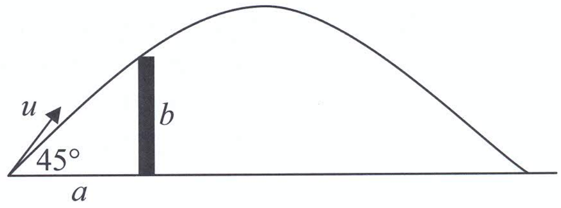
2008 **3.** **(a)** A ball is projected from a point on the ground at a distance of a from the foot of a vertical wall of height b, the velocity of projection being u at an angle 45° to the horizontal.



If the ball just clears the wall prove that the greatest height reached is

$$\frac{a^2}{4(a-b)}.$$

$u\cos 45.t = a$	5	
$u\sin 45.t - \frac{1}{2}gt^2 = b$	5	
$u\frac{1}{\sqrt{2}}\left(\frac{a\sqrt{2}}{u}\right) - \frac{1}{2}g\left(\frac{a\sqrt{2}}{u}\right)^2 = b$		
$a - \frac{ga^2}{u^2} = b$		
$\Rightarrow u^2 = \frac{ga^2}{a-b}$		
At greatest height $v_j = 0$		
$u\frac{1}{\sqrt{2}} - gt = 0$		
$t = \frac{u}{g\sqrt{2}}$	5	
greatest height $= u\sin 45.t - \frac{1}{2}gt^2$		
$= u\frac{1}{\sqrt{2}}\left(\frac{u}{g\sqrt{2}}\right) - \frac{1}{2}g\left(\frac{u}{g\sqrt{2}}\right)^2$	5	
$= \frac{u^2}{4g}$		
$= \frac{ga^2}{(a-b)4g}$		
$= \frac{a^2}{4(a-b)}$	5	25