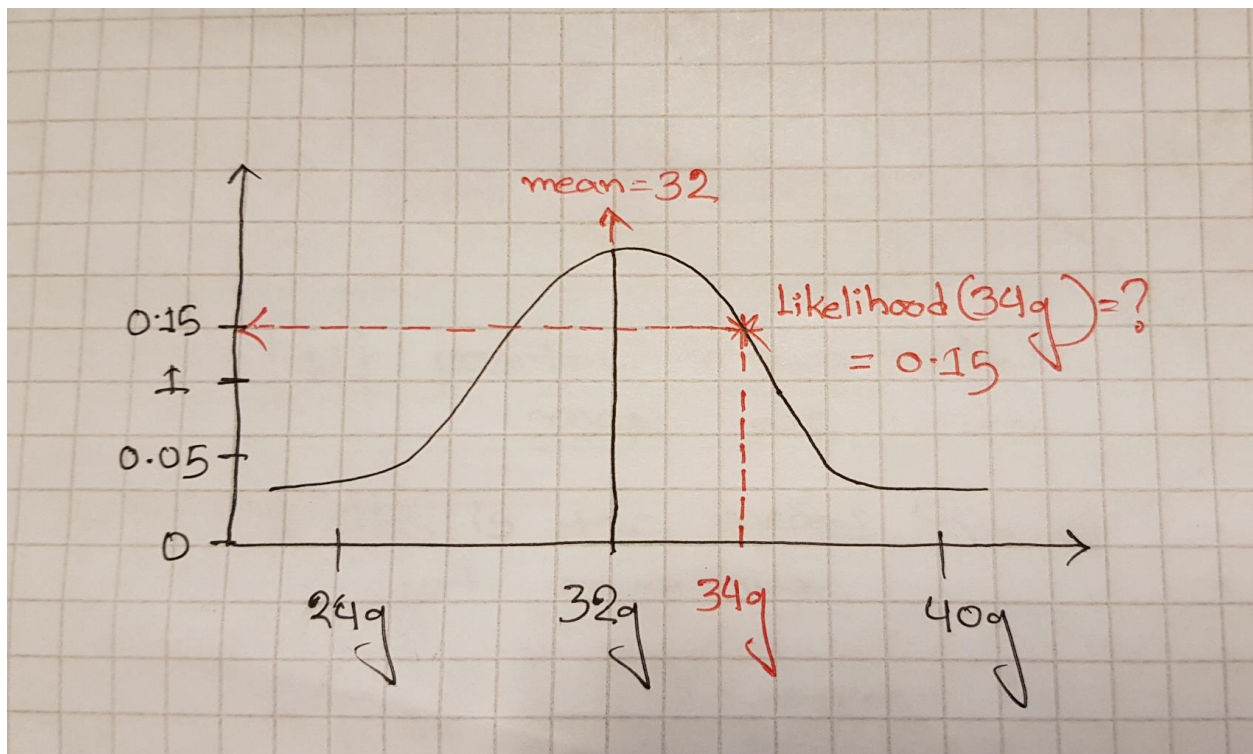
What is the likelihood of a mouse being 34 gram?

To calculate this, we have to locate the exact point of 34 gram and the Y-axis value of that point will be the likelihood. Here, let's consider mean is 34 gram and Standard Deviation = 2.5.

