

### Homework 3

Question 1 (parts a i ii and b i ii); Question 2 (parts a i ii, b i ii and c i ii).

## 1. Ray Diagrams & Galilean Telescope

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This question concerns two different thin lens systems

- (a) You have a thin lens with focal length -100mm with a real object 50mm to the left of the lens.
- i. Using a ray diagram, determine approximately where the image lies and whether it is real or virtual.
  - ii. Use the thin lens equation to calculate the resulting image distance and magnification.
- (b) You have a Galilean telescope where the first thin lens has a focal length +200mm and the second has a focal length -50mm.
- i. Calculate both the distance between the two lenses and the magnification of the system.
  - ii. Using a ray diagram, show that this system is afocal.

## 2. Plotting the Thin Lens Equation

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For the following question, do all parts for lenses of focal lengths +100mm and -100mm. You may use Excel, MATLAB, Desmos, etc.

- (a) Plot the change in image distance (y-axis) for object distances between -300mm and 300mm (x-axis).

i.  $f=+100\text{mm}$  ii.

$$f=-100\text{mm}$$

- (b) Plot the change in magnification (y-axis) for object distances between -300mm and 300mm (x-axis).

i.  $f=+100\text{mm}$  ii.

$$f=-100\text{mm}$$

- (c) For a magnification of +2, what are the required object and image distances? Are the objects and images real or virtual?

i.  $f=+100\text{mm}$  ii.

$$f=-100\text{mm}$$