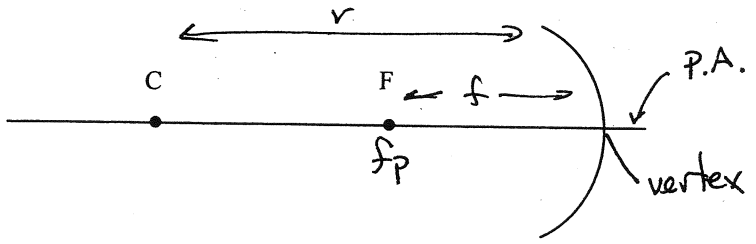
Physics 11 **Pre-Test: Geometric Optics (Mirrors and Lenses)** Name: KEY

1. What is the definition of a real image? light rays converge through the image

2. What is the definition of a virtual image? light rays only appear to have originated from the image.

3. Label the focal length, focal point, principal axis, radius of curvature, and the vertex on the concave mirror diagram below.



4. What type of lens would you use to produce a magnified image? Where would you place the object?
convex

5. Describe how you experimentally find the focal length of a concave mirror?
use light rays from a distant object: the location of the image is the focal point.

6. A converging mirror has a focal length of 60 cm. Where would you locate an object such that its image is real, inverted, and 70 cm from the vertex?

$d_i = -70$ $\quad \frac{1}{d_o} = \frac{1}{60} - \frac{1}{70}$

$f = 60$

$\frac{1}{d_o} = \frac{10}{4200} \quad d_o = 420\text{ cm}$

7. An object 5.0 cm high, is 20.0 cm from a concave mirror. The radius of curvature of the mirror is 20.0 cm.

a) What is the image distance?

$\frac{1}{d_i} = \frac{1}{10} - \frac{1}{20} = \frac{1}{20} \quad d_i = 20\text{ cm}$

b) What is the size of the image?

$\frac{h_i}{h_o} = \frac{-d_i}{d_o} \quad h_i = \frac{-(20 \cdot 5)}{20} = -5\text{ cm}$

8. You want to project a real image that is 50 cm high. The object must be 10 cm from the mirror, and the object is 4.0 cm high. What is the required focal length of the mirror?

$h_i = -50$
$d_o = 10$
$h_o = 4$
$f = ?$

$d_i = \frac{-d_o h_i}{h_o}$

$= \frac{-10(-50)}{4}$

$= \frac{500}{4} = 125$

$\frac{1}{f} = \frac{1}{10} + \frac{1}{125} = \frac{25+2}{250}$

$f = \frac{250}{27} = 9.3\ cm$

9. An object is placed 30 cm in front of a converging lens of 20 cm focal length.

a) Find the image distance.

$d_o = 30$
$f = +20$

$d_i = \frac{30 \cdot 20}{(30-20)} = 60\ cm.$

b) Calculate the magnification of the image.

$mag = -2\times$

10. When an object is placed 30 cm in front of a converging mirror the image is 15 cm from the mirror. Find the focal length of the mirror.

$d_o = 30$
$d_i = 15$

$\frac{1}{f} = \frac{1}{30} + \frac{1}{15} = \frac{3}{30}$

$\therefore f = 10\ cm$

11. A **virtual** image is formed 6.7 cm from a **diverging** lens whose focal length is 20 cm.

a) Calculate the object distance?

$d_i = -6.7\ cm$
$f = -20\ cm.$

$\frac{1}{d_o} = \frac{1}{f} - \frac{1}{d_i} = \frac{1}{-20} - \frac{1}{-6.7}$

$\frac{1}{d_o} = \frac{-6.7 + 20}{(-20 \cdot 6.7)} = \frac{13.3}{134}$

$d_o = 10.1\ cm$

b) Calculate the magnification of the image.

$mag = -\frac{-6.7}{10.1} = +0.66\times$

12. An object is placed between the focal point and the vertex of a converging mirror.

a) Is the image real or virtual? _____

b) Is the image erect or inverted? _____

13. A convex lens is needed to produce a **real** image that is located 50cm beyond the lens. The magnification of the image is 0.85.

a) Calculate the object distance. (2marks)

$d_i = +50$

$mag = -0.85$

$mag = \frac{-d_i}{d_o}$ $\quad d_o = \frac{-50}{-0.85} = 58.8\ cm$

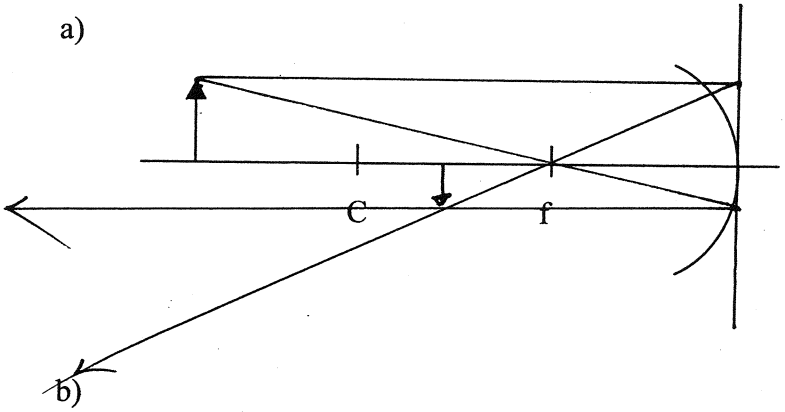
b) Calculate the focal length of the lens. (2 marks)

