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MATRIC No: 16/ENG04/045
DEPT: ELECT/ELECT
COURSE: ENG 232

ASSIGNMENT 1

1a) For bacteria growth we use

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

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

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

$$\ln y = kt + c$$

$$y = e^{kt+c}$$

$$y = e^{kt} \cdot e^{c}$$

$$y = e^{kt} \cdot c$$

$$y = Ce^{kt}$$

At initial time $t = 0$hr, $y = 20$

$$20 = Ce^{k \cdot 0}$$

$$C = 20$$

At $t = 5$, $y = 2y_0$

$t = 5$, $y = 40$

$$40 = Ce^{k \cdot 5}$$

$$40 = 20 \cdot e^{5k}$$

$$e^{5k} = 2$$

$$5k = \ln 2$$

$$5k = 0.6931$$

$$k = 0.1386$$

$y = 20e^{0.1386t}$ is the required model

(b) At $t = 1\frac{1}{2}$ day

$t = (24 + 12)$ hours

$t = 36$ hours

$y = 20e^{36 \times 0.1386}$

$y = 20 \times 146.8777$

$y = 2937.55$

) At $y = 10$ and $t = 0$

$10 = Ce^{k0}$

$C = 10$

At $t = 5$, $y = 20$

$\therefore 20 = 10e^{5k}$

$e^{5k} = 2$

$5k = \ln 2$

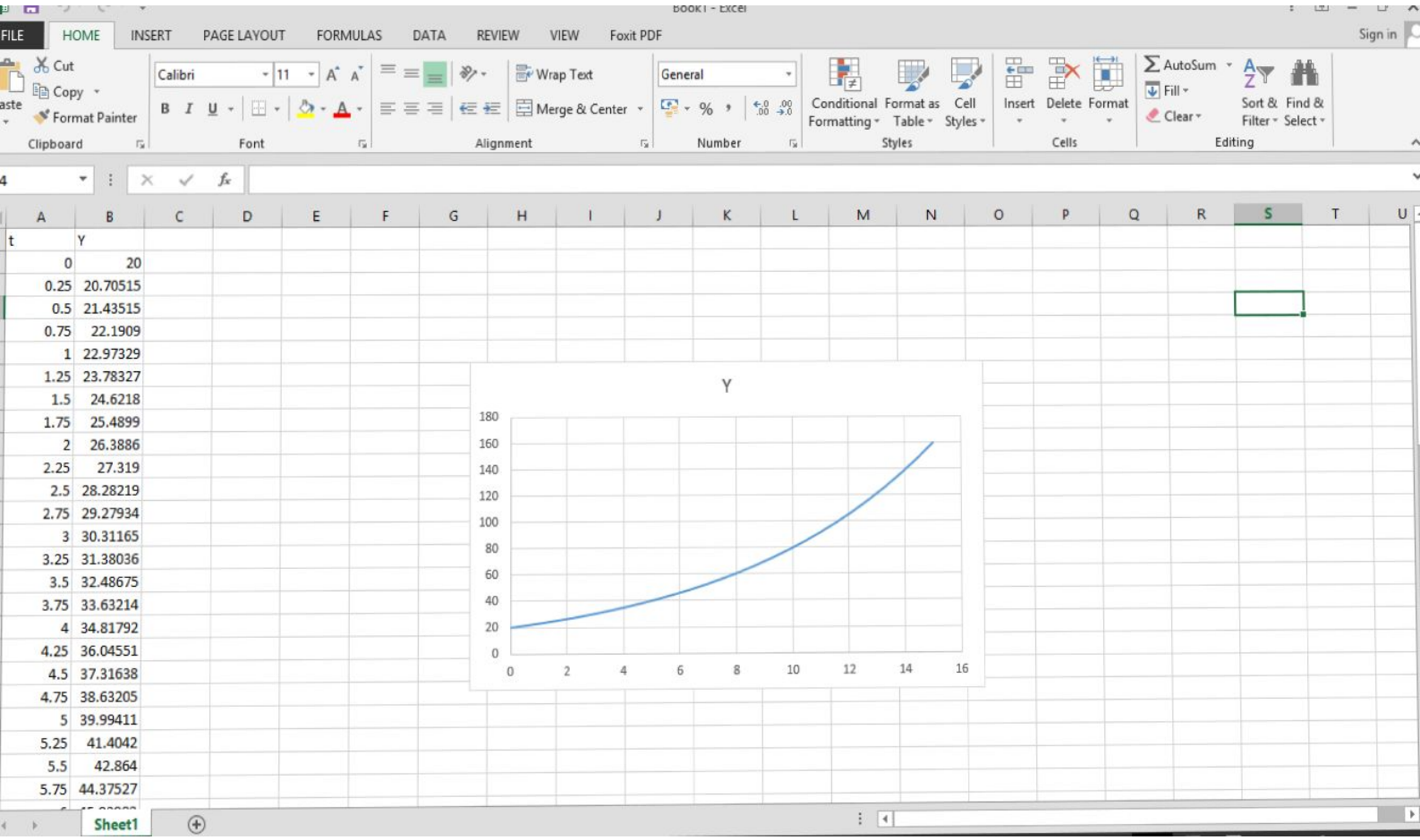
$k = 0.1386$

