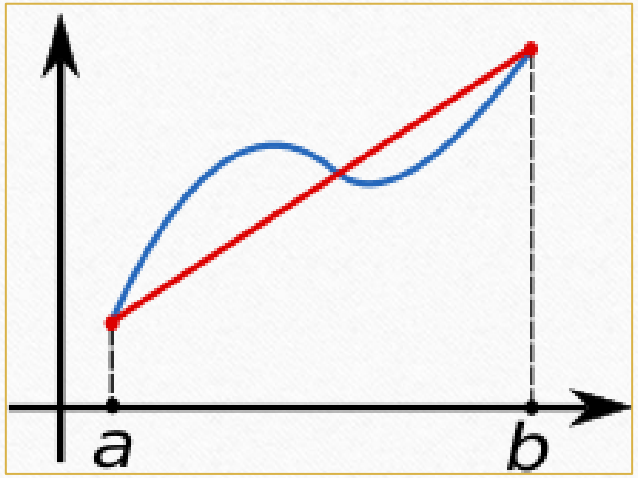
Lab.3

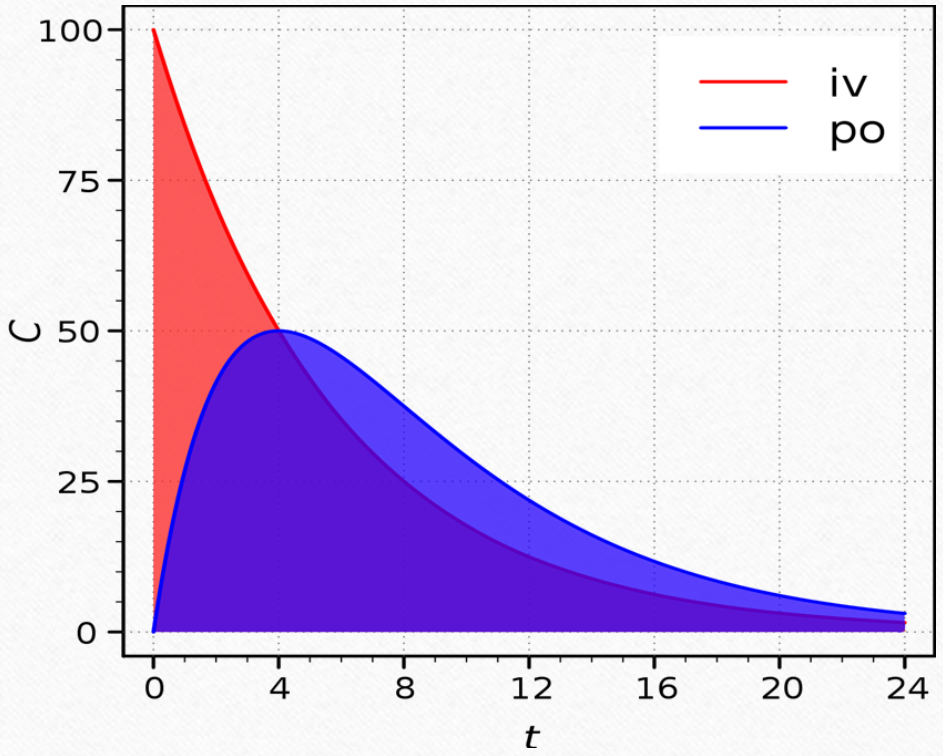
AUC CALCULATION- IV

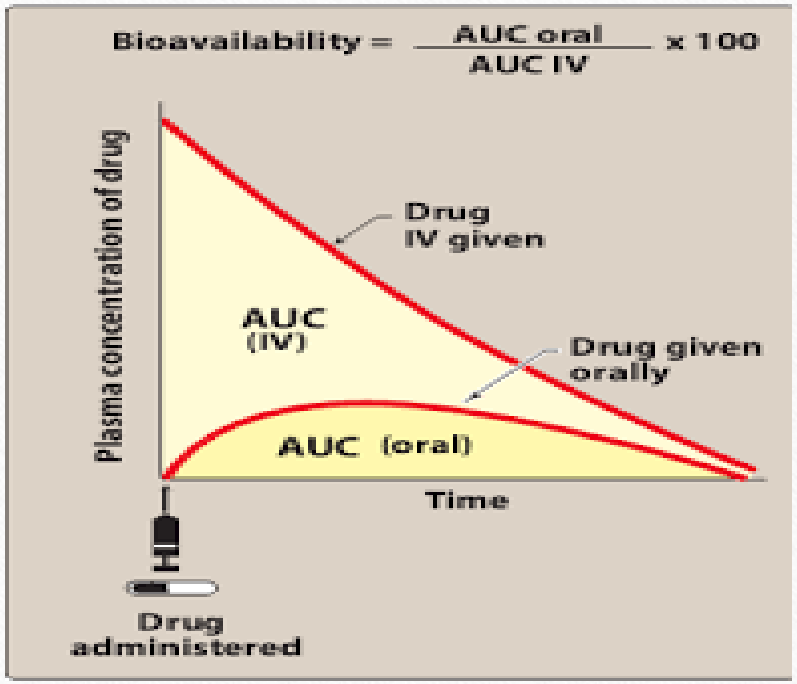
What is AUC?

- **Area under the conc. curve** (AUC) is **a measure of the total systemic exposure** of a drug.
- **In practice**, the **drug concentration** is measured at certain discrete points in **time** and the **trapezoidal rule** is used to estimate AUC.

