Rinit 12/09/23

Lab Report

Name of the Experiment : Period of Oscillation for a Simple Pendulum

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Instructor's comments:

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Table 1. Mass Dependence of the Period

Length of Pendulum, L = 0'60 m $\theta = 5^\circ$

Mass (grams)	A Single Period (sec)			T_{avg} (sec)	T_{avg}^2 (sec²)
13	1.575	1.574	1.565	1.571	2.47
19	1.590	1.597	1.599	1.595	2.54
62	1.581	1.585	1.590	1.585	2.51

Table 2. Angle Dependence of the Period

Mass of Pendulum = 62 grams L = 0.60m

Angle (degrees)	A Single Period (sec)			T_{avg} (sec)	T_{avg}^2 (sec²)
10	1.591	1.592	1.595	1.592	2.53
15	1.622	1.625	1.624	1.623	2.63
20	1.638	1.636	1.640	1.638	2.68
30	1.653	1.655	1.656	1.654	2.73
40	1.678	1.675	1.677	1.676	2.81

Calculation :

Table 1

$$T_{avg} = \frac{T_1 + T_2 + T_3}{3}$$

$$= \frac{1.575 + 1.574 + 1.565}{3}$$

$$= 1.571 \text{ sec}$$

$$T_{avg}^2 = (1.571)^2 = 2.47 \text{ sec}^2$$

Table 2

$$T_{avg} = \frac{T_1 + T_2 + T_3}{3}$$

$$= \frac{1.591 + 1.592 + 1.595}{3}$$

$$= 1.592 \text{ sec}$$

$$T_{avg}^2 = (1.592)^2 = 2.53 \text{ sec}^2$$

Questions:

1. Does the period of a simple pendulum depend on the mass?

No, because as per theory $T_o = 2\pi\sqrt{\frac{L}{g}}$, there is no mass, m in equation. As well as we can see that from graph of T_{avg}^2 vs mass, There is no correlation.

2. Is the period constant over small angles? Does it vary when one reaches larger angles?

Yes the period is constant over small angles. Yes, time period varies greatly in large angles because as per theory $\sin\theta \simeq \theta$ when θ is smaller.

3. Does the period depend on the length of the pendulum?

Yes. The time period depend on the Length of the pendulum as theory states $T_o = 2\pi\sqrt{\frac{L}{g}}$ where L is length, In graph of T_{avg}^2 vs Length we can also see a linear correlation. So, period depend on length.

4. Of the three parameters explored in this experiment, which has the strongest influence?

Length has the strongest influence on time period as its graph has the most correlation than other graphs.

5. Is your best-fit line in form Table-3 goes through the origin? Explain why or explain not?

No, the best fit line do not go through origin because of the relation $L = l + R$ where R is the radius of the spherical mass.
If it were the case $R = 0$ or ~~if we had taken~~ then it would've gone through the origin.

Discussion:

In this experiment, I tried to find the time period of a pendulum setup created with wires, stand, and ~~a~~ spherical mass. The mass was tied with the wire and the wire was tied to the stand. With pendulums harmonic motion, [I evaluated three criteria: Time period's dependence on mass, angle, and length of wire. So, I tried to do the experiment with three times, where only one variable was changed others ~~w~~ were kept same. Then I graphed the T_{avg}^2 vs mass, T_{avg}^2 vs angle, T_{avg}^2 vs length to find and visualize the dependency and correlation between the dependent variable (time period) with respect to independent variable (mass, angle, and length). Then I found that Length gives greater dependency/correlation. Then I ~~find~~ found the T_{avg}^2 vs length graph then using that I calculated $g_{experimental}$ and compared $g_{experimental}$ value with $g_{theoretical}$, that is $9.81 m/s^2$. I found 4.28% percentage error, which is negligible. So, the experiment was a success ~~with~~ and everything went smoothly without any problem.

