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Assignment (iv)

~~It is~~

Bacteria triples in population every 9 hours
Therefore it is a growth problem
∴ we have

$$\frac{dy}{dt} = ky$$

Separating variables we have

$$\int \frac{1}{y}\,dy = \int k\,dt$$

$$\ln y = kt$$

$$\therefore y = e^{kt}$$

Initial numbers of bacteria are
Case A = 50
Case B = 150
It is an Initial value problem ∴

$$y = 50e^{kt} \rightarrow \text{case A}$$

$$y = 150e^{kt} \rightarrow \text{case B}$$

Since it triples every 9 hours

Case A
at 0 hr

$$y = 50e^{k(0)} \quad \therefore y = 50$$

then

$$3 \times 50 = 50e^{k(9)}$$

$$150 = 50e^{9k}$$

$$3 = e^{9k}$$

$$\ln 3 = 9k$$

$$k = \frac{\ln 3}{9} = 0.12207$$

Case B

at 0hr

$y = 150e^{k(0)}$

$y = 150$

then

$3 \times 150 = 150e^{k9}$

$450 = 150e^{k9}$

$\ln 3 = 9k$

$k = \frac{\ln 3}{9} = 0.12207$

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CASE 1

$$k := \frac{\ln(3)}{9}$$

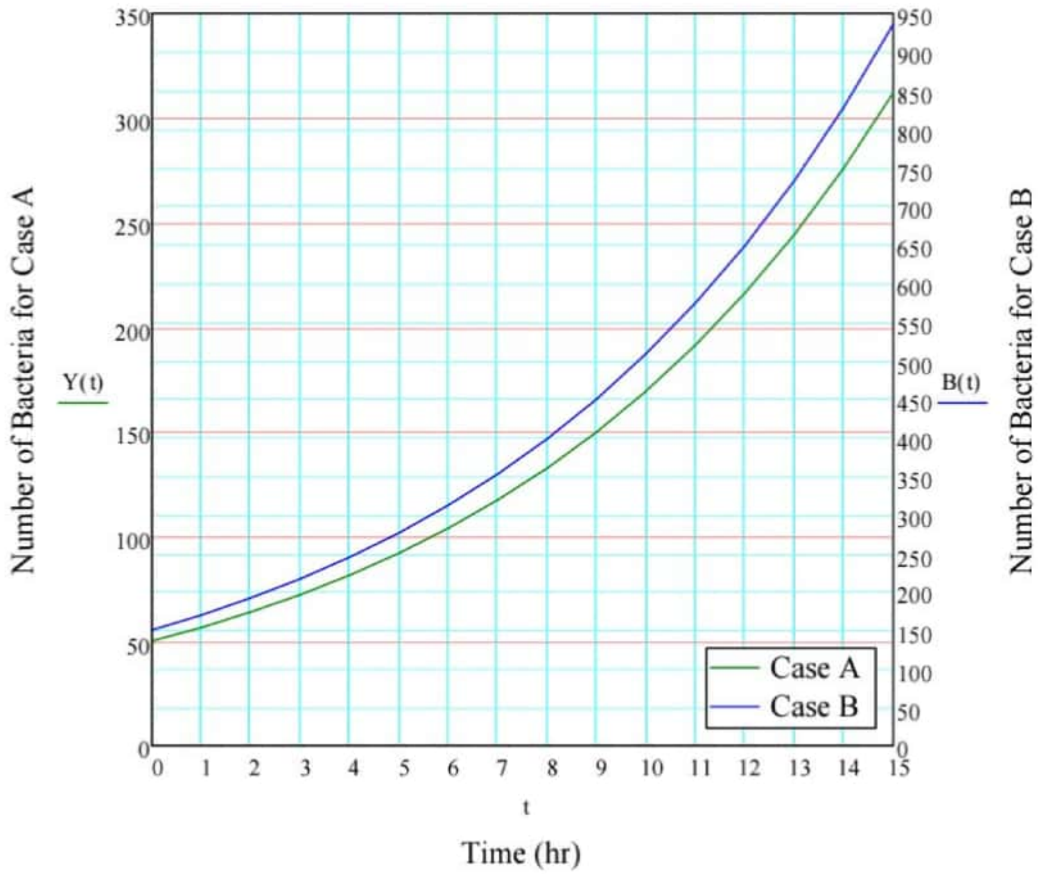
$$Y(t) := 50e^{k \cdot t}$$

CASE 2

$$B(t) := 150e^{k \cdot t}$$

$$t := 0, 1 .. 15$$

t =	Y(t) =	B(t) =
0	50	150
1	56.492	169.475
2	63.826	191.478
3	72.112	216.337
4	81.475	244.425
5	92.053	276.159
6	104.004	312.013
7	117.507	352.521
8	132.763	398.29
9	150	450
10	169.475	508.424
11	191.478	574.433
12	216.337	649.012
13	244.425	733.274
14	276.159	828.476
15	312.013	936.038


Number of Bacteria for Case A
Y(t)
Number of Bacteria for Case B
B(t)
Case A
Case B
t
Time (hr)
0
50
100
150
200
250
300
350
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15