

5. (16 points) Use the information given in the table below to calculate the indicated values. If a value cannot be determined, state explicitly what is missing. Assume that  $f$  and  $f'$  are continuous, and that the table is reflective of the behavior of  $f$ .

$x$	0	3	6	9	12
$f(x)$	30	20	13	8	5
$f'(x)$	-4	-3	-2	-1.5	-0.5

Determine the following and show your work (3 points each):

- (a) an approximate value for  $f(3.1)$  using a local linearization

- (b) a left-hand sum with 4 subdivisions to approximate  $\int_0^{12} f(x)dx$

- (c) the least number of subdivisions necessary to assure that the left- and right-hand approximations of  $\int_0^{12} f(x)dx$  agree to within 1 unit

- (d)  $\int_3^{12} f'(x)dx$

Explain your answers to the following (2 points each):

- (e) Do you expect your approximation for  $f(3.1)$  from part (a) to be an overestimate or an underestimate?

- (f) Do you expect your left-hand approximation from part (b) to be an overestimate or an underestimate?