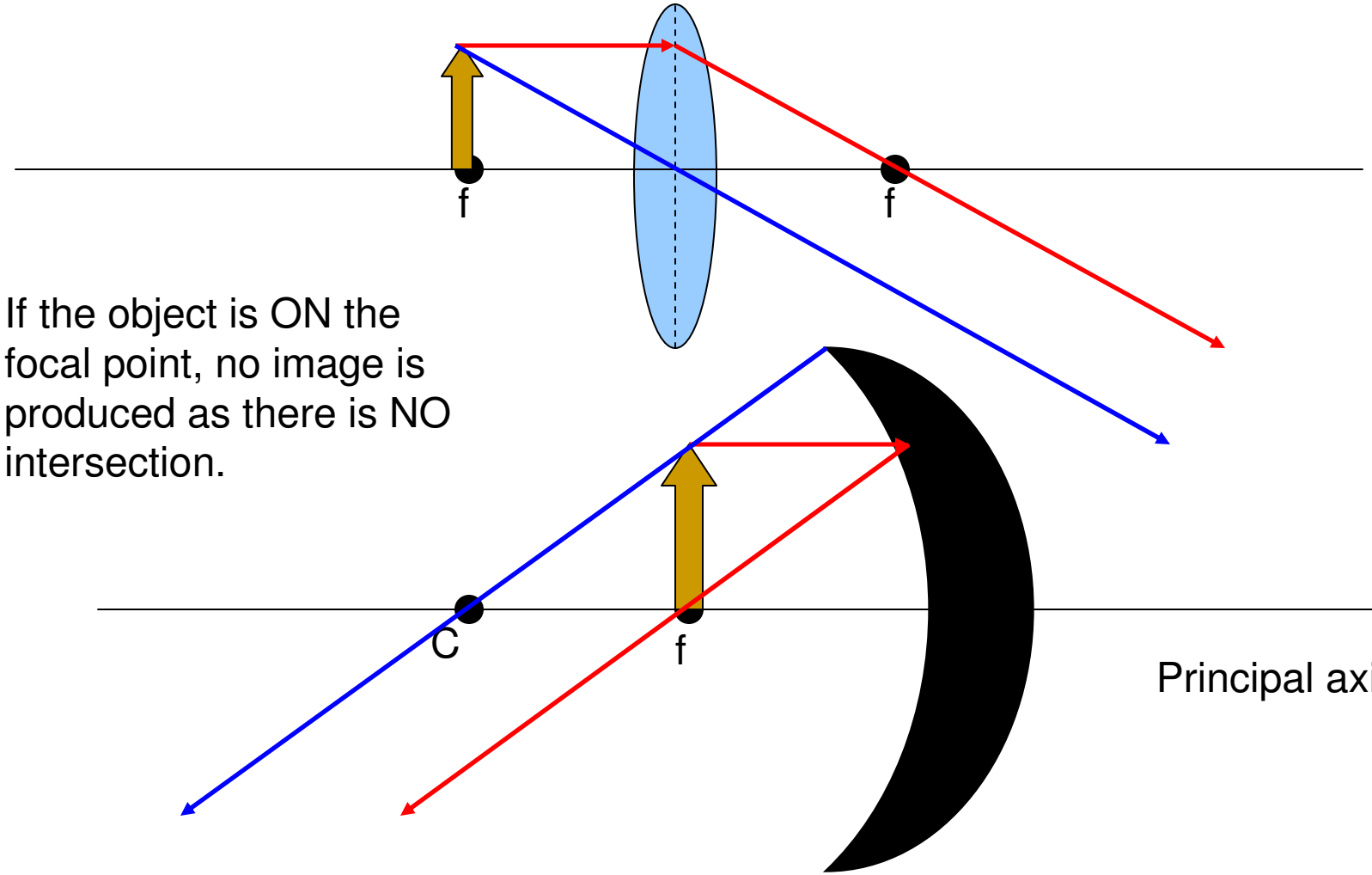
Special Case – Ray Diagrams

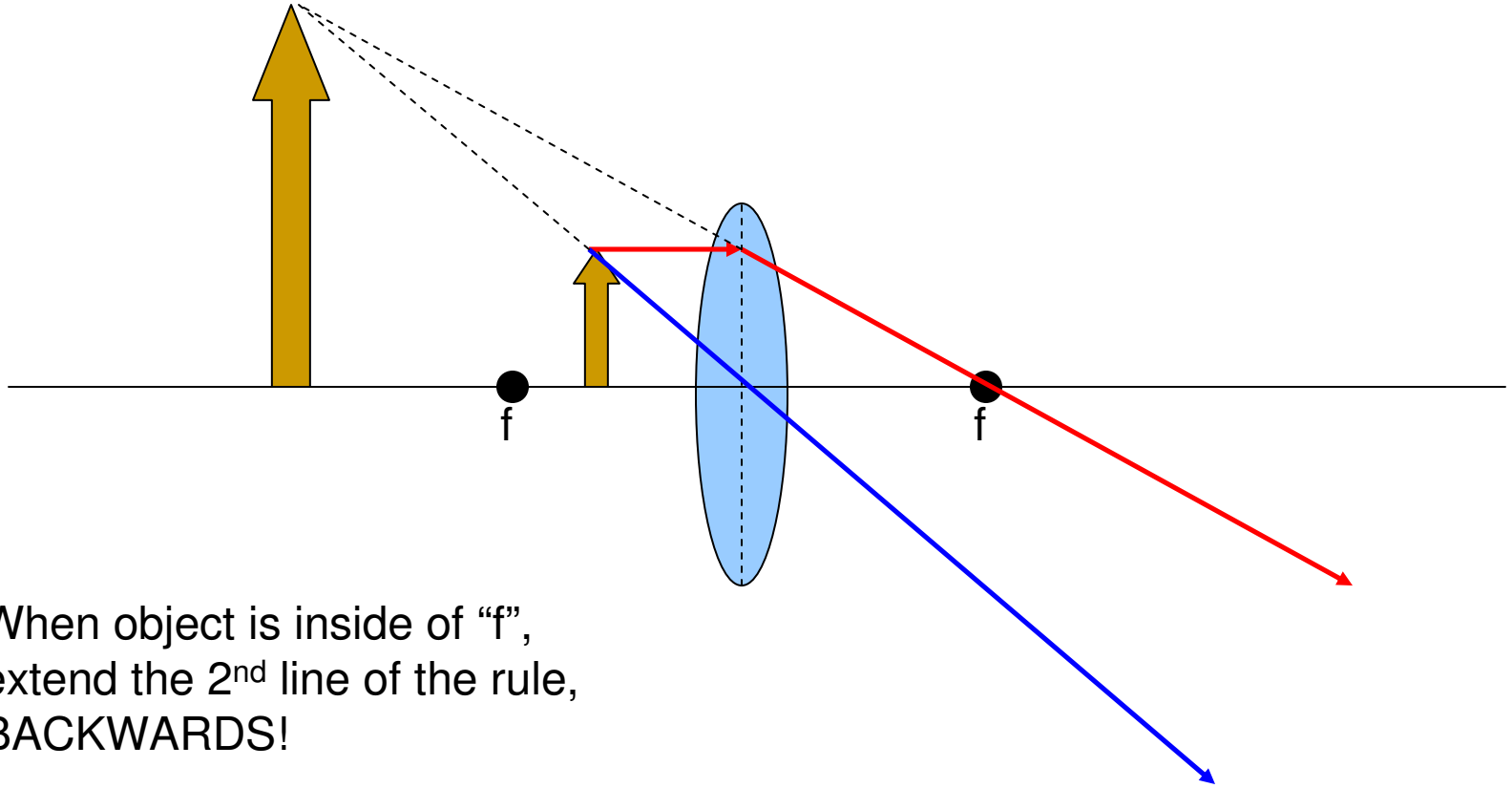
Honors Physics

What if the object is ON “f “ ?



If the object is ON the focal point, no image is produced as there is NO intersection.

Converging Lens – Inside of "f"