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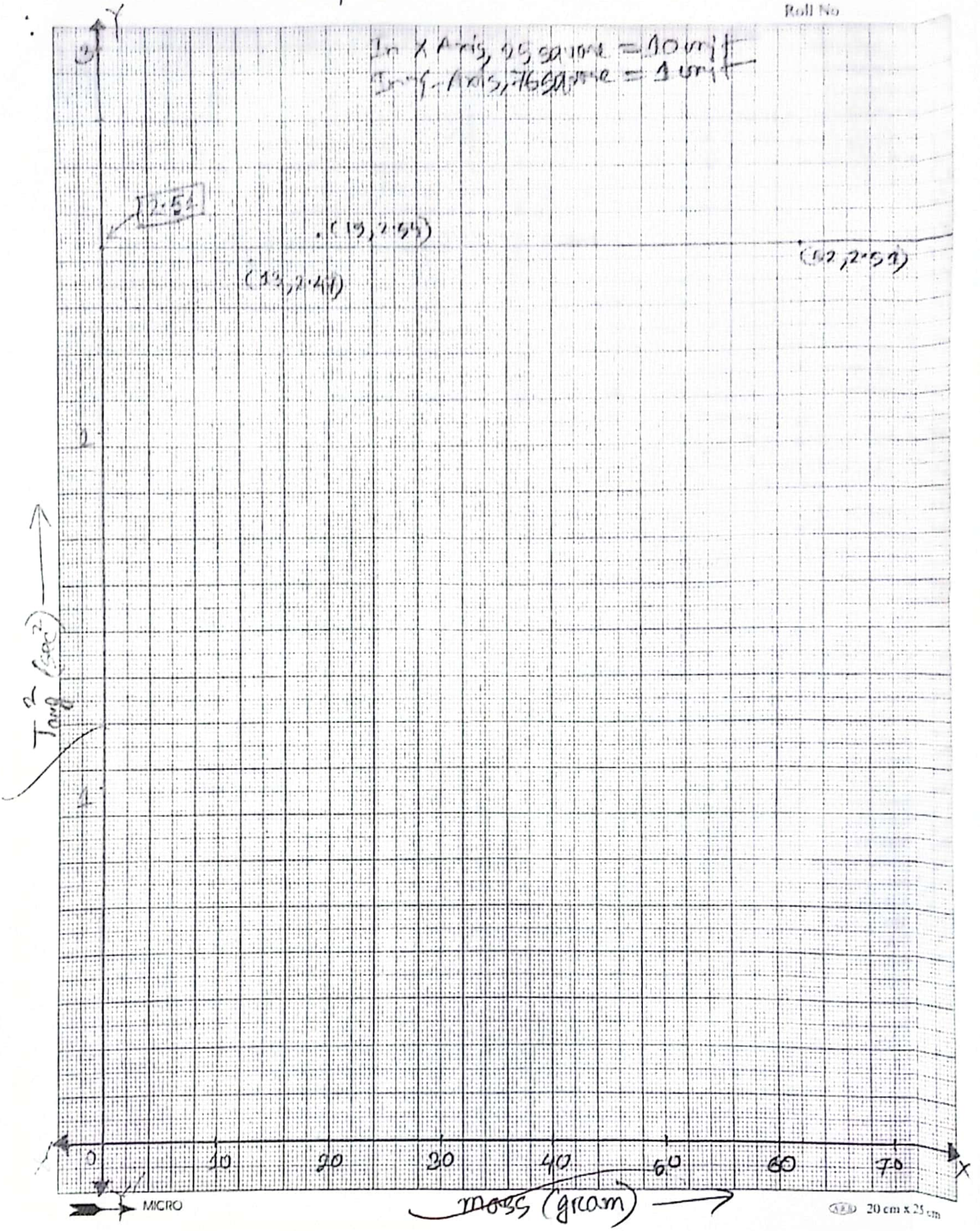
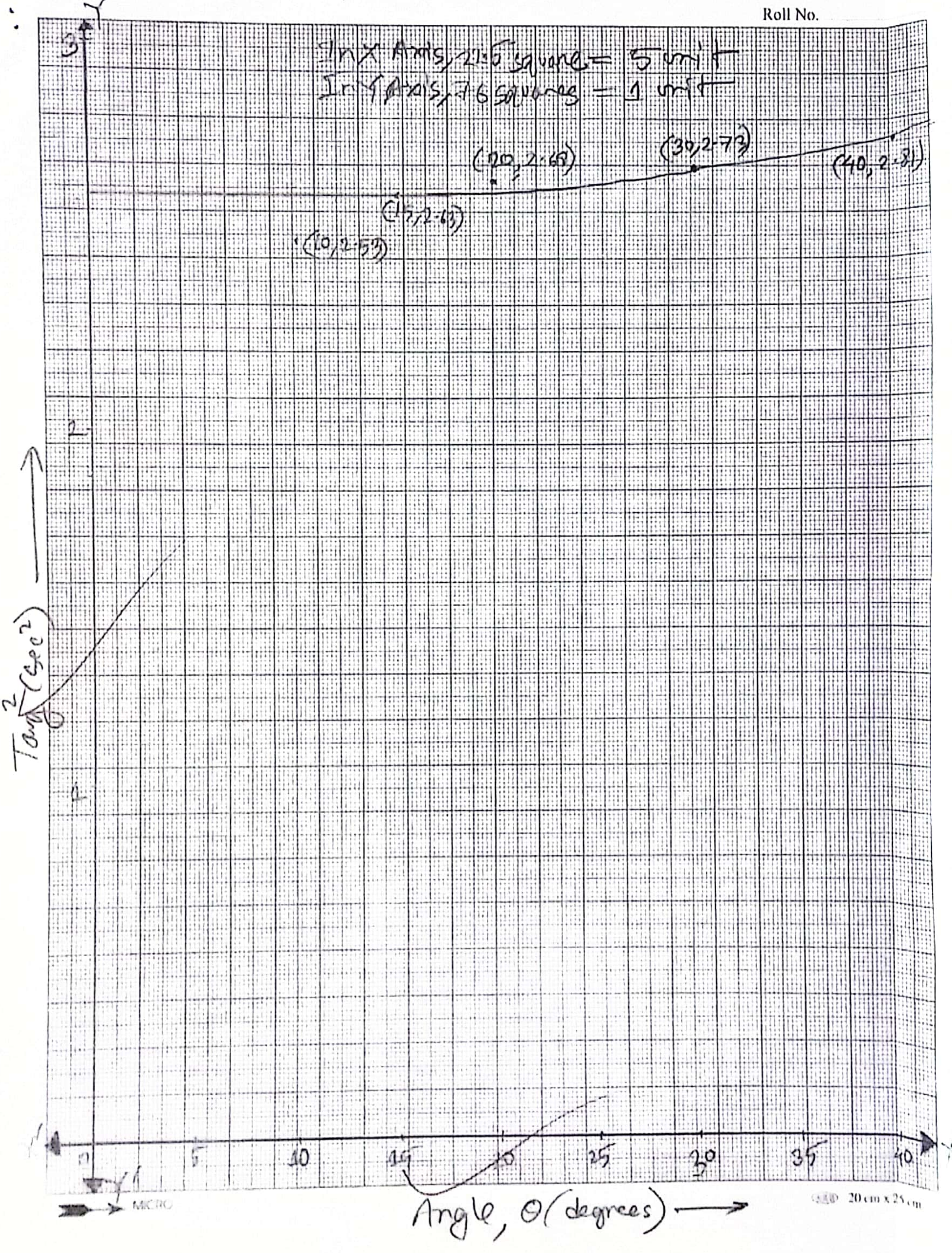
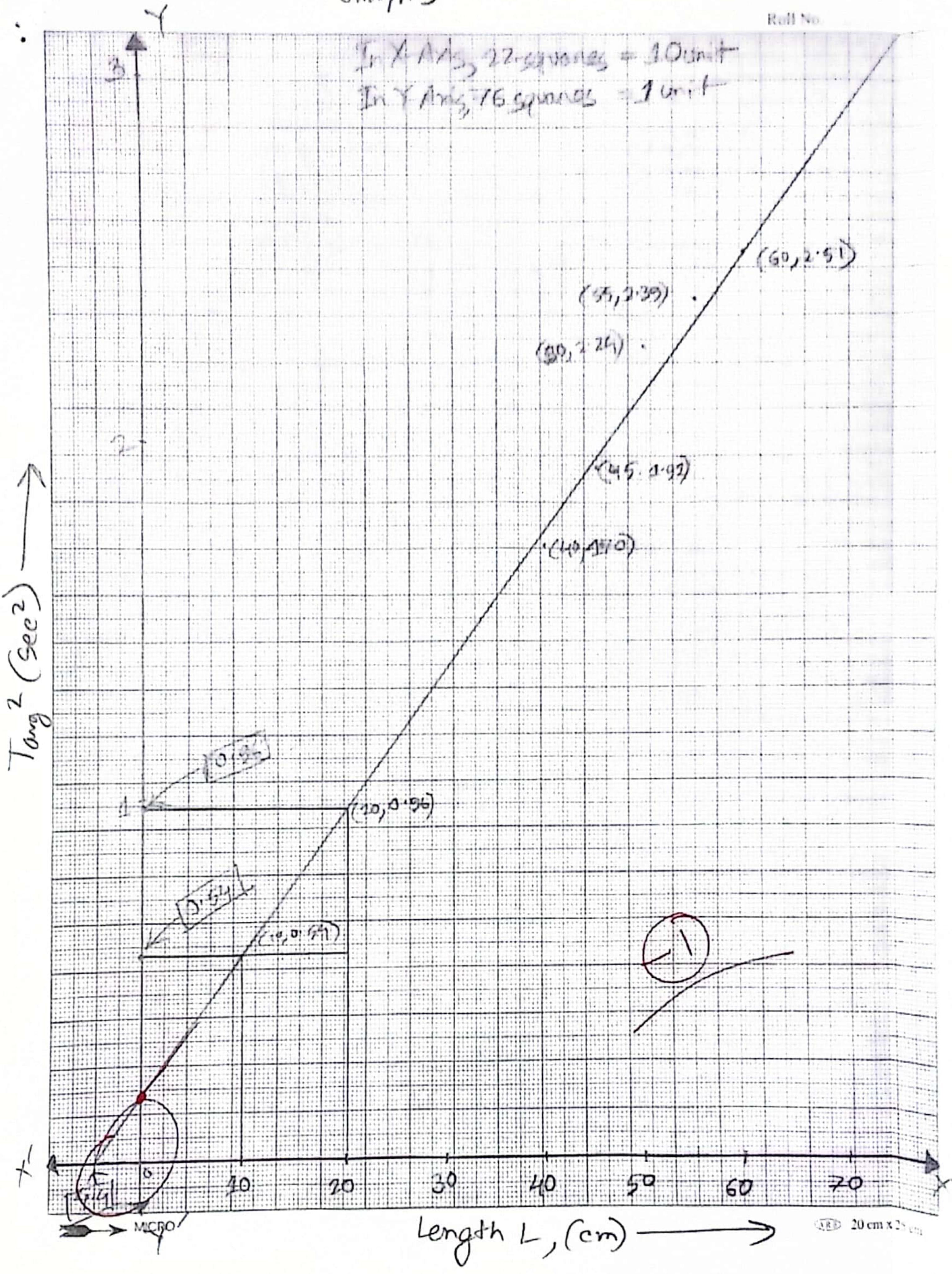
Graph 1


In X Axis, 15 square = 10 unit
In Y Axis, 76 square = 1 unit
Y
3
2
1
2·51
(19, 2·54)
(13, 2·47)
(52, 2·57)
T^2_{avg} (sec^2)
0
10
20
30
40
50
60
70
X
mass (gram)

Graph-2


Roll No.
In X Axis, 2.5 square = 5 unit
In Y Axis, 7.6 squares = 1 unit
(10, 2.53)
(15, 2.63)
(20, 2.68)
(30, 2.73)
(40, 2.81)
3
2
1
0
5
10
15
20
25
30
35
40
X
Y
Tan²θ (sec²)
Angle, θ (degrees)
MICRO
20 cm x 25 cm

Graph 3


Roll No.
In X Axis, 22 squares = 10 unit
In Y Axis, 76 squares = 1 unit
(60, 2.51)
(55, 2.39)
(50, 2.26)
(45, 1.97)
(40, 1.70)
(20, 0.96)
(10, 0.54)
Tang² (sec²)
Length L, (cm)
0
10
20
30
40
50
60
70
1
2
3
X
Y
MICRO
20 cm x 25 cm