Problems

① An object 3 cm high is placed 24 cm ~~is placed~~ away from a convex lens of focal length 8 cm. Find the position, height and nature of the image

↳ Given: $h = 3$ cm

$u = -24$ cm

$f = +8$ cm (convex)

$v = ?$

$h' = ?$

WKT

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} - \frac{1}{(-24)} = \frac{1}{8}$$

$$\Rightarrow \frac{1}{v} + \frac{1}{24} = \frac{1}{8}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{8} - \frac{1}{24}$$

$$\Rightarrow \frac{1}{v} = \frac{2}{24} \quad (12)$$

$$\Rightarrow v = +12 \text{ cm}$$

Image will be formed behind the lens at a distance 12 cm from the lens.

Nature → Real and inverted (∵ h' is −ve)

Again, $m = \frac{v}{u}$

$$= \frac{12}{-24}$$

$$= -\frac{1}{2} \quad \left| < 1 \right.$$

$\therefore m = \frac{h'}{h} \Rightarrow h' = mh = \frac{1}{2} \times 3 \text{ cm} = 1.5 \text{ cm}$

(2) Calculate a distance at which an object should be placed in front of a convex lens of focal length 10 cm to obtain a virtual image of double its size.

↳ Given,

Convex lens and $f = 10$ cm

and $h' = 2h$ (according to Q.)

$\Rightarrow \frac{h'}{h} = 2$

$\Rightarrow m = 2$

Again

$m = \frac{v}{u}$ (for lens)

$\Rightarrow 2 = \frac{v}{u}$

$\Rightarrow v = 2u$

WKT

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\Rightarrow \frac{1}{2u} - \frac{1}{u} = \frac{1}{f}$

$\Rightarrow \frac{1-2}{2u} = \frac{1}{10}$

$\Rightarrow \frac{-1}{2u} = \frac{1}{10}$

$\Rightarrow 2u = -10$

$\Rightarrow u = -5$ cm //

Q/ What is the power of a lens of focal length 40 cm?

↳ WKT, $P = \frac{1}{f}$

$= \frac{1}{0.4} = \frac{10}{4}$

$= 2.5$ D

Given

$f = 40$ cm

$= 0.4$ m

(only mag. is considered here)