Numerical Integration

In class, we found a trapedoidal approximation for $\int_1^2 \frac{1}{x}dx$ using n=4 trapezoids. We got an error bound $|E_T| \leq \frac{1}{96}$

How big would we have to take n to ensure that the error is less than 10^{-4}? Remember: $|E_T| \leq \frac{M(b-a)^3}{12n^2}$ where $|f''(x)| \leq M$ on the interval.

You've designed a robot that collects samples on the moon. Normally, you track its location in real time- but interference from a solar flare prevented you from receiving your robot's transmissions for some time. Fortunately, your robot is also designed to record his speed every minute (for a separate study about how difficult it is to travel on the moon.), and log what time he takes samples. The list below describes his speed at each minute, measured in mph. It's essential for your experiments that you know how many miles apart the samples were taken. You can assume that the robot always moves forward.

01:49 Sample 1 collected
01:50 0 mph
01:51 0 mph
01:52 20 mph
01:53 30 mph
01:54 45 mph
01:55 40 mph
01:56 15 mph
01:57 20 mph
01:58 12 mph
01:59 23 mph
02:00 0 mph
02:01 Sample 2 collected.

Estimate the distance as best you can using the trapezoidal rule. Show your work.

Draw a parabola with vertex $(0, y_1)$passing through the points $(-h, y_0)$, and (h, y_2). Let this parabola be described by $y = Ax^2 + Bx + C$.

1) Assuming $y_0, y_1, y_2 > 0$, find the area between the parabola and the x-axis in terms of A,B,C, and h. Simplify as much as possible.

2) Set $x = 0$ in the equation of the parabola to find y_1 in terms of A,B,C

3) Write equations for y_0 and y_2 in terms of A,B,C, and h

4) Use your answers to part (2) and part (3) to write equations for $y_0 - y_1$ and $y_2 - y_1$. Add these equations and solve for $2Ah^2$

5) Rewrite your answer to part (1) in terms of y_0, y_1, y_2 and h