$\frac{1}{f} = \frac{1}{58.8} + \frac{1}{50} = \frac{(50 + 58.8)}{(50 \times 58.8)}$

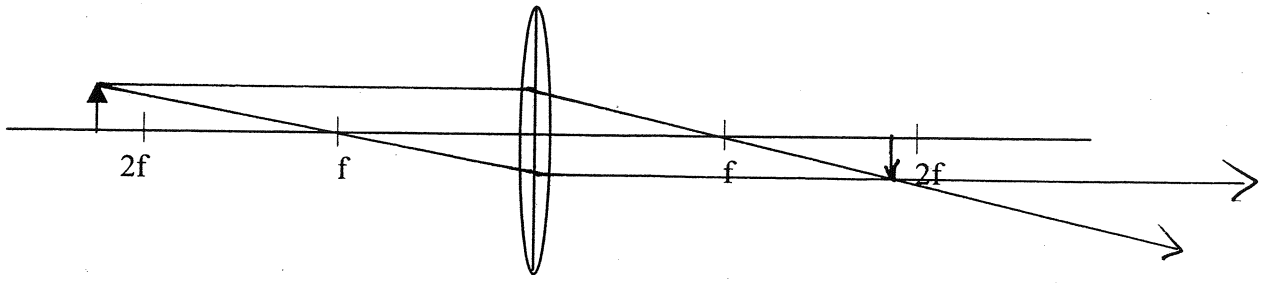
$f = 27.0\ cm$

14. Use ray diagrams to located the image in each situation below.

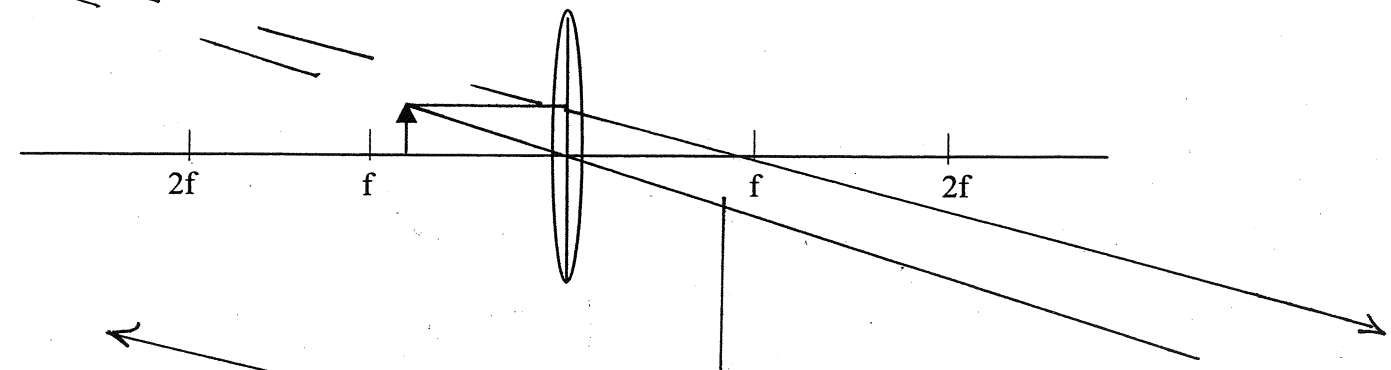
a)



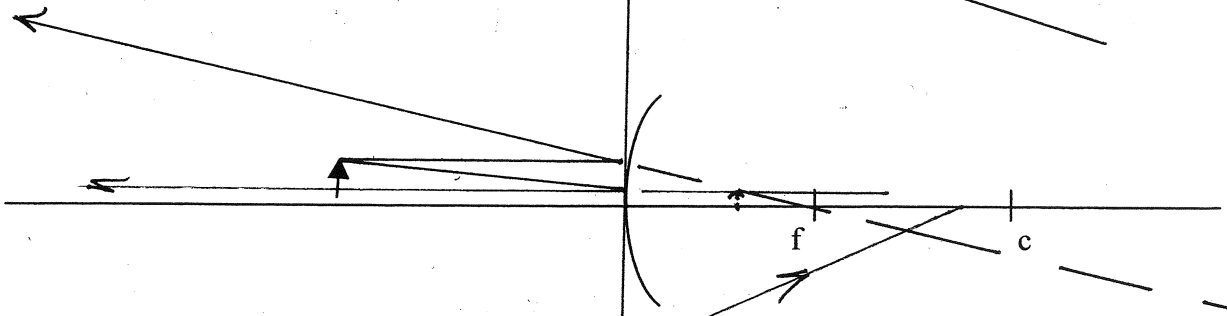
b)



c)



d)



e)