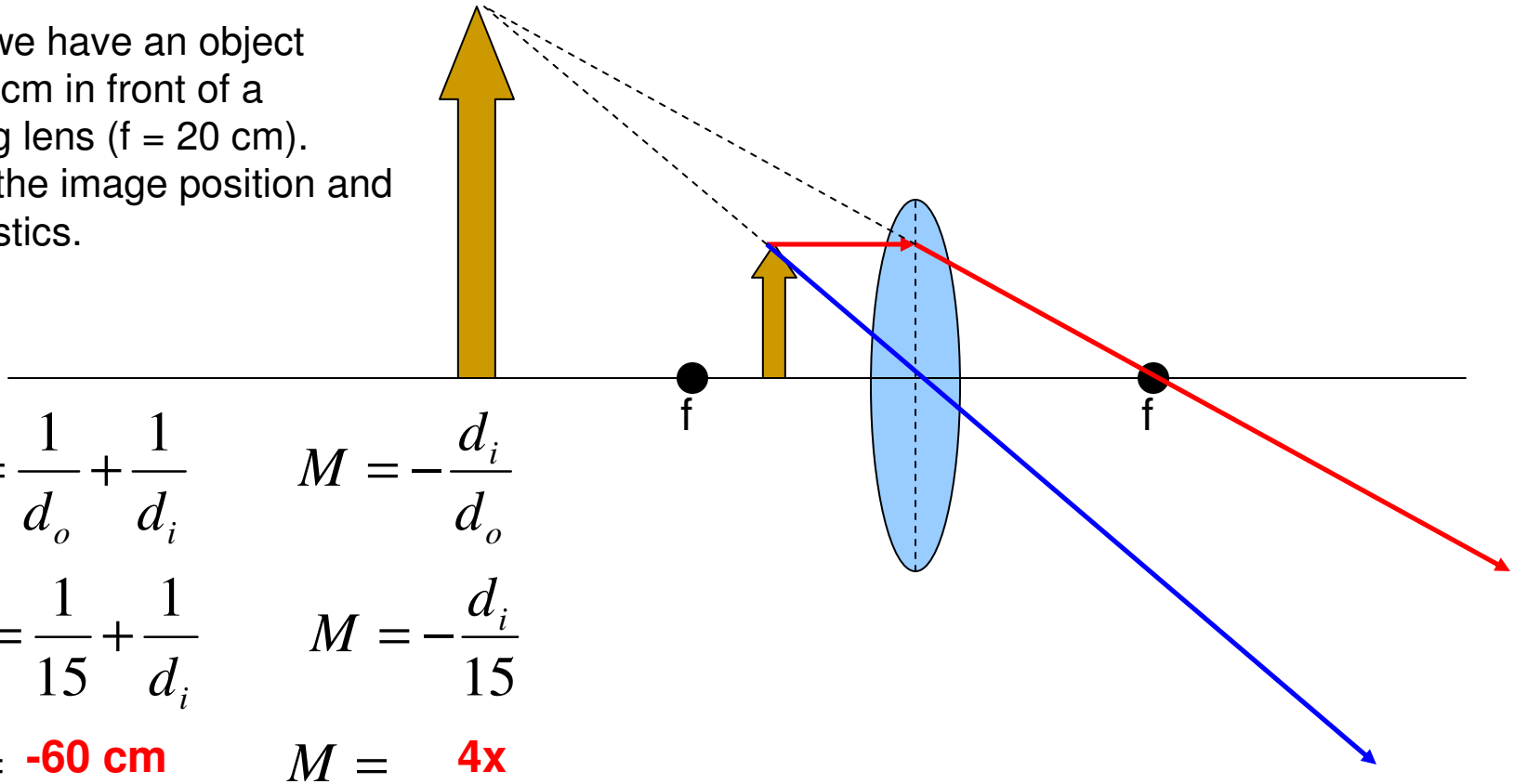


When object is inside of "f",
extend the 2nd line of the rule,
BACKWARDS!

This image is VIRTUAL, ENLARGED, and UPRIGHT

Converging Lens – Inside of "f "

Suppose we have an object placed 15 cm in front of a converging lens (f = 20 cm). Calculate the image position and characteristics.