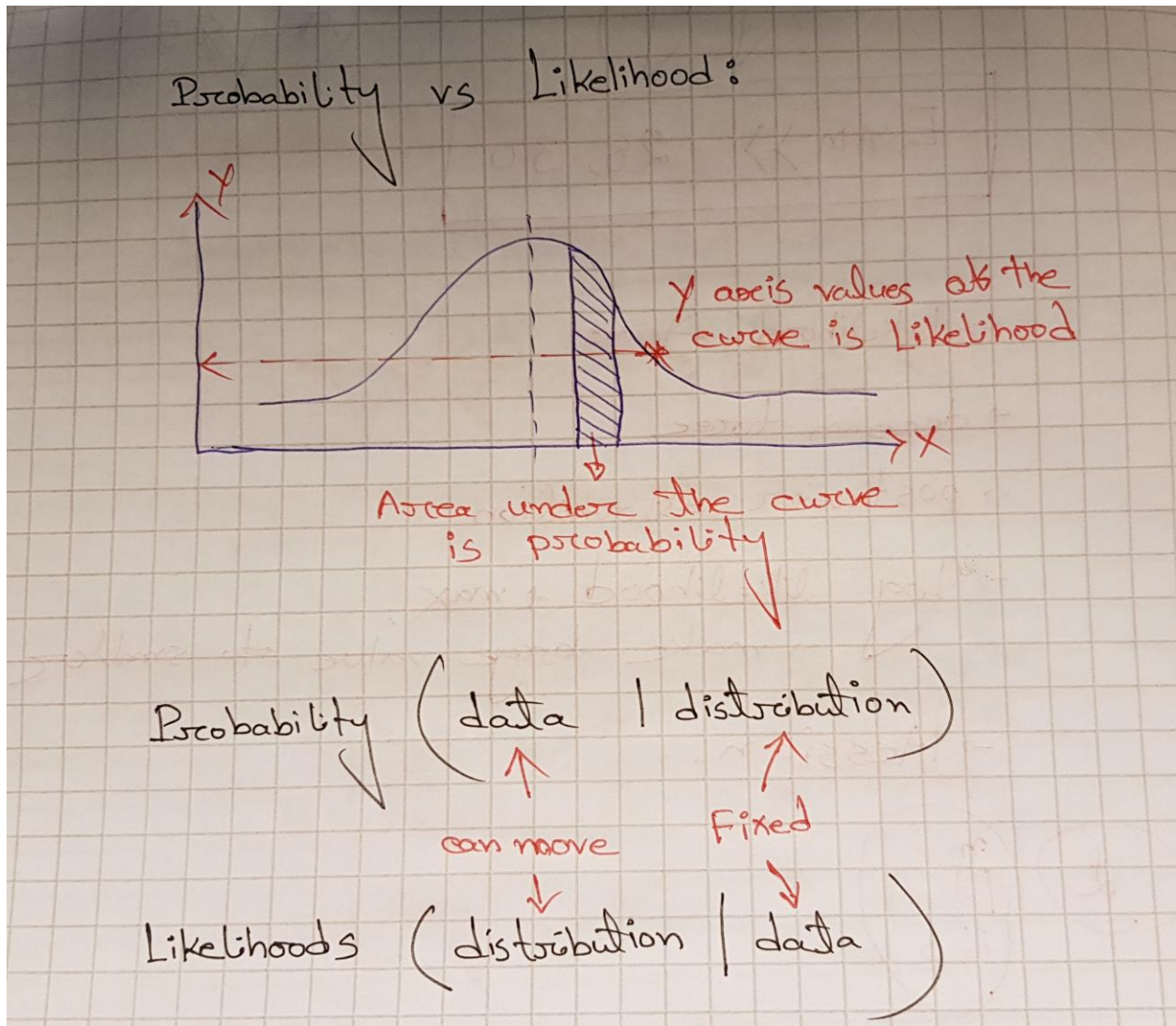
We express it,

$L(\text{mean} = 32 \text{ and Standard Deviation} = 2.5 \mid \text{mouse weighs } 34 \text{ gram})$

= Y-axis value of the curve = 0.15



Probability vs Likelihood:



Likelihood Function:

Likelihood function:

different definition have:

→ discrete } probability
→ continuous } distribution

Discrete probability distribution:

$$L(\theta | x) = P_{\theta}(x) = P_{\theta}(X=x)$$

Here, θ = parameter

x = outcome

X = random variable

p = probability mass function

L = likelihood

Example : [coin flip]

probability range : 0 to 1

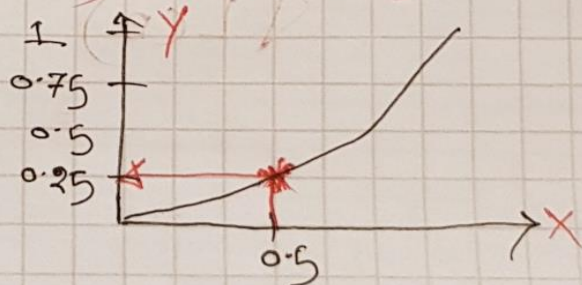
" of getting head : $P_H = 0.5$

Probability of getting 2 Head :

$$P(HH | P_H = 0.5) = 0.5^2 = 0.25$$

Likelihood,

$$L(P_H = 0.5 | HH) = 0.25$$



Continuous Probability Distribution:

$$l(\theta | x) = \log(\pi(x))$$

Here,

X = random variable

x = outcome of X

θ = parameter

$P(\text{Data} | \text{Parameters})$

is:

$P(\text{Parameters} | \text{Data})$ called posterior

Log likelihood: \rightarrow expressed by $\log l$.

Probability distribution is often exponential, so logarithmic transformation makes it convenient to work, which is called log-likelihood function.

$$\begin{aligned} \log \frac{L(A)}{L(B)} &= \log L(A) - \log L(B) \\ &= l(A) - l(B) \end{aligned}$$