تحقیق قانون اوہم	LAB
1) Ohm's Law verification	3
	WEEK 4

LEARNING OUTCOMES

Ability to interpret basic electrical laws, units and dimensional analysis

OBJECTIVE

1. To learn Resistor Color Code
2. To determine the stated value of a resistor by interpreting the color code indicated on the resistor.

APPARATUS AND EQUIPMENT USED

Table 1.1: Equipments and Components required

S #	Equipment/Component name	Specification/Rating	Quantity
1	Plug-in board (or bread board)	DIN A4	1
2	DC Power Supply	0 to ±15v	1
3	Ammeter/Digital multi-meter	0 to 150mA	1
4	Voltmeter/Digital multi-meter	0 to 10v	1
5	STE Resistor (or simple resistor)	1kΩ, 2W, 5%	1
6	Connecting leads (wires)	Red, black, 50cm	2
7	Bridging plugs		10

DESCRIPTION

Ohm's Law Verification:

Ohm's law states that the voltage V across a resistor is directly proportional to the current I flowing through the resistor.

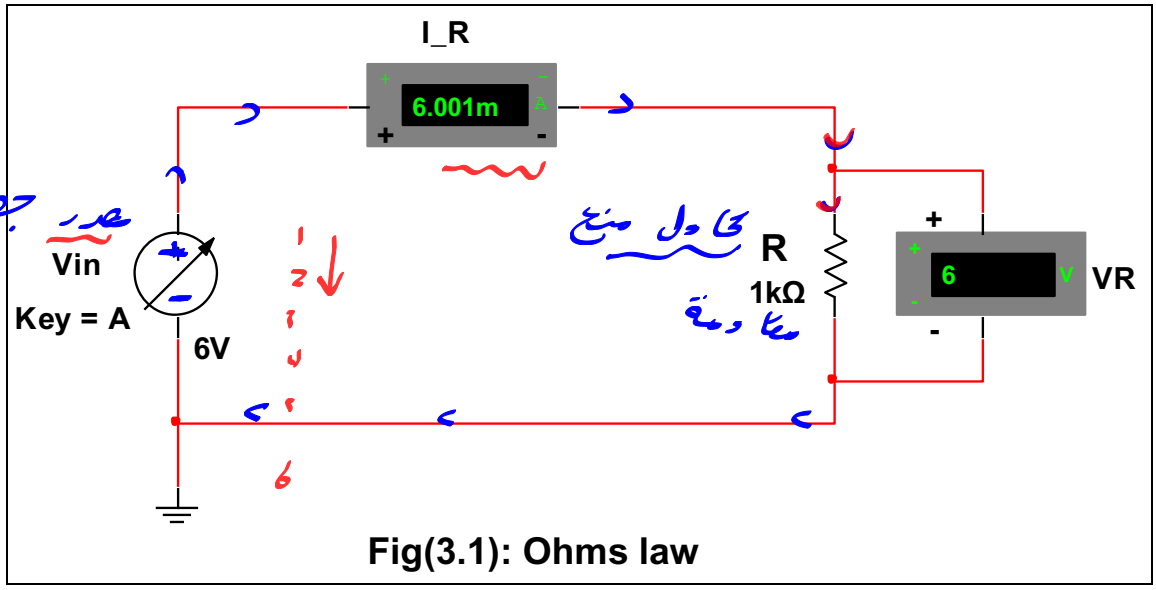
$$V \propto i \quad (1)$$

Ohm defined the constant of proportionality for a resistor to be the resistance; R. (The resistance is material properties which can change if the internal or external conditions of the element are altered, e.g., if there are changes in the temperature.)

$$V = i * R \text{ (unit of R is ohm or } \Omega \quad (2)$$

This is the mathematical equation of Ohm's law becomes:

CIRCUIT DIAGRAM



Fig(3.1): Ohms law

EXPERIMENTAL SETUP / PROCEDURE

1. Assemble the circuit as shown in Figure 3.1 using a resistor R=10KΩ. Make sure that the polarity of the voltage source and multi-meter is correct and that the correct measurement range has been selected.
2. Beginning with 1v, increase the input voltage to 10v in steps as shown in Table 1.2. Measure the current (IR) at each step. Do not change the measurement range settings of the Digital multi-meter (DMM). Record the results in Table 1.2.
3. Use the digital multi-meter (DMM) to measure the voltage across and the current through R1 for each value of V1. Record these measurements in Table 1.2 where indicated.

