Mirror Practice Problems

1. A small object is placed 50 cm from a concave mirror with a focal length of 20 cm.
   a) How far is the image from the mirror? **+33.33cm**
   b) Is the image on the same side of the mirror as the object? **YES BK d, is positive**
   c) Is the image upright or inverted? **Inverted bk it is a real image**
   d) Is the image real or virtual? **Real bk on some side of object (di =ve)**
   e) If the object is 8 mm tall, how tall is the image?

-0.53cm

$$\frac{1}{f}=\frac{1}{do}+\frac{1}{di}$$
$$\frac{1}{20cm}=\frac{1}{50cm}+\frac{1}{di}$$
$$\frac{5}{100cm}-\frac{2}{100cm}-\frac{1}{di}$$
$$\frac{3}{100cm}=\frac{1}{di}$$
$$di=\frac{100cm}{3}$$
$$di=33.33cm$$

$$\frac{hi}{ho}=\frac{-di}{do}$$
$$\frac{hi}{0.8cm}=-\frac{33.33cm}{50cm}$$
$$hi=-0.53cm$$

2. A 6.0 cm pin is located 20 cm from a 25 cm focal length concave mirror. Determine the location, size, nature and orientation of the image of the pin. **S- larger (5x) A- upright (hi=ve) L- behind mirror T- virtual (di=ve)**

$$\frac{1}{f}=\frac{1}{do}+\frac{1}{di}$$
$$\frac{1}{25cm}=\frac{1}{20cm}+\frac{1}{di}$$
$$\frac{4}{100cm}-\frac{5}{100cm}=\frac{1}{di}$$
$$\frac{-1}{100cm}=\frac{1}{di}$$
$$di=-100cm$$
$$m=\frac{-di}{do}$$
$$=\frac{-(-100cm)}{20cm}$$
$$=5$$

3. A light source 30 cm from a concave mirror on the lab bench produces an image across the room on the wall, a distance of 10 metres away.

a) What is the focal length of the mirror? **0.29m**

b) Is the image inverted or upright? **Inverted since do >f**

c) If the filament is 25 mm across, how big is the image? **-83cm**

$$\frac{1}{f} = \frac{1}{do} + \frac{1}{di}$$

$$\frac{1}{f} = \frac{1}{0.3m} + \frac{1}{10m}$$

$$\frac{1}{f} = \frac{10}{3m} + \frac{0.3}{3m}$$

$$\frac{1}{f} = \frac{10.3}{3m}$$

$$f = \frac{3m}{10.3} = 0.29m$$

$$\frac{hi}{ho} = \frac{-di}{do}$$

$$\frac{hi}{0.025m} = \frac{10m}{0.3m}$$

$$hi = -0.83m$$

=-83cm

4. A concave mirror produces a real, inverted image of an object. The image is half the size of the object. If the object is 40 cm from the mirror, what is its focal length? **13.33cm**

$$\frac{1}{f} = \frac{1}{40cm} + \frac{1}{20cm}$$

$$\frac{1}{f} = \frac{3}{40cm}$$

$$f = 13.33cm$$

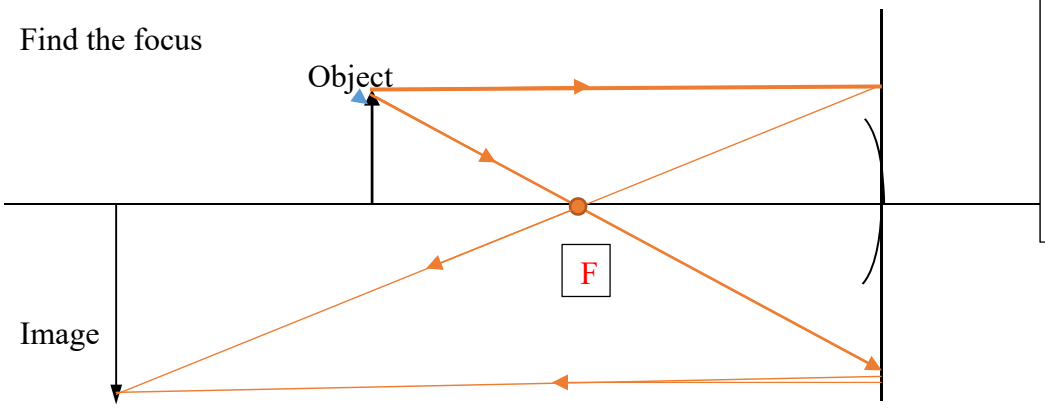
5. Concave mirrors can be used as for shaving or applying make up. The face must be inside the focus. You hold a concave mirror, with a focal length of 40 cm, about 30 cm from your face. a) Where is your image located? **-120cm**

