

LC 2017 (SET A): PAPER 1

QUESTION 4 (25 MARKS)

Question 4 (a)

Day	1	2	3	4
Percentage of substance (%)	95	42.75	19.2375	8.6569

METHOD 1:

$$a = 95, r = \frac{42.75}{95} = \frac{9}{20} = 0.45$$

$$T_n = ar^{n-1} = 95 \times 0.45^{n-1}$$

$$T_n = 0.01 \Rightarrow 95 \times 0.45^{n-1} = 0.01$$

$$0.45^{n-1} = \frac{0.01}{95}$$

$$\log_{10} 0.45^{n-1} = \log_{10} \left(\frac{0.01}{95} \right)$$

$$(n-1) \log_{10} 0.45 = \log_{10} \left(\frac{0.01}{95} \right)$$

$$n = \frac{\log_{10} \left(\frac{0.01}{95} \right)}{\log_{10} 0.45} + 1 = 12.47$$

Answer: 13th day

METHOD 2:

$$P = ka^t$$

$$t = 1: 95 = ka^1 = ka \dots (1)$$

$$t = 2: 42.75 = ka^2 \dots (2)$$

$$(2) \div (1): \frac{ka^2}{ka} = \frac{42.75}{95} \Rightarrow a = 0.45$$

$$\text{Into (1): } k \times 0.45 = 95 \Rightarrow k = \frac{95}{0.45} = \frac{1900}{9}$$

$$P = ka^t = \frac{1900}{9} \times 0.45^t = 0.01$$

$$0.45^t = \frac{0.09}{1900}$$

$$\log_{10} 0.45^t = \log_{10} \left(\frac{0.09}{1900} \right)$$

$$t \log_{10} 0.45 = \log_{10} \left(\frac{0.09}{1900} \right)$$

$$t = \frac{\log_{10} \left(\frac{0.09}{1900} \right)}{\log_{10} 0.45} = 12.47$$

Answer: 13th day

Question 4 (b)

Perimeter of first square = $4 \times 2 = 8$ cm

Perimeter of second square = $4 \times \sqrt{2} = 4\sqrt{2}$ cm

Perimeter of third square = $4 \times 1 = 4$ cm

Sum $S = 8 + 4\sqrt{2} + 4 + \dots$

$$a = 8, r = \frac{4\sqrt{2}}{8} = \frac{\sqrt{2}}{2}$$

$$S_{\infty} = \frac{a}{1-r} = \frac{8}{1-\frac{\sqrt{2}}{2}} = (16 + 8\sqrt{2}) \text{ cm}$$