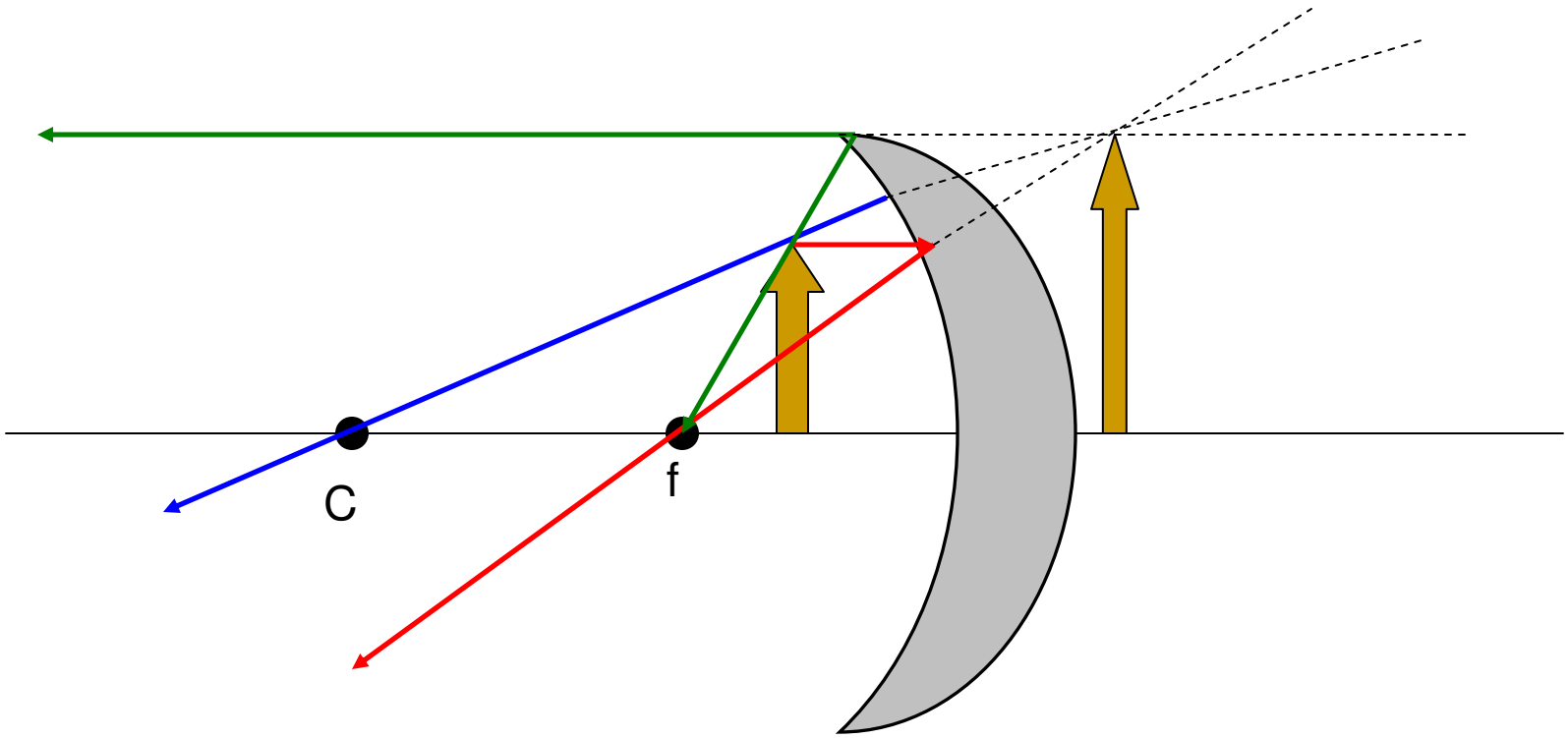
$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \qquad M = -\frac{d_i}{d_o}$$

$$\frac{1}{20} = \frac{1}{15} + \frac{1}{d_i} \qquad M = -\frac{d_i}{15}$$

$d_i =$ **-60 cm** $\qquad M =$ **4x**

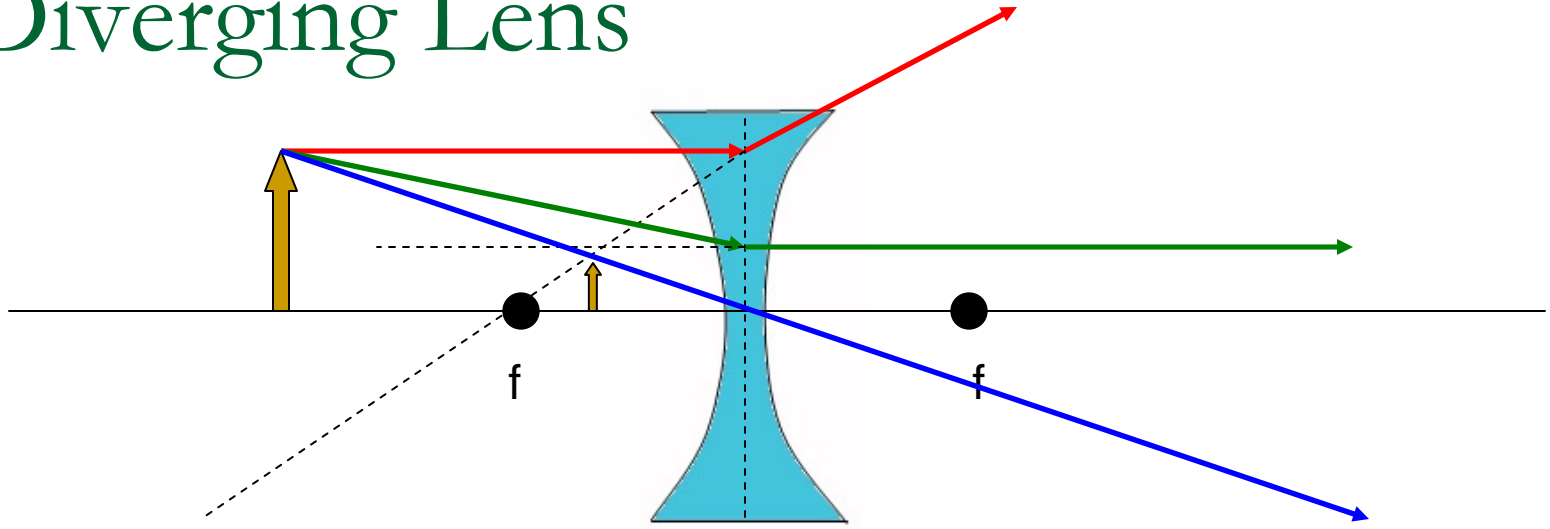
As we thought. The image distance is negative, thus making it a VIRTUAL image. The magnification was positive and greater than 1, making it enlarged and upright. This is a MAGNIFYING GLASS!