b) How much bigger than your face is the image? **4x larger**

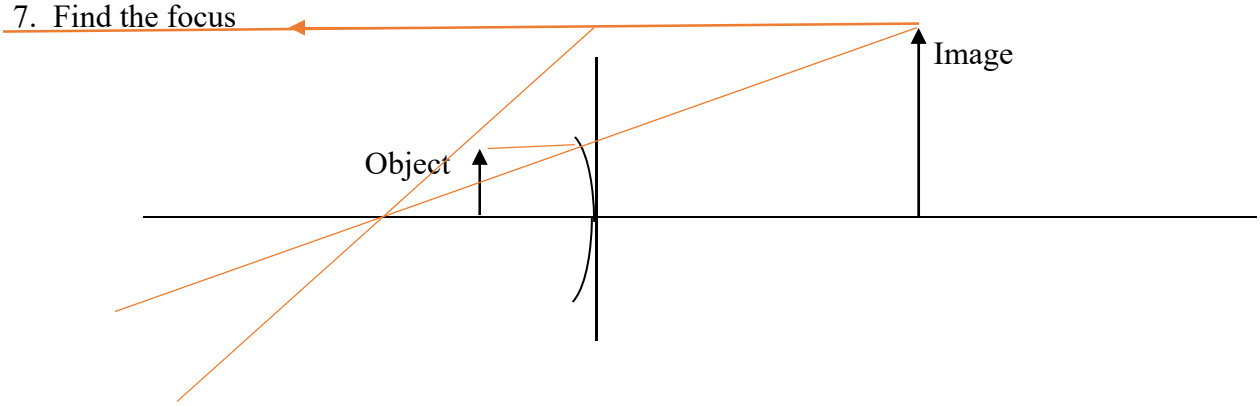
$$\frac{1}{40cm} = \frac{1}{30cm} + \frac{1}{di}$$
$$\frac{3}{120cm} - \frac{4}{120cm} + \frac{1}{di}$$
$$\frac{-1}{120cm} = \frac{1}{di}$$
$$di = -120cm$$

$$m = \frac{-di}{do}$$
$$= \frac{-(-120cm)}{30cm}$$
$$= 4$$

6. Find the focus



7. Find the focus



8. A convex mirror is placed on the ceiling at the intersection of two hallways. If a person stands directly underneath the mirror, the person's shoe is a distance of 195 cm from the mirror. The mirror forms an image of the shoe appearing 12.8cm behind the mirror's surface.
   a) What is the mirror's focal length? **-13.70**
   b) What is the magnification of the image? **0.07**
   c) Is the image real or virtual? **Virtual (always in context)**
   d) Is the image upright or inverted? **Upright (always in context)**

$$\frac{1}{f} = \frac{1}{do} + \frac{1}{di}$$
$$\frac{1}{f} = \frac{1}{195} + \frac{1}{-12.8}$$
$$= \frac{12.8}{2496} - \frac{-195}{2496}$$

$$= \frac{-182.2}{2496}$$

$$m = \frac{-(-12.8cm)}{195cm}$$
$$= +0.066$$

$$\frac{1}{f} = \frac{-182.2}{2496}$$
$$f = -13.70$$

9. A dentist uses a small mirror of radius 40mm to locate a cavity in a patient's tooth. The mirror is concave and held 16mm from the tooth.
   a) What is the magnification of the image? **5 x**
   b) What is the mirror's focal length? **20 min**
   c) What is the distance of the image from the mirror? **-80mm**
   d) Is the image real or virtual? **virtual**
   e) Is the image upright or inverted? **Upright**

$$\frac{1}{20mm} = \frac{1}{16mm} + \frac{1}{di}$$
$$\frac{1}{20mm} = \frac{1}{16mm} = \frac{1}{di}$$
$$\frac{4}{80mm} - \frac{5}{80mm} = \frac{1}{di}$$
$$\frac{-1}{80mm} = \frac{1}{di}$$
$$di = -80mm$$

$$radius = C = 2f$$
$$40mm = 2f$$
$$f = 20m$$
$$m = \frac{-di}{do} = \frac{-(-80mm)}{16mm}$$
$$.5$$

10. A production line inspector wants a mirror that produces an upright image with a magnification of 7.5 when it is located 14.0 mm from a machine part.
   a) What kind of mirror would do this job? **Concave since M is +ve**
   b) What is the radius of curvature? **C=2f= 32.4 mm**

$+m$ *so must be concanve*

$$\frac{1}{f} = \frac{1}{do} + \frac{1}{di}$$

$$= \frac{1}{14mm} + \frac{1}{-105mm}$$

$$\frac{1}{f} = \frac{13}{20} \quad f = 16.2mm$$

$$m = \frac{-di}{do}$$

$$7.5 = \frac{-di}{14mm} \quad -di = 105mm$$

11. Penny wishes to take a picture of her image in a plane mirror. If the camera is 1.2m in front of the mirror, at what distance should the camera lens be focused? **2.4 m**

12. Draw the ray diagram to find the image