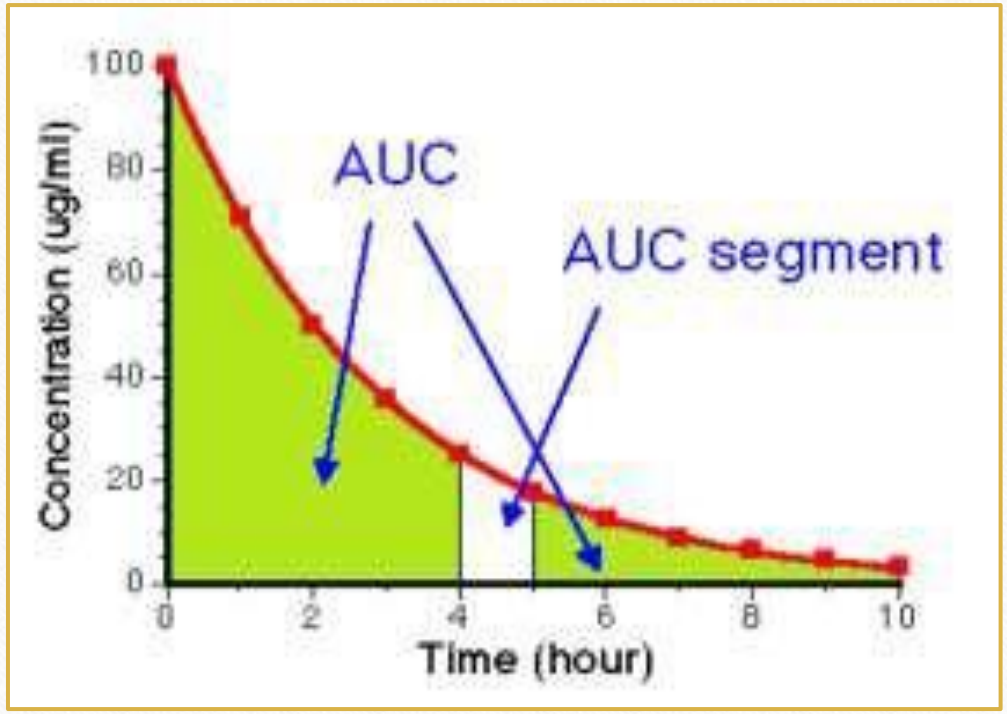


IV versus Oral

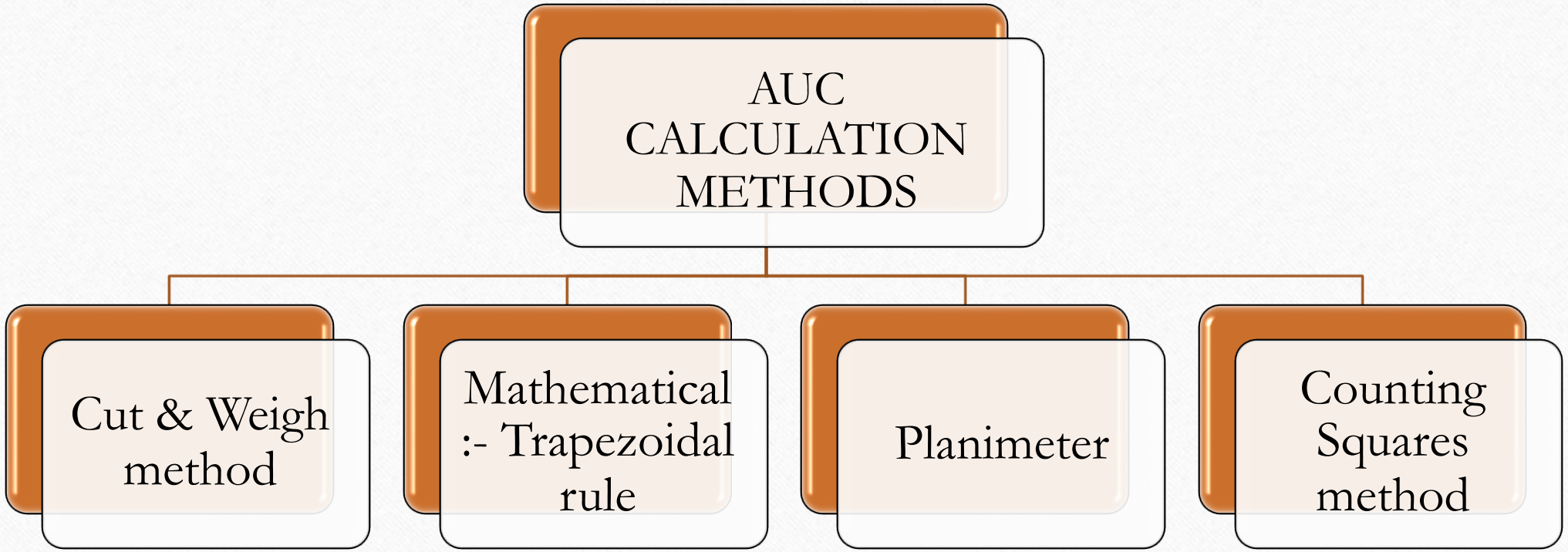




Area Under Plasma Concentration-Time linear Curve :



