## **Model**

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### **A Simple Deep Neural Network**

How to build complex functions using Deep Neural Networks

1. Consider the previously used example of mobile phone like/dislike predictor with the variables Screen-size and Cost. It has a complex decision boundary as shown here
2. With a single sigmoid neuron, it is impossible to obtain this shape, regardless of how we vary the parameters w & b, as the sigmoid neuron can only produce a shape ranging from s-shaped to flat. The formula is

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| **Sigmoid decision boundary, can range from s-shaped to flat, based on w and b values** | |
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1. Now, let us consider a Deep Neural Network for the same mobile phone like/dislike predictor
2. Breaking down the model:
   1. x1 = Screen-Size, x2 = Cost
   2. First Neuron *h1 = f1(x1,x2)* or
      1. Here, w11 and w12 are the weights of x1 and x2 corresponding to the first neuron h1
      2. b11 is the corresponding bias
   3. Second Neuron *h2 = f2(x1,x2)* or
      1. Here, w13 and w14 are the weights of x1 and x2 corresponding to the second neuron h2
      2. b12 is the corresponding bias
   4. Output Neuron *ŷ = g(h1,h2)* or
      1. Here, w21 and w22 are the weights of h1 and h2 corresponding to the output neuron ŷ
      2. b21 is the corresponding bias
   5. From this configuration, we have 9 parameters (w11,w12,w13,w14,w21,w22, b1, b2, b3), which allow for a much more complex decision boundary than a single sigmoid neuron with 3 parameters
3. The output would look something like this

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| **Deep Neural Network Decision Boundary, more complex than a single sigmoid neuron.** | |
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| \* This simple neural network already allows for a much better decision boundary than with a single sigmoid neuron | |

1. The next step would be figuring out how to choose the best configuration of the DNN for our task, this is called **Hyperparameter Tuning.**
2. For now, we can rest easy knowing that by the **Universal Approximation Theorem** we will be able to approximate any kind of function with our Neural Network