$$\therefore \frac{1}{F} = \frac{1}{V} - \frac{1}{U} = \frac{1}{90} + \frac{1}{45} = \frac{1}{30} \Rightarrow$$

$$f = 30 \text{ cm}$$

When the needle is moved 5cm towards the lens

$$U = -(45 + 5) = -50 \text{ cm}$$

$$\frac{1}{V} = \frac{1}{F} + \frac{1}{U} = \frac{1}{30} + \frac{1}{(-50)} = \frac{2}{150} \Rightarrow V = 75$$

Displacement of image $= v - v' = 90 - 75 = 15$ cm towards the lens

c) Power $P_1 = +3D$ and $P_2 = -5D$

Position of object $u = -50$ cm

Power gets added

$$P = P_1 + P_2$$

$$P = 3 - 5 = -2$$

$$f = \frac{1}{P} = \frac{1}{-2} = -50 \text{ cm}$$

Apply lens formula

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

$$v = \frac{uf}{f+u} = \frac{(-50) \times (-50)}{(-50) \times (-50)} = +25 \text{ cm}$$

Position of image is V = +25 cm

(3) for Convex lens

focal length = f = 10cm

Power of lens = P = 10

Concave lens

focal length = -25cm

Power of lens = +4D

object distance = -20cm

image distance = V = +100cm

magnification = $\frac{\text{height of image}}{\text{height of object}}$

$= \frac{-5}{1} = \frac{V}{U}$

$-5 \text{ (increase)} = \frac{V}{-20}$

$-5 \times -20 = V$

$100\text{cm} = V$

By lens formula

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

$$\frac{1}{F} + \left(\frac{-1}{25}\right) = \frac{1}{100} - \left(\frac{-1}{20}\right)$$

$$\frac{1}{f} - \frac{1}{} = \frac{1}{} + \frac{1}{}$$

$\frac{1}{r} \quad \frac{1}{25} = \frac{20+200}{100 \times 20}$

$\frac{25-f}{25f} \quad \frac{120}{2000}$

$\frac{250f}{25-f} = \frac{200}{12}$

$25 \times 12 \times f = 200 (25-f)$

$300f = 5000 - 200f$

$500f - 5000$

$f = 10cm$

$\text{power} = \frac{1}{\text{focal length}} = \frac{100}{f}$

$\text{power of convex lens} = \frac{100}{10} = 10D$

(4) Total power - P — $P_1 + P_2$

$F = 1/f = 1/f' + 1/f_2$

When lenses of 10 D and -5 D are taken

Total power

$P = P_1 + P_2$

$10 D - 5 D$

Hence focal length = $100/5$

$= 20cm$