جامعة بيرزيت

BIRZEIT UNIVERSITY

Faculty of Science كلية العلوم

Department of Physics دائرة الفيزياء

Phys111 Report

Perfect Report 9.5

Experiment #5: Focal Length of a Convex Lens

Name:	[redacted]	**ID #:**	[redacted]
Partner:	—	**ID #:**	—
Section:	3.		
Date:	11/5/2022.		

(1) Abstract:

- **Aim of the experiment:**

is to Calculate the focal length of a convex lens.

- **The main result is:**
  - The focal length of the convex lens is $f = \pm$ (17.9 ± 0.2) cm.

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(2) Data:

	1.	2.	3.	4.	5.	6.
$u\ (cm)$	30.0	40.0	50.0	60,0	70,0	78,0
$v\ (cm)$	37,8	29,2	25,7	23,5	22,5	21,5
$1/u\ (cm)$	0,033	0,025	0,02	0,0166	0,0142	0,0128
$1/v\ (cm)$	0,0264	0,0342	0,0389	0,0425	0,0444	0,0465

$\bar{u} = 54,7$ cm.

$\bar{v} = 26,7$ cm.

$\Delta u \approx 0,4$cm	$\Delta v \approx 0,4$cm	$f_{true} \approx 16,5$cm

A.R 11/5/2022

(3)Calculations:

$\overline{u} = 54{,}7\,cm$. $\overline{v} = 26{,}7\,cm$. $\overline{\left(\frac{1}{u}\right)} = 0{,}0203\,cm^{-1}$. $\overline{\left(\frac{1}{v}\right)} = 0{,}0388\,cm^{-1}$.

$f_1 = x_{intercept} = 0{,}055\ cm^{-1} = 18{,}1818\,cm$ $f_2 = y_{intercept} = 0{,}057\,cm^{-1} = 17{,}5438\,cm$

$\bar{f} = \frac{f_1 + f_2}{2} = 17{,}8628\,cm \approx 17{,}90\,cm.$

$\Delta\bar{f} = \bar{f}^2\left(\frac{\Delta v}{\bar{v}^2} + \frac{\Delta u}{\bar{u}^2}\right) = (17{,}8628)^2 \cdot \left(\frac{0{,}4}{(26{,}7)^2} + \frac{0{,}4}{(54{,}7)^2}\right) = 0{,}22169 \approx 0{,}2.$

(4)Results:

- The focal length of the convex lens is $f = \pm$

$f = (17{,}9 \pm 0{,}2)\,cm$

(5)Conclusions:

When we used the discrepancy test. $|f_{exp} - f_{true}| \leq 2\Delta R$. We found $(1{,}4 \leq 0{,}4)$ that our result isn't accepted.

Sources of error:

① The light in the room: to get the best value for f we need only the source light in the lab to be the one on the lens.

② Tilted lens: the lens plane must be perpendicular to the light so that the focal length will be above the ruler and measured relation between v^{-1} and u^{-1}.

