Multiple Choice (1 point each)

_1_. For total internal reflection to take place, light must go from a medium of lower index of refraction to a medium of higher index of refraction.
   a. True  b. False  c. It depends

_2_. For a real object, a diverging lens always produces a virtual image.
   a. True  b. False  c. It depends

_3_. For a real object, a converging lens always produces
   a. a virtual image  b. a real image
   c. either a virtual image or a real image

_4_. The difference between a camera and the human eye is that a camera utilizes a fixed focal length lens and the eye does not.
   a. True  b. False

_5_. What type of eyeglasses should a nearsighted person wear?
   a. diverging lenses  b. bifocal lenses
   c. converging lenses  d. double convex lenses

Problem (5 points)

A converging lens (L$_2$) has a focal length of 4 cm is 24 cm to the right of a converging lens (L$_1$) of focal length 6 cm. An object is placed 12 cm to the left of the converging lens (L$_1$). Find (a) the location and (b) the magnification of the object's final image. (The drawing is not to the scale of present problem)

To lens L$_1$: \[ \frac{1}{d_0} + \frac{1}{d_i} = \frac{1}{f} \]
\[ \frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_0} = \frac{1}{6} - \frac{1}{12} = \frac{1}{12} \]
\[ d_i = 12 \text{ cm}, \quad m_1 = \frac{-d_i}{d_0} = -\frac{12}{12} = -1 \]

To lens L$_2$: \[ \frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f} \]
\[ \frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{4} - \frac{1}{12} = \frac{3}{12} - \frac{1}{12} = \frac{2}{12} = \frac{1}{6} \]
\[ d_i = 6 \text{ cm}, \quad m_2 = \frac{-d_i}{d_o} = -\frac{6}{12} = -\frac{1}{2} \]

(a) The final image is at 6 cm to the right of L$_2$.

(b) The magnification is \[ m_i = m_1 \times m_2 = (-1) \times (-\frac{1}{2}) = +\frac{1}{2} \]