Calculation of AUC



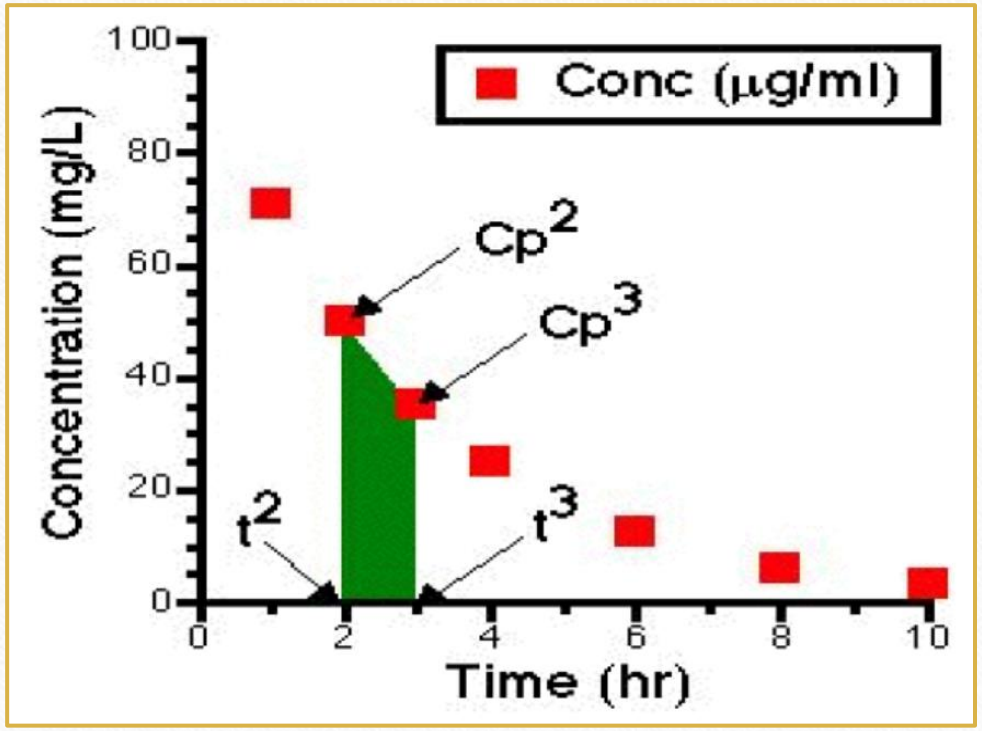
Trapezoidal rule

Trapezoid

Is four sided figure with two parallel sides

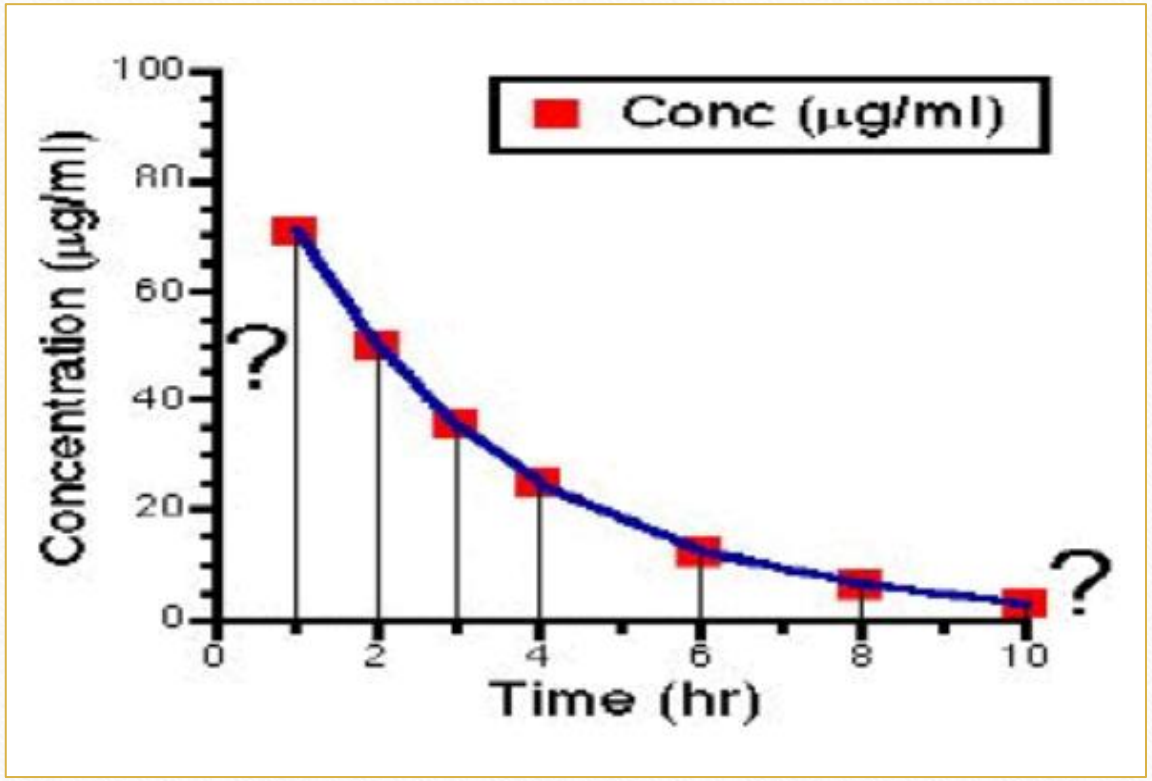
Steps

- ✓ Dividing whole AUC into trapezoidal segments
- ✓ Counting the area of each segments separately
- ✓ Summation of all the area to get the Total area



