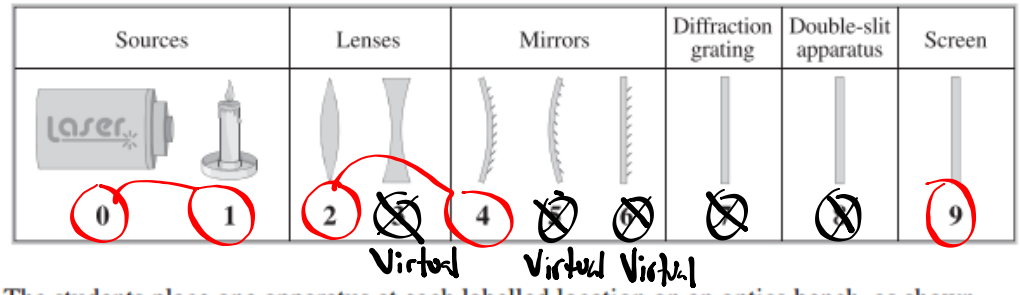
L07 - Refraction Lenses Graphing and Optics Rails

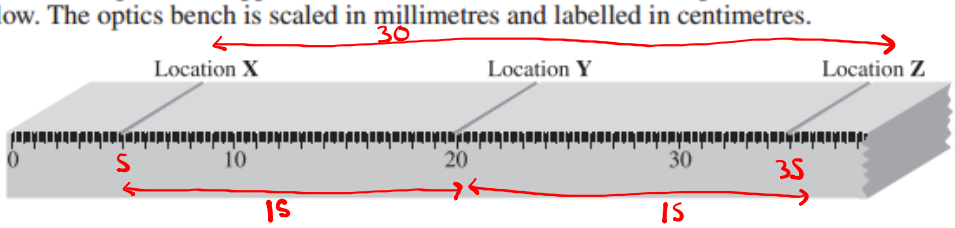
Use the following information to answer numerical-response question 2.

Students use three of the optical apparatus illustrated below to produce a **focused, real** image in a darkened room. One of the apparatus has a focal length of 10.0 cm.

Optical Apparatus



The students place one apparatus at each labelled location on an optics bench, as shown below. The optics bench is scaled in millimetres and labelled in centimetres.



Note: The diagrams are **not** drawn to scale.

2. The apparatus placed at location

X is numbered _____ (Record in the **first** column)

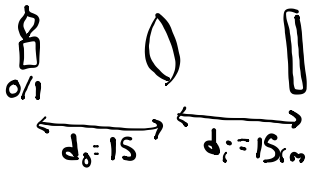
Y is numbered _____ (Record in the **second** column)

Z is numbered _____ (Record in the **third** column)

(Record your answer in the numerical-response section on the answer sheet.)

Answer: 194, 094, 491, or 490

Option #1

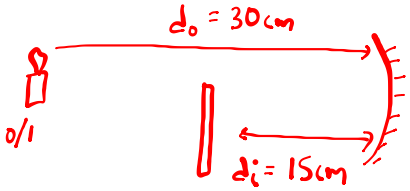


$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{f} = \frac{1}{15} + \frac{1}{15}$

$f = 7.5cm$

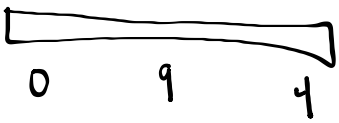
Option #2



$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{f} = \frac{1}{30} + \frac{1}{15}$

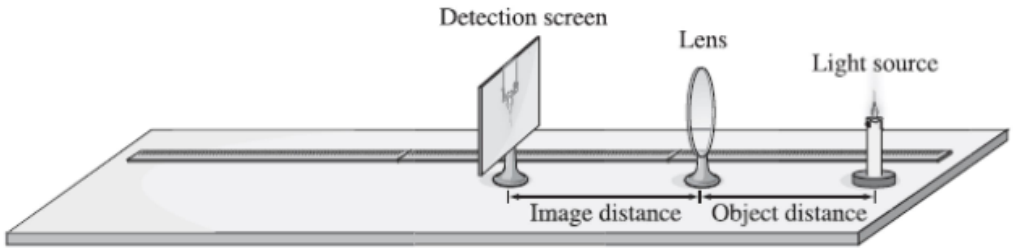
$f = 10cm$



0 9 4

Use the following information to answer this graphing-skills question.

Some physics students do an experiment to find the focal length of a convex lens. They set up an optical bench and measure the image distance as a function of object distance.



Their observations and the start of their analyses are given below.

d_o d_i $1/d_o$ $1/d_i$

Observations		Analysis	
Object Distance (m)	Image Distance (m)	Reciprocal of the Object Distance (m^{-1}) x	Reciprocal of the Image Distance (m^{-1}) y
1.50	0.30	0.667	3.3
1.25	0.32	0.800	3.1
1.00	0.33	1.00	3.0
0.75	0.38	1.3	2.6
0.50	0.50	2.0	2.0

Written Response—10%

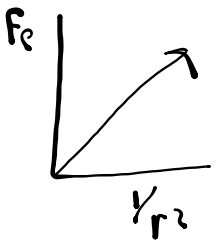
1. Using the *y*-intercept found from graphical analysis, **determine** the focal length of the lens. In your response, **provide** a graph of the reciprocal of the image distance as a function of the reciprocal of the object distance, **determine** the *y*-intercept of the graph, and **relate** the *y*-intercept algebraically to a physics equation. **State** all necessary physics concepts and formulas.

