8) In the Kitt Peak solar telescope a flat mirror 80 inches in diameter tracks the sun, reflecting collimated light down a 500-foot shaft to a 60-inch diameter parabolic mirror. This mirror in turn focuses the beam 300-feet back up the shaft. If the diameter of the sun is 864,000 miles and its distance from earth is 93,000,000 miles, how large will its image be at the focus of the telescope?

Collimated light : f.l. = 300 feet $\quad \theta = \frac{s}{r} = \frac{864,000}{93,000,000} = 0.00929$ radians

so for the image $\theta = \frac{s}{r}$ so $s = (0.00929)(300 \text{ ft}) = 2.79$ feet

or $\frac{y'}{y} = -\frac{s'}{s} = \frac{(0.0568)(8.64\times10^5)}{9.3\times10^7}$ (300')

9) Telephoto camera lenses most often resemble the Galilean telescope, i.e., they consist of a positive lens L1 followed by a negative lens L2. If the focal length of L1 is 20 cm, that of L2 is -40 cm and the separation is 10 cm, determine the focal length of the combination and its b.f.l.

like #7

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$$
$$= \frac{1}{20} - \frac{1}{40} + \frac{10}{(20)(40)}$$
$$= 0.05 - 0.025 + 0.0125$$
$$= 0.0375$$
$$f = 26.67$$

B.f.l. : lens 1: $i = f$

lens 2: $o = d - i = -10$ cm

$$\frac{1}{-10} + \frac{1}{i} = \frac{-1}{40}$$
$$i = 13.33 \text{ cm}$$

10) A positive thin lens is used on a digital projector to project the enlarged image of the LCD display onto a screen 10-meters away. If the LCD is 20 x 30 mm, and it its image is to be 2 x 3 meters, what must the focal length of the lens be and its distance from the LCD display?

$M = -100$

$S_i = 10$ m so $S_o = 0.1$ m

$$\frac{1}{S_o} + \frac{1}{S_i} = \frac{1}{f} = \frac{1}{0.1} + \frac{1}{10}$$

so $f = 0.099$ m

END OF TEST