$$B_2 = \frac{F}{g}$$

Q. Two Thin convex lenses of focal length 20 cm and 5 cm are kept co-axially seperated by a distance of 10 cm. Find the position of the cardinal points from the combination.

$f_1 = +20\text{cm}$ $f_2 = 5\text{cm}$, $d = 10\text{cm}$

$$f = \frac{f_1 f_2}{f_1 + f_2 - d} = \frac{20 \times 5}{25 - 10}$$

$$f = \frac{100}{15} = 6.67\text{cm}$$

First principal point

$$\alpha_1 = \frac{df}{F_2}$$

$$\alpha_1 = \frac{10 \times 6.67}{5} = \frac{66.7}{5} = 13.33\,cm$$

$$\alpha_2 = \frac{-df}{F_1} = \frac{-10 \times 6.67}{20} = \frac{66.7}{20}$$

$$= -3.33\,cm$$

second focus point =

$$\beta_2 = f\left(1 - \frac{d}{f_1}\right)$$

$$\beta_2 = 6.67\left(1 - \frac{10}{20}\right)$$

$$\beta_2 = 6.67\left(1 - \frac{1}{2}\right)$$

$$\beta_2 = \frac{6.67}{2} = 3.33\,cm$$

$$\beta_1 = -f\left(1 - \frac{d}{f_2}\right)$$

$$\beta_1 = 6.67\left(1 - \frac{10}{5}\right)$$

$$\beta_1 = -6.67\,(1 - 2)$$

$$\boxed{\beta_1 = +6.67\,cm}$$