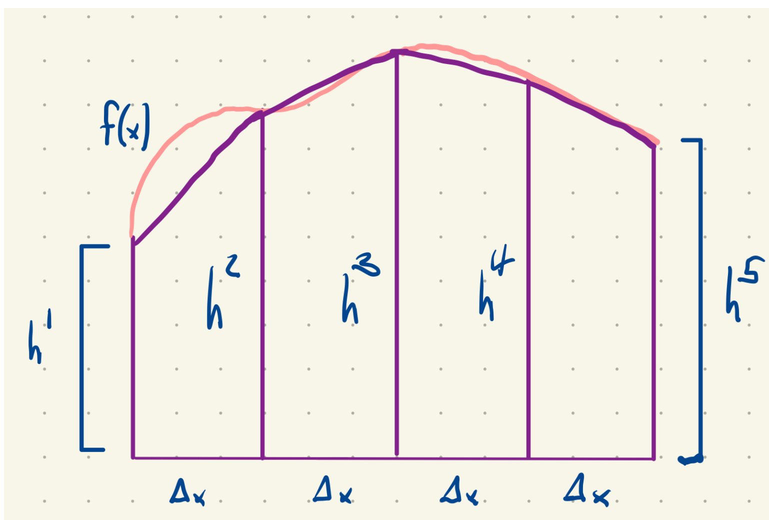
Name:

1. (4 points) The vector x has length 30 and each entry is either a 1 or a 0. Using an inner product, along with vector notation, write down a tidy little expression that equals the total number of ones in x.

$$\boxed{1_{30}^T x}$$

2. (6 points) Recall the trapezoid rule for integrating functions, as in the figure below, where the integral is estimated using areas of trapezoids. The area of a trapezoid with width w and heights h_1 and h_2 is $w(h_1 + h_2)/2$.



Let $h = (h_1, \cdots, h_5)$ be the vector of heights in the figure, and assume that $\Delta x = 1/4$. Express the sum of the area of the trapezoids in the form $c^T h$. That is, find the vector c. A complete answer expresses c as a vector of 5 explicit numbers.

Area: $\frac{\Delta x}{2}(h_1+h_2) + \frac{\Delta x}{2}(h_2+h_3) + \frac{\Delta x}{2}(h_3+h_4) + \frac{\Delta x}{2}(h_4+h_5)$

$= \frac{\Delta x}{2}\left[h_1 + 2h_2 + 2h_3 + 2h_4 + h_5 \right]$

$= \frac{1}{8}(1,2,2,2,1)^T h$

$$\boxed{c = (1/8, 1/4, 1/4, 1/4, 1/8)}$$