M3-L1 Problem 1 (6 points)

In [5]:

```
import numpy as np
import matplotlib.pyplot as plt
```

Sigmoid function

Define a function, `sigmoid(h)` , which computes and returns the sigmoid $g(h)$ given an input `h` . Recall the mathematical formulation of sigmoid:

$$g(h) = \frac{1}{1 + e^{-h}}$$

In [6]:

```
def sigmoid(h):
    # YOUR CODE GOES HERE
    return 1/(1 + np.exp(-h))
```

Transformation function

In logistic regression, we transform the input before applying the sigmoid function. This transformation can take many forms, but here let's define a function `transform_quadratic(x,w)` that takes in an input `x` , and a weight vector `w` , and returns the sum $w_0 \cdot 1 + w_1 \cdot x + w_2 \cdot x^2$.

In [7]:

```
def transform_quadratic(x, w):
    # YOUR CODE GOES HERE

    return w@np.array([1,x,x**2])
```

Example

Now, we will use both `sigmoid()` and `transform_quadratic()` in a logistic regression context.

Suppose a logistic regression model states that:
[Math Processing Error] for $g(h)$ the sigmoid function and $w = [4, -3, 2]$.

Use the functions you wrote to compute $P(y = 1 \mid x = 1.2)$ and $P(y = 1 \mid x = 7)$. Print these probabilities.

In [8]:

```
w = [4,-3,2]
for x in [1.2, 7.]:
    P = sigmoid(transform_quadratic(x,w))
    print(f"x = {x:3} --> P(y=1) = {P}")
```

```
x = 1.2 --> P(y=1) = 0.9637362836253517
x = 7.0 --> P(y=1) = 1.0
```

In [ ]: