Step 5A ***Graphical Method.*** We now show how to construct Table WE7-2.2. The derivative $(-dC_A/dt)$ is determined by calculating and plotting $(-\Delta C_A/\Delta t)$ as a function of time, t, and then using the equal-area differentiation technique (Appendix A.2) to determine $(-dC_A/dt)$ as a function of C_A. First, we calculate the ratio $(-\Delta C_A/\Delta t)$ from the first two columns of Table WE7-2.2; the result is written in the third column.

We use numerical differentiation to help identify inconsistencies in the data.

TABLE WE7-2.2 PROCESSED DATA

t (min)	$C_A \times 10^3$ (mol/dm^3)	$-\frac{\Delta C_A}{\Delta t} \times 10^4$ (mol/dm^3 · min)	$-\frac{dC_A}{dt} \times 10^4$ (mol/dm^3 · min)
0	50		3.0
		2.40†	
50	38		1.86
		1.48	
100	30.6		1.2
		1.00	
150	25.6		0.8
		0.68	
200	22.2		0.5
		0.54	
250	19.5		0.47
		0.42	
300	17.4		

† $-\frac{\Delta C_A}{\Delta t} = -\frac{C_{A2} - C_{A1}}{t_2 - t_1} = -\left(\frac{38 - 50}{50 - 0}\right) \times 10^{-3} = 0.24 \times 10^{-3} = 2.4 \times 10^{-4} (\text{mol/dm}^3 \cdot \text{min})$

Next, we use Table WE7-2.2 to plot the third column as a function of the first column in Figure WE7-1.1 [i.e., $(-\Delta C_A/\Delta t)$ vs. t]. Using equal-area differentiation, the value of $(-dC_A/dt)$ is read off the figure (represented by the arrows); then it is used to complete the fourth column of Table WE7-2.2.

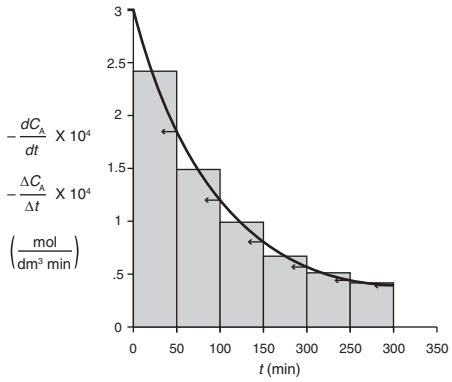

Figure WE7-2.1 Graphical differentiation.

The results to find $(-dC_A/dt)$ at each time, t, and concentration, C_A, are summarized in Table WE7-2.2.