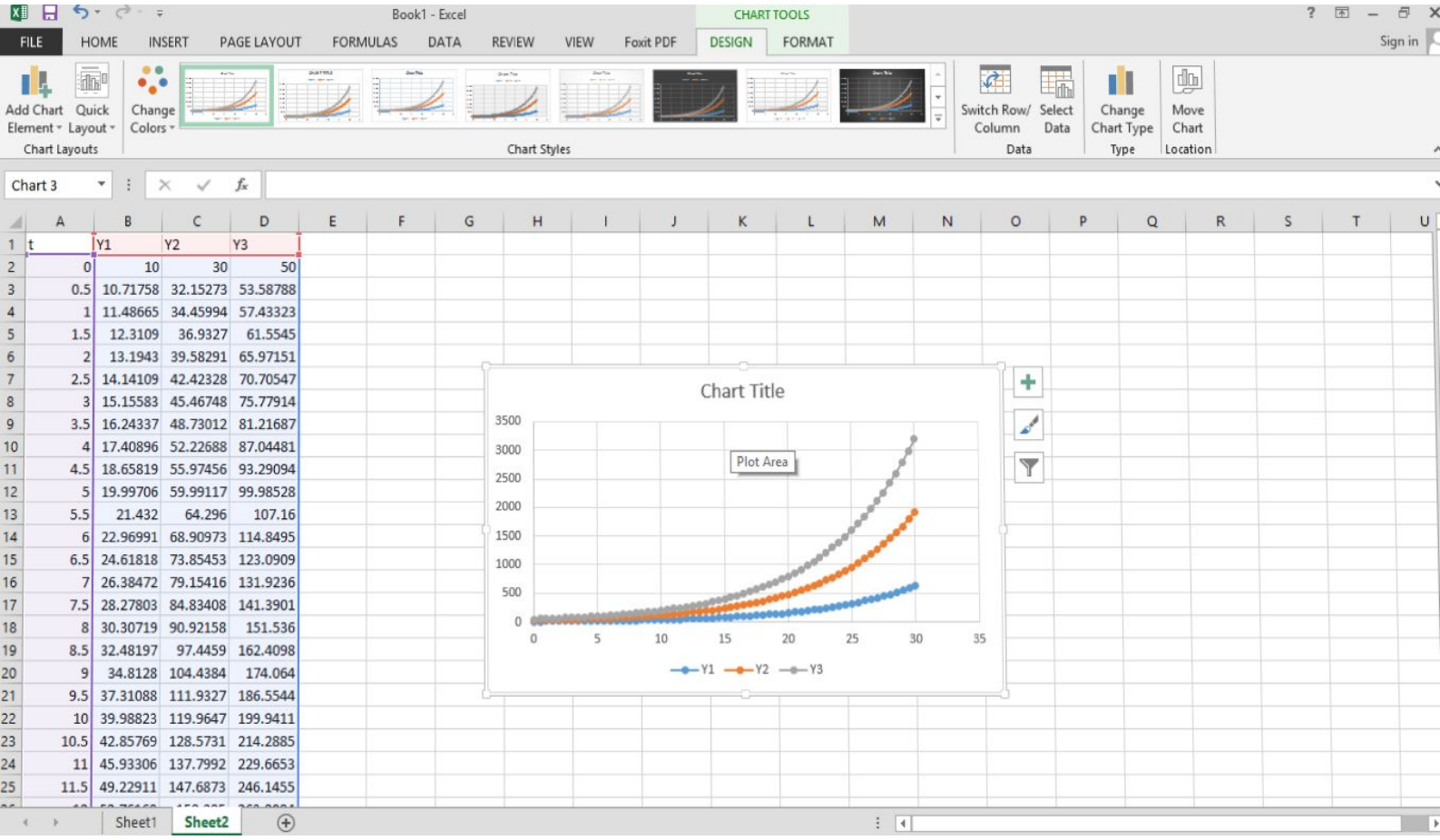
$\therefore$ For initial value = 10, we have $y = 10e^{0.1386t}$

for initial value = 30, we have $y = 30e^{0.1386t}$

for initial Value = 50, we have $y = 50e^{0.1386t}$

The initial amount of bacteria affected the exponential growth of the bacteria. highest initial amount had the highest final amount





t	Y1	Y2	Y3
0	10	30	50
0.5	10.71758	32.15273	53.58788
1	11.48665	34.45994	57.43323
1.5	12.3109	36.9327	61.5545
2	13.1943	39.58291	65.97151
2.5	14.14109	42.42328	70.70547
3	15.15583	45.46748	75.77914
3.5	16.24337	48.73012	81.21687
4	17.40896	52.22688	87.04481
4.5	18.65819	55.97456	93.29094
5	19.99706	59.99117	99.98528
5.5	21.432	64.296	107.16
6	22.96991	68.90973	114.8495
6.5	24.61818	73.85453	123.0909
7	26.38472	79.15416	131.9236
7.5	28.27803	84.83408	141.3901
8	30.30719	90.92158	151.536
8.5	32.48197	97.4459	162.4098
9	34.8128	104.4384	174.064
9.5	37.31088	111.9327	186.5544
10	39.98823	119.9647	199.9411
10.5	42.85769	128.5731	214.2885
11	45.93306	137.7992	229.6653
11.5	49.22911	147.6873	246.1455