4. Use graph paper (and also Excel spreadsheet) to generate a graph of VR1 (linear scale vertical axis) plotted against IR1 (linear scale horizontal axis). Calculate the value of the slope of this plot and compare to the measured value of R1.
5. Calculate the difference in percent (Diff (%)) between these two values with the measured value as the base. Record these values in Table 1.2 where indicated.
6. Repeat the measuring sequence once more using the resistor R=1k Ω. For this sequence set the current meter to the 15mA range.

MEASUREMENTS:

Table 1.2. Observations and Calculations

$V_{in}(v)$	$R = 1\ k\Omega$			$R = 10\ k\Omega$		
	$I_R(mA)$	V_R	$\frac{V_R}{I_R}$	$I_R(mA)$	V_R	$\frac{V_R}{I_R}$
1	1	1	1	0.1	1	10
2	2	2	1	0.2	2	10
4	4	4	1	0.4	4	10
6	6	6	1	0.6	6	10
8	8	8	1	0.8	8	10
10	10	10	1	1	10	10

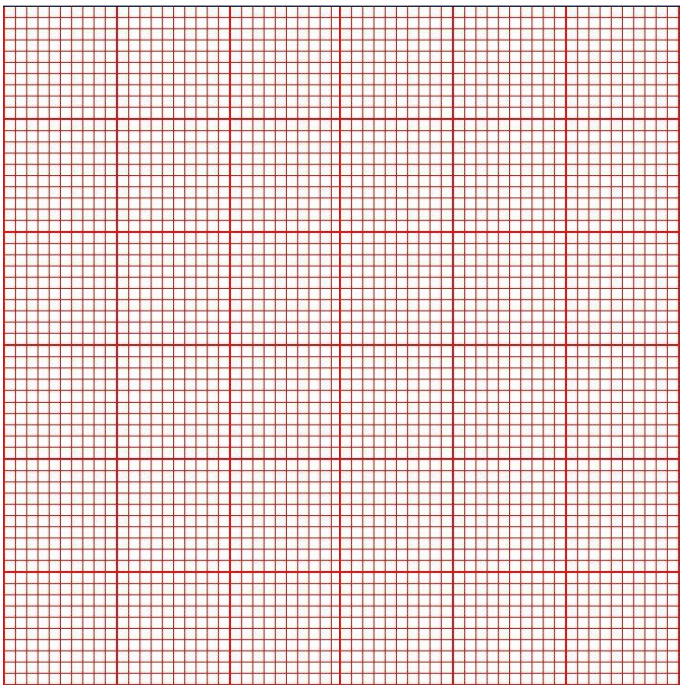
RESULTS

R	$R = 1\ k\Omega$	$R = 10\ k\Omega$
(slope of V-I plot) $R_{cal} = \frac{V_2 - V_1}{I_2 - I_1}$	1 kΩ = 1000 ohm 0.924 lab	10000 = 10 kΩ 8000 = 8 kΩ

	13 Ω	10 kΩ
$\text{Diff (\%)} = \left(\frac{R - Rcal}{Rcal}\right) * 100$	$\frac{(1 - 0.9744) * 1k\Omega}{0.9744}$ 2.63 %	$\frac{(10 - 8) * 100}{8}$ 25 %