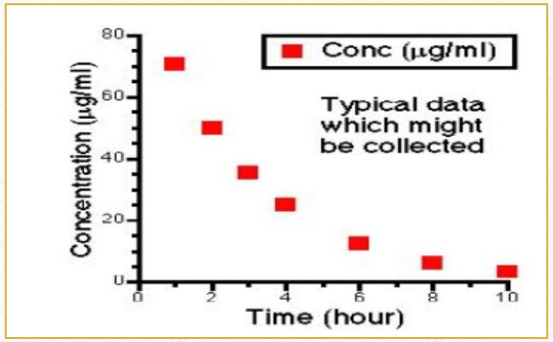
Types of AUC

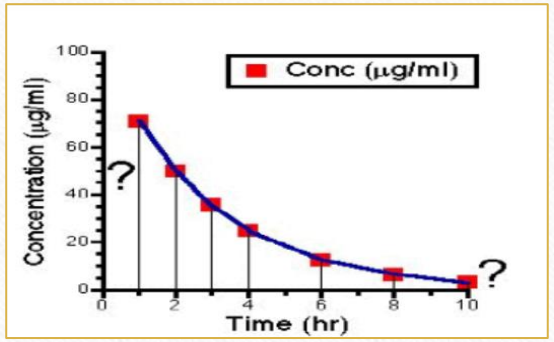
- AUC 1
- AUC t
- AUC last
- AUC ∞

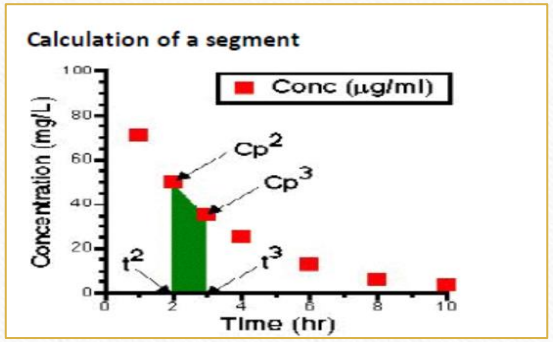


Trapezoidal rule

- **We can calculate the AUC of each segment if we consider the segments to be trapezoids**







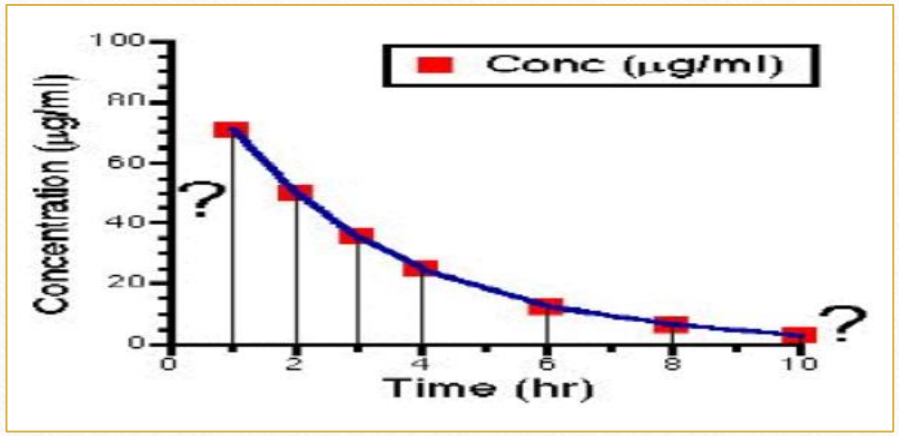
$$AUC_{2\text{-}3} = \frac{Cp2 + Cp3}{2} \times (t3 - t2)$$

Calculation of first & last Segment

- **The first segment** can be calculated after determining **the zero plasma concentration Cp0 by extrapolation**, while **Final segment** can be **calculated from t last to t infinity**.

$$AUC_{0-1} = \frac{Cp_0 + Cp_1}{2} \times t_1$$

$$AUC_{t_{last}-\infty} = \int_{t=t_{last}}^{t=\infty} Cp \bullet dt = \frac{Cp_{last}}{kel}$$



