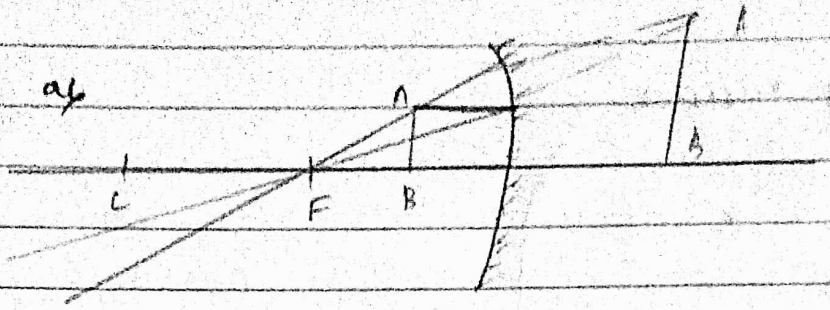
SHORT ANSWER

11) a)



b) $u = -10$

$f = -20$

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

$$\frac{1}{-10} + \frac{1}{v} = \frac{1}{-20}$$

$$\frac{1}{v} = \frac{1}{-20} + \frac{1}{10}$$

$$\frac{1}{v} = \frac{-1+2}{20}$$

$$\frac{1}{v} = \frac{2}{20}$$

$$2v = 20$$

$$v = \frac{20}{2}$$

$$v = 10\ cm$$

c) Virtual and erect.

12) $u = -36$

$f = -12$

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

$$\frac{1}{-36} + \frac{1}{v} = \frac{1}{-12}$$

$\frac{1}{v} = \frac{1}{-12} + \frac{1}{36}$

$\frac{1}{v} = \frac{-3+1}{36}$

$\frac{1}{v} = \frac{-2}{36}$

$-2v = 36$

$v = \frac{36}{2}$

$v = -18$

The image is real and inverted.

134 $f = -10$

$m = \frac{h_2}{h_1}$

$m = \frac{2}{6}$ $\quad m = \frac{6}{2}$

$2m = 6$

$m = 3$

$m = -\frac{v}{u}$

$3 = -\frac{v}{u}$

$3u = -v$

$v = -3u$

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

$\frac{1}{-3u} + \frac{1}{u} = \frac{1}{-10}$

$\frac{-1+3}{3u} = \frac{1}{-10}$

$\frac{2}{3u} = \frac{1}{-10}$

$-20 = 3u$

$3u = -20$

$u = \frac{-20}{3}$

(4) $P = \frac{1}{2}$

$= 0.5$

An object 5cm is held 25cm away from a converging of 10cm Find the position, size and nature.

