**1**   (a)   It means that <u>rays parallel to the principal axis</u> will                     [1]
            <u>meet 10.0 cm away from the centre of the len</u>s measured a<u>long the principal axis</u>.   [1]

            diagram                                                               [1]



10.0 cm
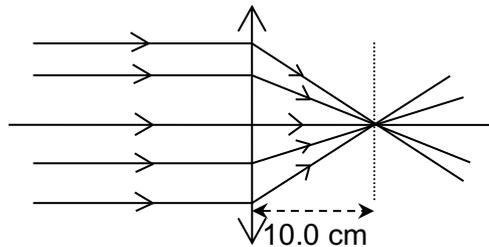
        (i)  1/10.0 = 1/12.5 + 1/v
             v = 50.0 cm                                                         [2]

        (ii) Magnification = hi / ho = v / u

             H = 25 x (50.0/12.5)
               = 100 mm                                                          [2]


**2**   1/$f$ = 1/50 + (-1/150)                                                       [2]
        $f$ = 75 mm

**3**    (a)  (i)   real
                    1/150 = 1/u + 1/3u
                    u = 200 mm                                                   [2]

             (ii)  virtual.

                   If we take u as positive (which is always the case), v = -3u

                   1/150 = 1/u - 1/3u
                   u = 100 mm                                                    [2]

        (b)   1. <u>Move the object further from the lens (u>2$f$ ie u>300mm to get a smaller image)</u>   [1]

              2. <u>Move the screen closer to the lens.</u>                                    [1]