

1. [11 points] At a recent UM football game, a football scientist was measuring the excitement density,  $E(x)$ , in cheers per foot, in a one hundred foot row of the football stadium where  $x$  is the distance in feet from the beginning of the row. He took measurements every twenty feet and the data is recorded in this table.

$x$	0	20	40	60	80	100
$E(x)$	30	24	19	16	13	7

Assume for this problem that  $E(x)$  is a decreasing function for  $0 \leq x \leq 100$ .

- a. [6 points] Write a right sum and a left sum which approximate the total cheers in the row. Be sure to write all of the terms for each sum.

- b. [2 points] Indicate whether the right and left sums are overestimates or underestimates for the total number of cheers in the row.

The right sum is an      **overestimate**      **underestimate**

The left sum is an      **overestimate**      **underestimate**

- c. [3 points] How many measurements must the scientist take to guarantee that the left sum approximates the total number of cheers in the row within 5 cheers of the actual number?