Total AUC

Total AUC

$$AUC_{0-\infty} = AUC_{0-1} + AUC_{1-last} + AUC_{last-\infty}$$

$$= \frac{Cp_0 + Cp_1}{2} \bullet t_1 + \frac{Cp_1 + Cp_2}{2} \bullet (t_2 - t_1)$$

$$+ \frac{Cp_2 + Cp_3}{2} \bullet (t_3 - t_2) + \ldots + \frac{Cp_{last}}{kel}$$

Practice Example

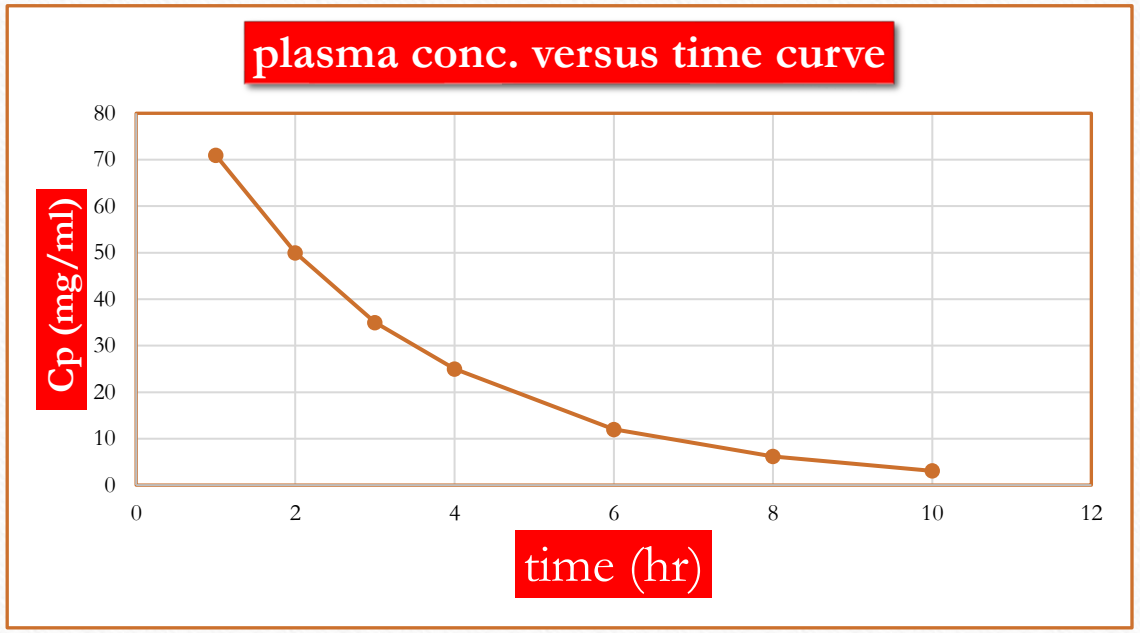
A single intravenous dose of an antibiotic was administered to a 50-kg woman at a dose level of 20 mg/kg. Samples of blood were removed periodically and assayed for parent drug. The following data were obtained:

Time (hr)	Conc. (mg / L)
1	71
2	50
3	35
4	25
6	12
8	6.2
10	3.1

Using the data in the preceding problem, determine the AUC infinity?

