SNC 2D   **Mirror Equation Questions**

- based on the geometry of the rays theoretically reflecting from a curved mirror, the *mirror equation* is derived to be:

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

  d_o = distance to object
  d_i = distance to image
  f = focal length

- the conventions for this equation include:
    - all distances are measured from the vertex of a curved mirror
    - distances of real objects and images are positive
    - object heights and image heights are positive when measured upward from the principal axis, and negative when measured downward

- *magnification equation*:
    the –ve sign is added to agree with the sign convention used above

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

Practice:

1. Determine the image distance in each of the following.
   a) A converging mirror has a focal length of 15 cm. An object is placed (i) 40 cm, and (ii) 10 cm from the mirror.   (24 cm, -30 cm)
   b) A diverging mirror has a focal length of -20 cm. An object is placed (i) 10 cm, and (ii) 30 cm from the mirror.   (-6.7 cm, -12 cm)
2. A candle 3.0 cm high is placed 30 cm from a converging mirror with a focal length of 20 cm. Using the mirror and magnification equations, determine the image position and its height. From these results, provide the image characteristics (S.A.L.T.)   (d_i = 60 cm; h_i = -6.0 cm)
3. A converging mirror has a focal length of 20 cm. Where should an object be placed so that its virtual image will be twice as tall as the object?   (10 cm)
4. A woman looks at herself in a magnifying converging mirror whose focal length is 20 cm. If her face is 10 cm from the mirror,
   a) at what distance from the mirror is her image?   (-20 cm)
   b) what is the magnification of her face?   (+2)
5. A 2.0 cm high candle is placed 15 cm in front of a concave mirror with a focal length of 30 cm. How far "behind" the mirror does the candle appear, and how large is it? (-30 cm, 4 cm)
6. A trucker sees the image of a car passing her truck in her diverging rear-view mirror, whose focal length is -60 cm. If the car is 1.5 m high and 6.0 m away, what is the size and location of the image? (13.5 cm, 54 cm)
7. A spherical, polished metallic ball is used as a diverging mirror (f = -20 cm) over a birdbath. A bird, 25 cm tall, standing 50 cm away, looks directly at the mirror. What are the size and position of the bird's image?   (7.2 cm, -14 cm)
8. When standing 2.0 m in front of an amusement park mirror, you notice that your image is three times taller. What is the radius of curvature of the mirror?   (6.0 m)
9. A child looks at his reflection in a spherical Christmas tree ornament 8.0 cm in diameter, and sees that the image of his face is reduced by one-half. How far is his face from the ornament? (2.0 cm)
10. A converging mirror has a focal length of 15 cm. Where would you place an object in order to produce an erect virtual image twice as tall as the object?   (d_o = 7.5 cm)