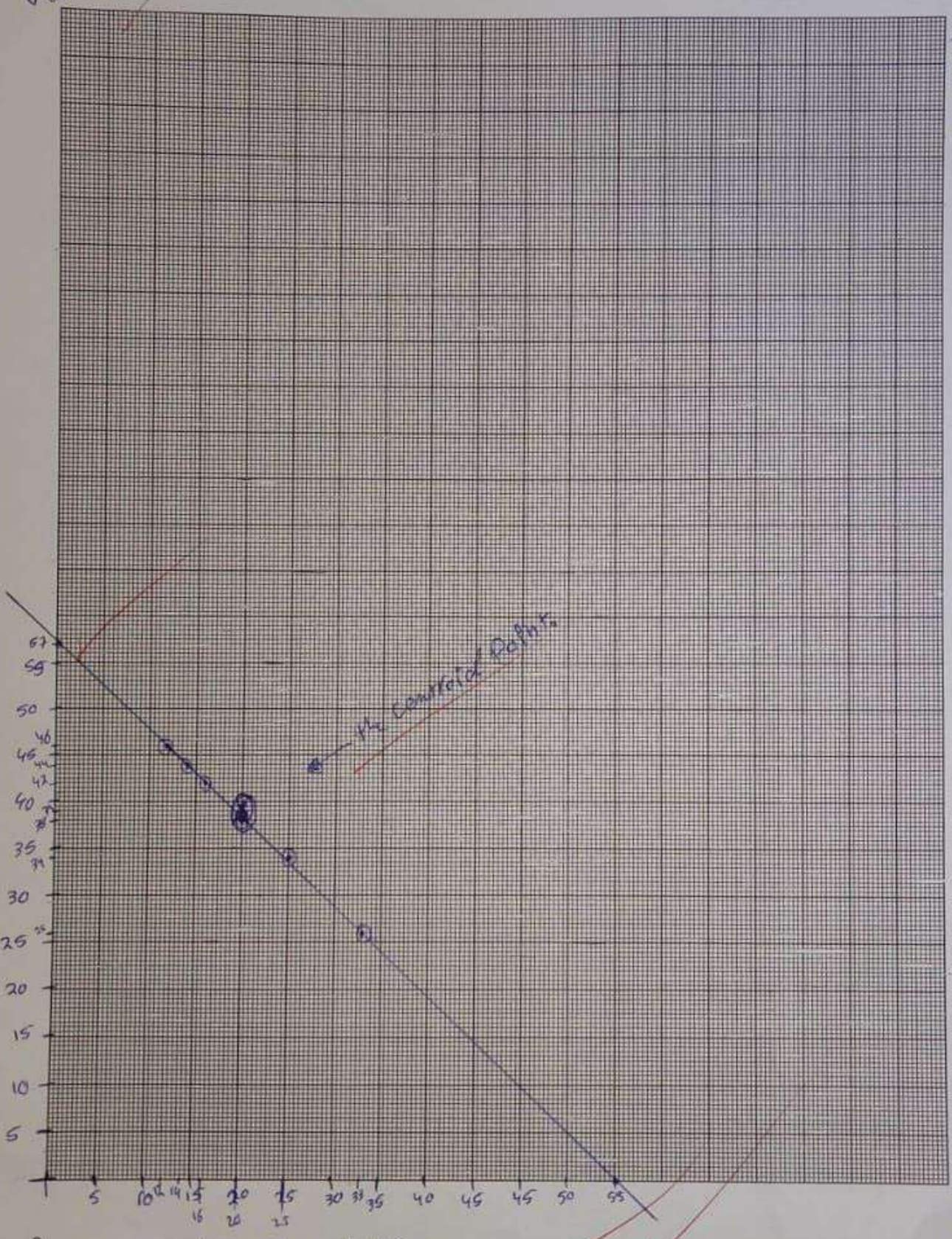
③ Calibration of the ruler: the ruler was old, and it had some of its height lost from the bottom. So the measurment should be taken from a non-zero point. So the measurments wasn't accure.

④ in graph we used a large scale to show the (x) and (y) intercepts points. So it will be estimated.

the letter appearing on my lens was (M). and I used the average of f_y and f_x because the reasons that I mentioned before.

$\frac{1}{V_{(cm)}}$ Vs $\frac{1}{u_{(cm)}}$

$\frac{1}{V_{cm}} \times 10^{-3}$



The Centroid Point is $(\frac{1}{V}, \frac{1}{u}) = (38, 20,3) \times 10^{-3}$

$\frac{1}{u_{cm}} \times 10^{-3}$

$f_1 = x_{intercept} = \frac{1}{x\text{-int}} = \frac{1}{0,055} = 18,18\,cm$

$f_2 = \frac{1}{y\text{-int}} = \frac{1}{0,057} = 17,5438\,cm$