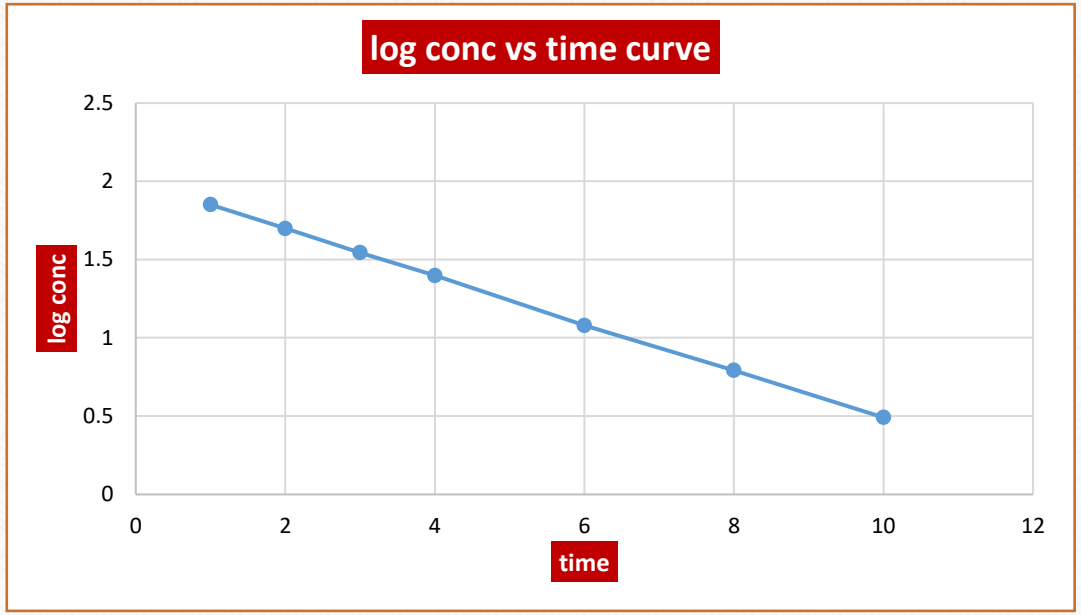
Example solution

Time (hr)	Conc. (mg / L)
1	71
2	50
3	35
4	25
6	12
8	6.2
10	3.1



Step1 C_{p0} calculation:

Time (hr)	Conc. (mg / L)	log conc.
0	?(100)	2 (from curve)
1	71	1.851258349
2	50	1.698970004
3	35	1.544068044
4	25	1.397940009
6	12	1.079181246
8	6.2	0.792391689
10	3.1	0.491361694



From extrapolation the y intercept is 2 which represent the log conc. At zero time so conc. At zero time is 100 (to convert log to number we take the ln 2)

Step2 AUC_t calculation:

Time (hr)	Conc. (mg / L)	log conc.	AUC	
0	100	2		
1	71	1.851258349	85.5	AUC1
2	50	1.698970004	60.5	AUC2
3	35	1.544068044	42.5	AUC3
4	25	1.397940009	30	AUC4
6	12	1.079181246	37	AUC5
8	6.2	0.792391689	18.2	AUC6
10	3.1	0.491361694	?	AUC last

Step3 AUC_{last} calculation:

1. $AUC_{last} = \frac{C_{P_{Last}}}{k_e}$
2. $ke = -2,303 * slope$
3. $slope = -[\log(conc\ last) - \log conc\ (last - 1)] / [T(last)-T(last-1)]$

So slope=- 0.15,

Ke= -2.303* -0.15 = 0.346

Then AUC last = 8.94

Step3 AUC_{last} calculation:

Time (hr)	Conc. (mg / L)	log conc.	AUC	
0	100	2		
1	71	1.851258349	85.5	AUC1
2	50	1.698970004	60.5	AUC2
3	35	1.544068044	42.5	AUC3
4	25	1.397940009	30	AUC4
6	12	1.079181246	37	AUC5
8	6.2	0.792391689	18.2	AUC6
10	3.1	0.491361694	8.943098	AUC last

Step4 AUC_{inf} calculation:

Total AUC

$$AUC_{0-\infty} = AUC_{0-1} + AUC_{1-last} + AUC_{last-\infty}$$

$$= \frac{Cp_0 + Cp_1}{2} \bullet t_1 + \frac{Cp_1 + Cp_2}{2} \bullet (t_2 - t_1)$$

$$+ \frac{Cp_2 + Cp_3}{2} \bullet (t_3 - t_2) + \ldots + \frac{Cp_{last}}{kel}$$

Step3 AUC_{inf} calculation:

Time (hr)	Conc. (mg / L)	log conc.	AUC	
0	100	2		
1	71	1.851258349	85.5	AUC1
2	50	1.698970004	60.5	AUC2
3	35	1.544068044	42.5	AUC3
4	25	1.397940009	30	AUC4
6	12	1.079181246	37	AUC5
8	6.2	0.792391689	18.2	AUC6
10	3.1	0.491361694	8.943098	AUC last
AUC TOTAL			282.6431	

Thank you for your attention