$f = 10$

$u = -25$

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

$\frac{1}{-25} + \frac{1}{v} = \frac{1}{10}$

$\frac{1}{v} = \frac{1}{10} - \frac{1}{25}$

$\frac{1}{v} = \frac{5-2}{50}$

$\frac{1}{v} = \frac{3}{50}$

$3v = 50$

$v = \frac{50}{3} = 16.67\text{ cm}$

$$m = -\frac{v}{u}$$

$$= -\frac{16.67}{-25}$$

$$= -0.66$$

$$m = \frac{h_2}{h_1}$$

$$-0.66 = \frac{h}{5}$$

$$h_2 = -3.3 \text{ cm}.$$

u = -2f

17) $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

$\frac{1}{-2f} + \frac{1}{v} = \frac{1}{-18}$

$\frac{1}{v} = \frac{1}{-18} + \frac{1}{27}$

$\frac{1}{v} \quad \frac{-3+2}{54}$

$\frac{1}{v} = \frac{-1}{54}$

$-1v = 54$

$v = -54$

Real and inverted

16) $f = -20$

$u = -10$

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

$\frac{1}{-10} + \frac{1}{v} = \frac{1}{-20}$

$\frac{1}{v} = \frac{1}{-20} + \frac{1}{10}$

$\frac{1}{v} = \frac{1-2}{-20}$

$\frac{1}{v} = \frac{-1}{20}$

$v = -20$

$m = \frac{-v}{u}$

$m = \frac{-20}{-10}$

$m = 2$

$m = \frac{h_1}{h_2}$

$2 = \frac{h_1}{3}$

$h_1 = 6$ cm

Virtual and erect

19) $f = -4$

$u = -9$

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

$\frac{1}{-9} + \frac{1}{v} = \frac{1}{-4}$

$\frac{1}{v} = \frac{1}{-4} + \frac{1}{9}$

$\frac{1}{v} = \frac{9-4}{-36}$

$\frac{1}{v} = \frac{5}{-36}$

$5v = -36$

$v = \frac{-36}{5}$

$v = -7.2\,cm$

Real and inverted

$m = \frac{-v}{u}$

$m = \frac{-(-7.2)}{-9}$

$m = \frac{7.2}{9}$

$m = 0.8$

$m = \frac{u_1}{u_2}$

$0.8 = \frac{u_2}{2}$

$u_2 = 1.6\,cm$

20) $u = -20$

$m = \frac{-v}{u}$

$3 = \frac{+v}{+20}$

$v = 60$

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

$\frac{1}{-20} + \frac{1}{60} = \frac{1}{f}$

$\frac{-3+1}{60} = \frac{1}{f}$

$\frac{-2}{60} = \frac{1}{f}$

$-2f = 60$

$f = \frac{60}{-2}$

$f = -30$

$4f = 60$

$f = \frac{60}{4}$

$f = 15$

$$-3 = \frac{-(-v)}{u}$$

$$-3 = \frac{v}{u}$$

$$-3u = v$$

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{+}$$

$$\frac{1}{u} + \frac{1}{-3u} = \frac{1}{15}$$

$$\frac{-3+1}{-3u} = \frac{1}{15}$$

$$\frac{-2}{-3u} = \frac{1}{15}$$

$$-30 = -3u$$

$$u = \frac{\pm 30}{\pm 3}$$

$$u = 10 \text{ cm}$$

21.

$$R = 3$$

$$4 = \frac{3}{2}$$

$$5 = \frac{-v}{u}$$

$$-v = 5u$$

$$v = -5u$$

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{+}$$

$$\frac{1}{u} + \frac{1}{-5u} = \frac{1}{\frac{3}{2}}$$

$$\frac{-5+1}{-5u} = \frac{2}{3}$$

$$\frac{+4}{+5u} = \frac{2}{3}$$

$$10u = 12$$

$$u = \frac{12}{10} \quad u = 1.2 \text{ cm}$$

22) $f = \frac{R}{2}$ $\quad u = -10$

$= \frac{1.5}{2}$

$= -\frac{3}{4}$ m

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

$= \frac{1}{-10} + \frac{1}{v} = -\frac{1}{\frac{3}{4}}$

$\frac{1}{v} = -\frac{4}{3} + \frac{1}{10}$

$\frac{1}{v} = \frac{-40+3}{30}$

$\frac{1}{v} = \frac{37}{30}$

$37v = 30$

$v = \frac{30}{37} = 0.81$

23) $u = -20$

$f = -15$

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

$\frac{1}{-20} + \frac{1}{v} = \frac{1}{-15}$

$\frac{1}{v} = \frac{1}{-15} + \frac{1}{20}$

$\frac{1}{v} = \frac{-4+3}{60}$

$\frac{1}{v} = \frac{-1}{60}$

$-v = 60$

$$m = \frac{-v}{u}$$

$$m = \frac{-(-60)}{-20}$$

$$m = \frac{60}{-20}$$

$$m = -3$$

$$-3 = \frac{h_1}{h_2}$$

$$-3 = \frac{h_1}{5}$$

$$h_1 = -15 \text{ m}$$

2nd $u = -10$

$$3 = \frac{+v}{-10}$$

$= v = +30$

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

$$\frac{1}{-10} + \frac{1}{30} = \frac{1}{f}$$

$$\frac{-3+1}{-30} = \frac{1}{f}$$

$$\frac{-2}{30} = \frac{1}{f}$$

$$-2f = 30$$

$$f = \frac{30}{-2} = 15$$

$f = -15$

$$\frac{R}{2} = \frac{-15}{1}$$

$= -30 = R$

$R = -30$

$$-\frac{15}{2} = \frac{R}{2}$$

$R = -15 - 30 = R_2$

$R = 30 + 15$

$R = 45$ cm

$f = -20$

26) $m = \frac{-v}{u}$

$\frac{-1}{4} = \frac{-v}{u}$

$-u = -4v$

$u = 4v$

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

$\frac{1}{4v} + \frac{1}{v} = \frac{1}{-20}$

$\frac{1+4}{4v} = \frac{1}{-20}$

$\frac{5}{4v} = \frac{1}{-20}$

$-100 = 4v$

$v = \frac{-100}{4}$

$v = -25$

$u = 4v$

$u = 4(-25)$

$u = -100\ cm.$

27) $u = -50$

$m = \frac{-v}{u}$

$\frac{-1}{2} = \frac{-v}{-50}$

$-2v = 50$

$v = \frac{50}{2}$

$v = -25$

$m = \frac{+v}{u}$

$\frac{5}{1} = \frac{(-25)}{u}$

$5u = -25$

$u = -5$

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

$\frac{1}{-25} + \frac{1}{-50} = \frac{1}{f}$

$\frac{-3}{50} = \frac{1}{f}$

$-3f = 50$

$f = \frac{-50}{3}$

$$m = \frac{-1}{5}$$

$$\frac{-1}{5} = \frac{-v}{u}$$

$$+u = +5v$$

$$v = \frac{u}{5}$$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{+}$$

$$\frac{1}{\frac{u}{5}} + \frac{1}{u} = \frac{-3}{50}$$

$$\frac{5}{u} + \frac{1}{u} = \frac{-3}{50}$$

$$\frac{6}{u} = \frac{-3}{50}$$

$$-3u = 300$$

$$u = \frac{-300^{100}}{3}$$

$$u = -100$$