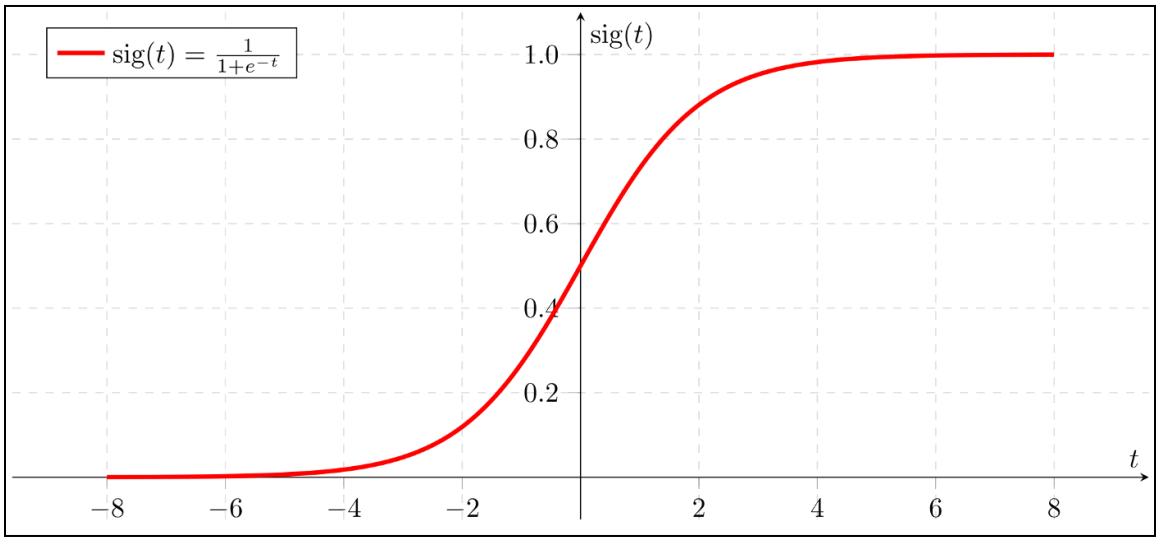
6.

a.

1. Function: Sigmoid Function
   Equation:

$$S(x) = \frac{1}{1 + e^{-x}}$$

Graph:



Justification:

Range:
In the above equation, substituting extreme values, -∞ and +∞.
-∞:
As we substitute -∞ in the equation, we see that the equation e^(∞) , according to its graph, tends to +∞. Therefore the sigmoid function tends towards 0.
+∞:
Upon substituting the +∞ in the equation, we see that the equation e^(-∞) tends towards 0. Therefore the sigmoid function tends towards 1.

Thus, we can conclude that as the extreme unbounded values get compromised between, [0,1], the range is justified.

Monotonic:
Upon differentiating the equation of the sigmoid function, we see that the equation formed is: $e^{(-x)}/(1+e^{(-x)})^2$.

In this we can observe that the numerator and denominator always stay in the positive range, thus it always stays positive and therefore is monotonically increasing.

2. Min Max Normalization
This type of normalization helps in reducing the size of the range, the formula used for the same is: (X - Xmin)/(Xmax - Xmin). By using this we can keep the data in the considerable range of [-1,1]. As we are provided with the ranges as well as the mean and median.

b.

1. Method used: Distributed Word Vector

   Justification:
   Distributed word vector takes in consideration of all the words provided in the sentence, thus providing a much deeper meaning of the sentiment compared to one hot encoding in a given sentence.

   Example:
   Sentence: “I expected the shirt to be good, but it did not match my expectations.”

   One-Hot Encoding:
   Suppose the vector in this situation, the one hot encoding will utilize the words as individuals and take only the meaning of the words, and not what they convey in the sentence. Thus in this case, “good” will be taken as a positive feedback, which is not the actual case.
   Distributed Word Vector:
   In this situation all the words in the sentence will have some meaning contributing to the sentence, hence, “not” as well as “good” will contribute values to the deduction of the feedback. Hence, it would more likely give negative feedback.

2. Method used: Distribution Word Vector

   Justification:
   This method utilizes the meaning from the sentence, hence drawing a semantic meaning amongst different words in a more efficient way. Hence including this technique to find antonyms and synonyms in the sentence, will help in finding it more efficiently as it will draw semantic relationship between all the different words in the sentence