Converging Mirror – Inside of "f "



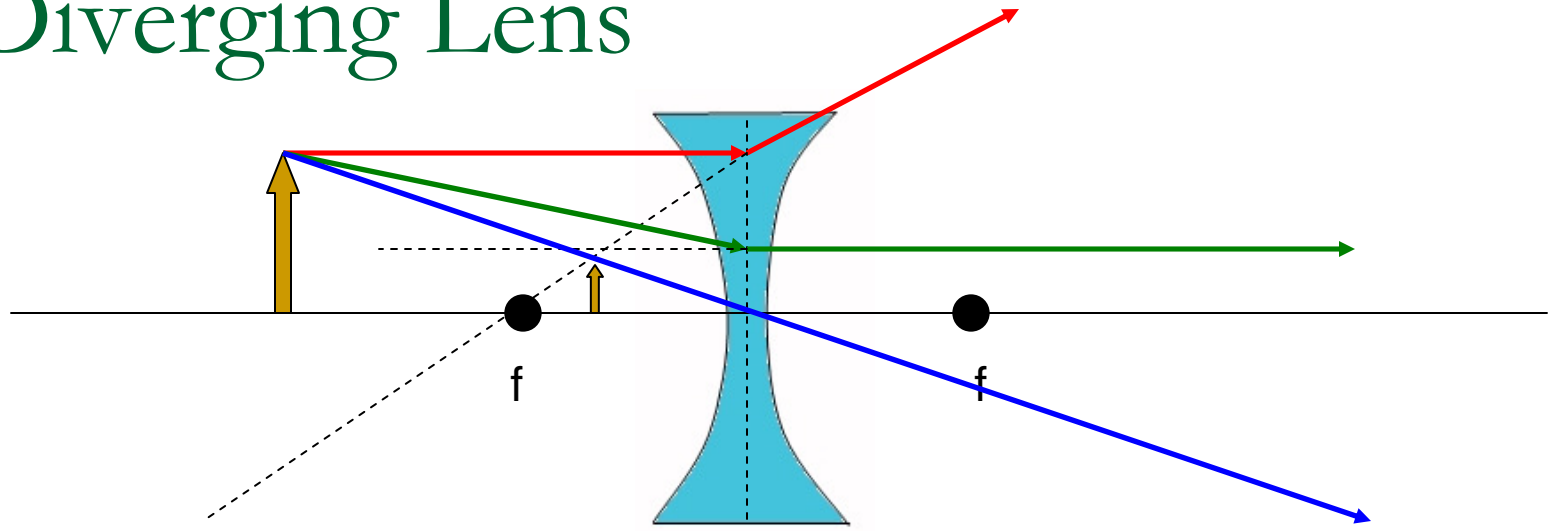
The image is VIRTUAL, ENLARGED, and UPRIGHT. This is a compact mirror!