EVALUATIONS

7. Plot the values measured on the graph.

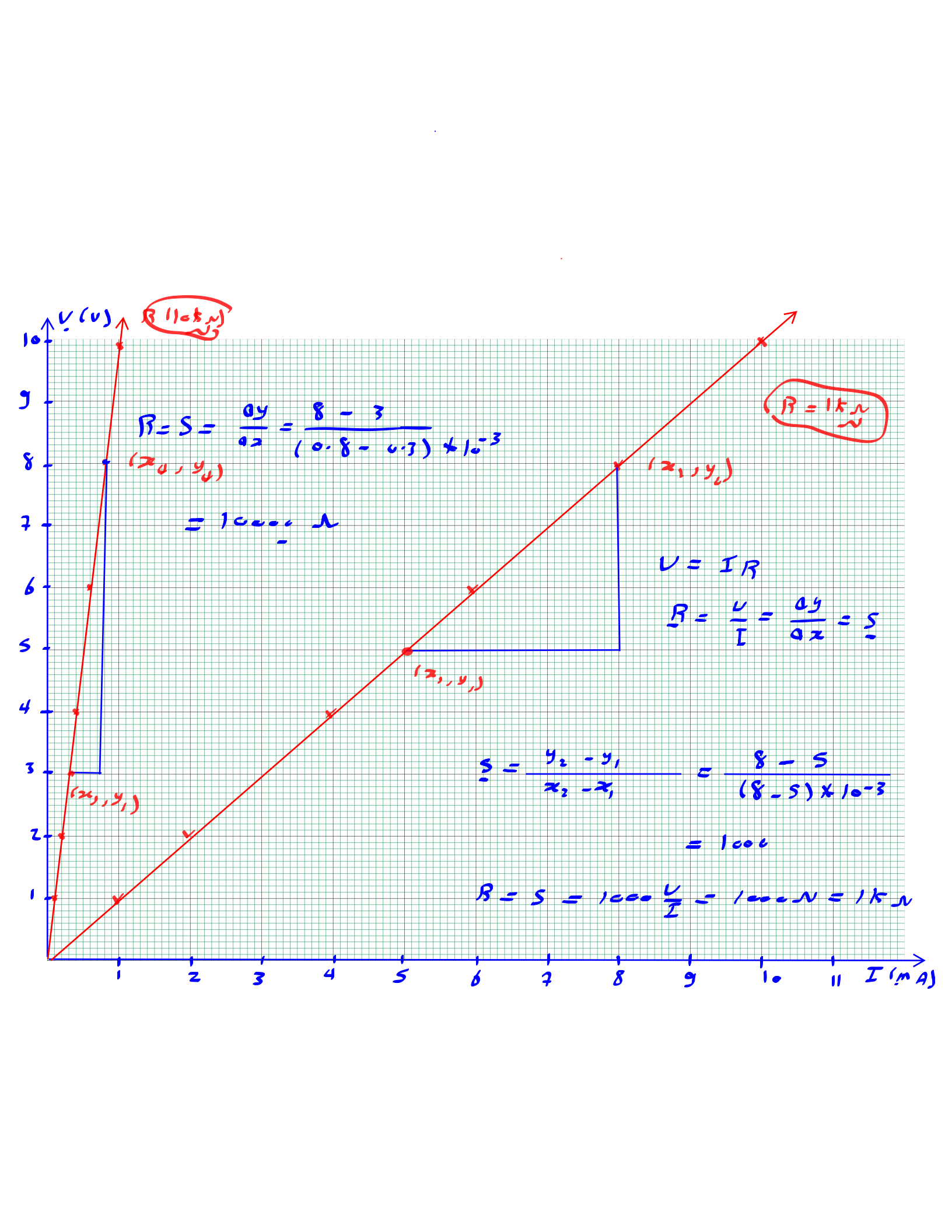


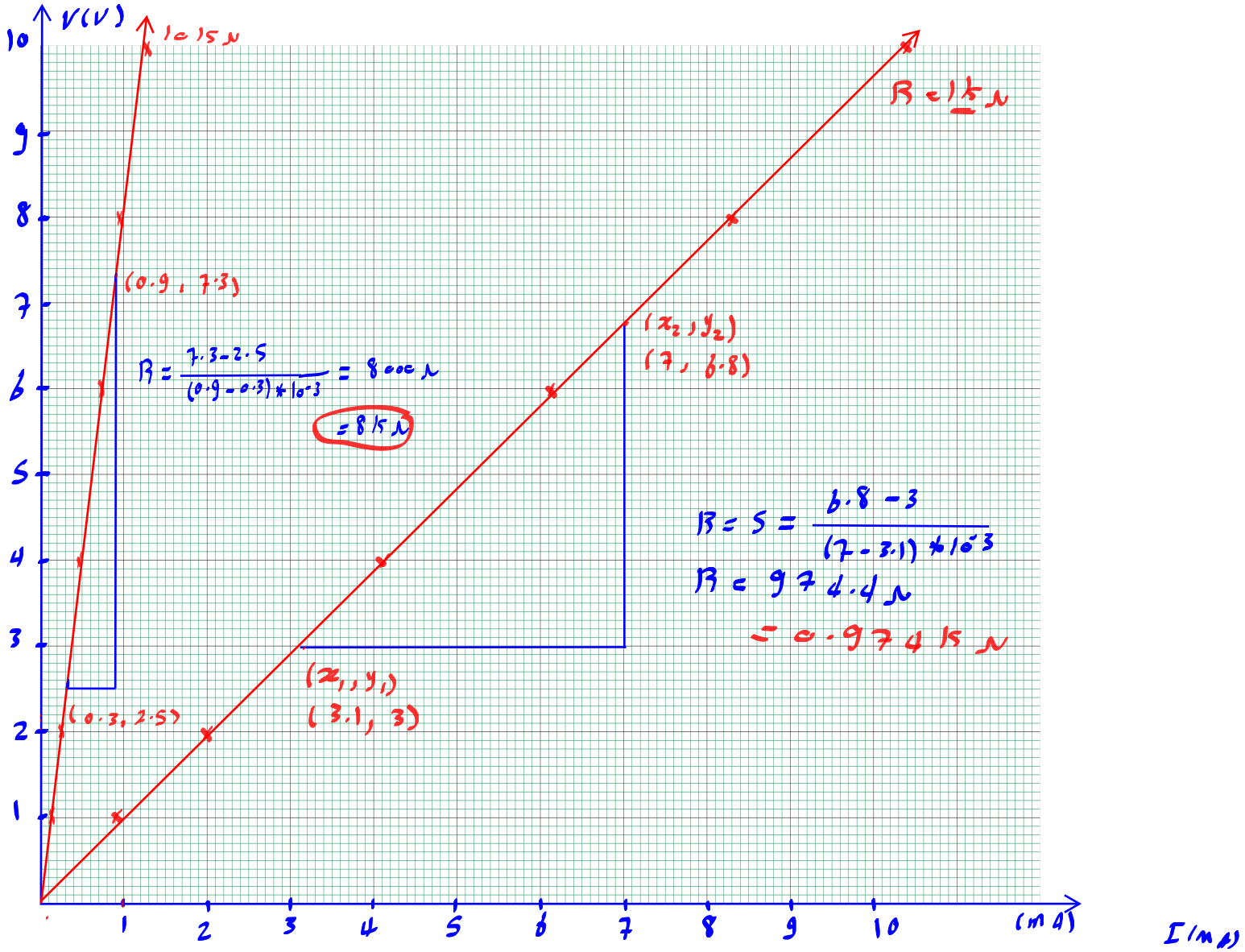
8. What relationship can be seen between current and voltage?

   The relation between the voltage across the resistor and the current flowing through it is a linear one. i.e., the current changes according to the changes in the voltage.

   We say that V is proportional to I: V – I.

9. Determine the quotient V: I for the values recorded in Table 1.2 and enter them in the column provided for that purpose.
10. The quotient V/I is the measure of electrical resistance, measured in Ohm (the symbol for Ohm is the Greek letter Omega) 1Ω = 1V/1A


V (V)
I (mA)
R للكتلة
R = 1k Ω
$R = S = \frac{\Delta y}{\Delta x} = \frac{8-3}{(0.8-0.3)\times 10^{-3}}$
$= 10000\ \Omega$
(x_0, y_0)
(x_1, y_1)
(x_2, y_2)
(x_3, y_3)
$V = IR$
$R = \frac{V}{I} = \frac{\Delta y}{\Delta x} = S$
$S = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-5}{(8-5)\times 10^{-3}}$
$= 1000$
$R = S = 1000 \frac{V}{I} = 1000\ \Omega = 1k\Omega$


V(V)
10
9
8
7
6
5
4
3
2
1
1 2 3 4 5 6 7 8 9 10
(mA)
I(mA)
10.15 Ω
(0.9 ; 7.3)
(0.3, 2.5)
R = 8000 Ω
= 8 kΩ
(x1 , y1)
(3.1, 3)
(x2 , y2)
(7, 6.8)
R = 1/5 kΩ
R = 5 = 6.8 − 3 / (7 − 3.1) × 10^-3
R = 974.4 Ω
= 0.974 kΩ