Unit 2

$F_e = \frac{kq_1q_2}{r^2}$

$F_e = (kq_1q_2)\frac{1}{r^2} + 0$

$y = (m)x + b$



Unit 3

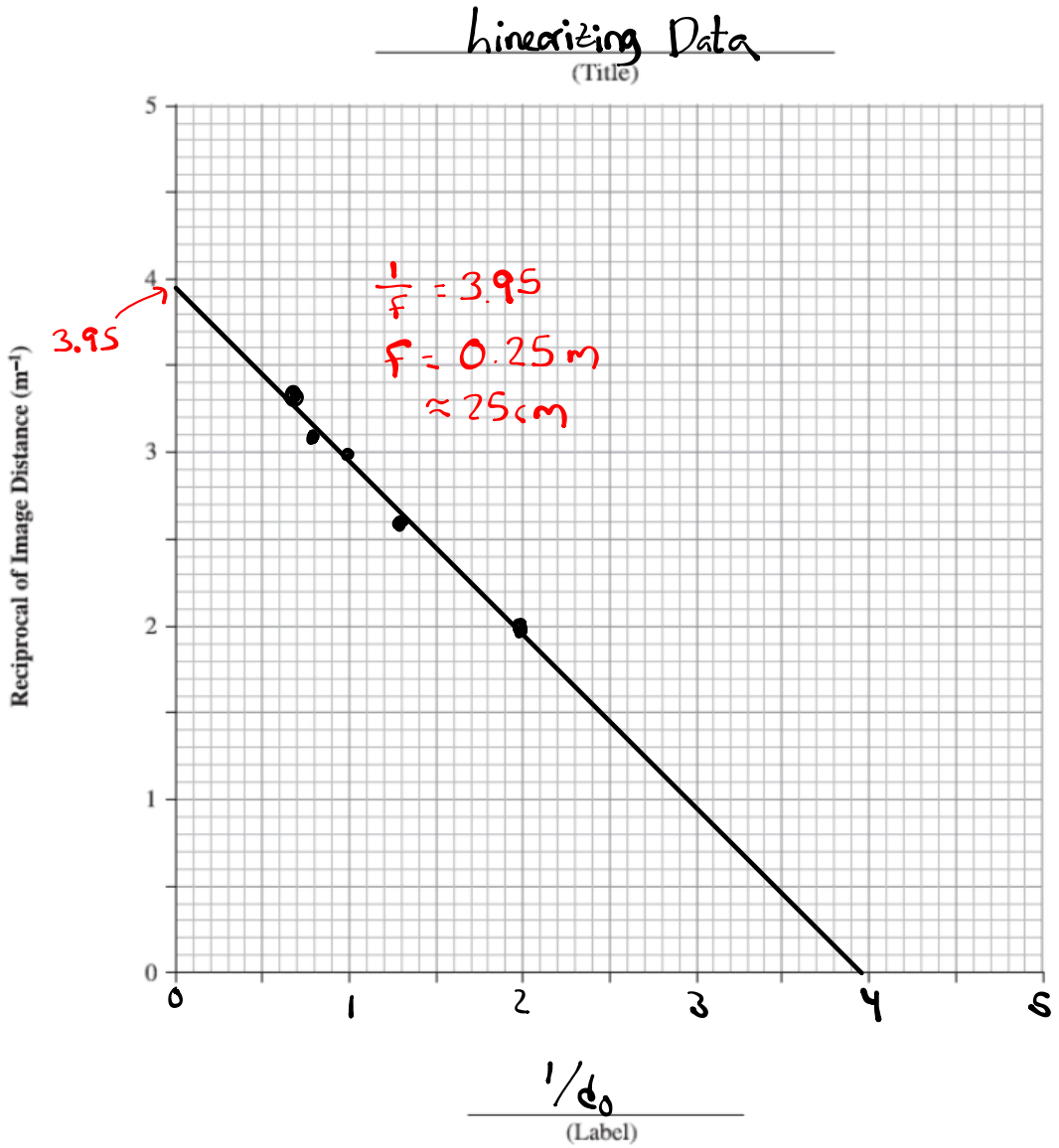
$b = \frac{1}{f}$

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{d_i} = -\frac{1}{d_o} + \frac{1}{f}$

$\left(\frac{1}{d_i}\right) = (-1)\left(\frac{1}{d_o}\right) + \frac{1}{f}$

$y = (m)(x) + b$


linearizing Data
(Title)
Reciprocal of Image Distance (m⁻¹)
3.95
1/f = 3.95
f = 0.25 m
≈ 25 cm
0
1
2
3
4
5
1/dₒ
(Label)