Diverging Lens



The image is VIRTUAL, REDUCED, and UPRIGHT. On the next slide we will verify with the math. But before we do it is important to understand that all DIVERGING LENSES AND MIRRORS have **NEGATIVE FOCAL LENGTHS!!!.**

Diverging Lens



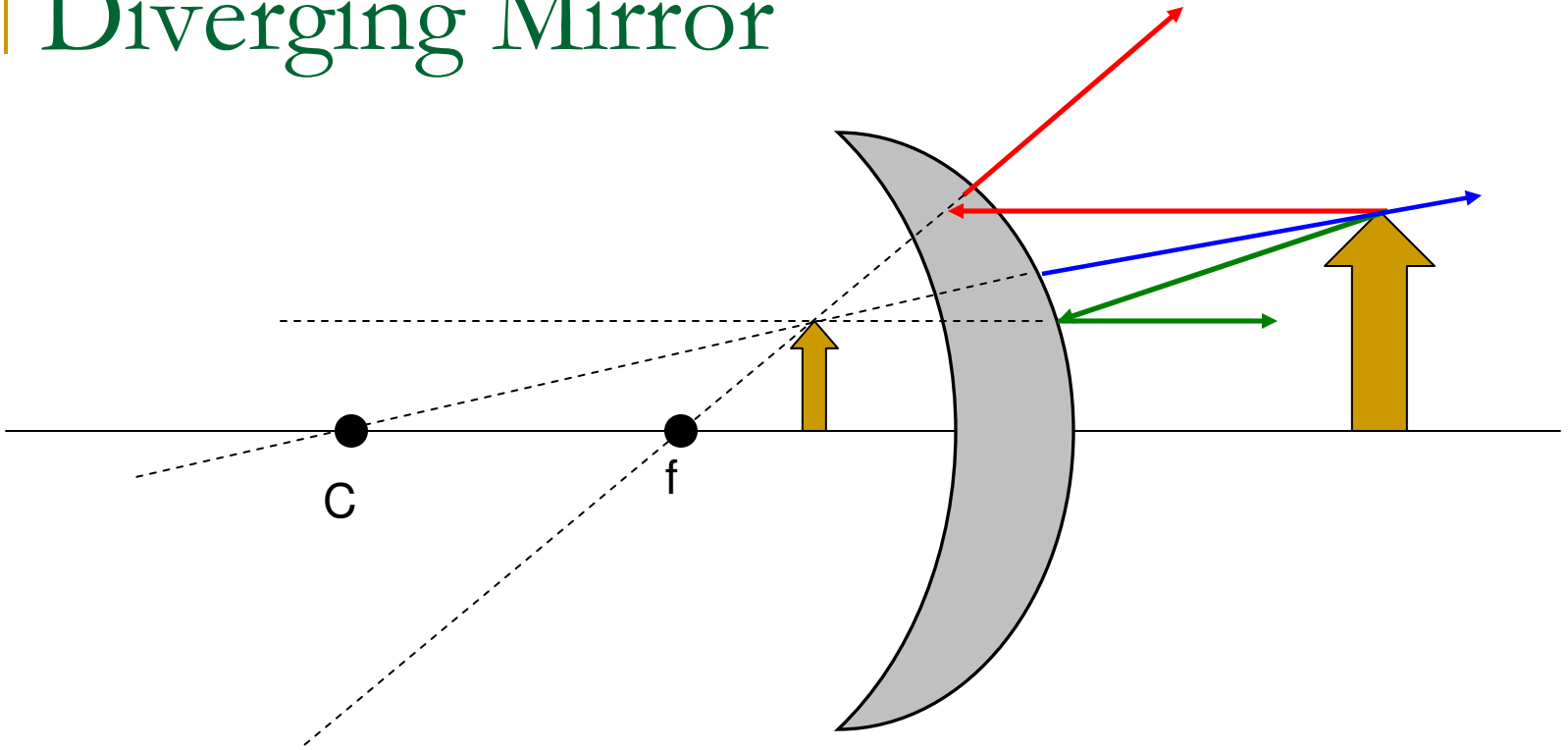
$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \qquad M = -\frac{d_i}{d_o}$$

$$\frac{1}{-20} = \frac{1}{35} + \frac{1}{d_i} \qquad M = -\frac{d_i}{35}$$

$d_i =$ **-12.73 cm** $\qquad M =$ **0.36x**

Once again, the image is verified as VIRTUAL as the image distance is negative. The image is verified using the magnification formula to be UPRIGHT and REDUCED.

Diverging Mirror



The image produced is VIRTUAL (it is on the OPPOSITE side) and REDUCED and UPRIGHT. This could be back end of a spoon, a Christmas tree ball ornament, an anti-theft mirror in a store.