**Q. 7. Bullet**

(i) Let the angle of projection be $\alpha$.

$u_x = v_x = 35\cos\alpha = 28$ … must match the speed of the bird

$\Rightarrow \cos\alpha = \frac{4}{5}$

$\Rightarrow \tan\alpha = \frac{3}{4}$

$\Rightarrow \alpha = \tan^{-1}\frac{3}{4}$

$u_y = 35\sin\alpha$

$= 35\left(\frac{3}{5}\right)$

$= 21$

$\Rightarrow s_y = 21t - \frac{1}{2}gt^2$

Bullet will reach bird when $s_y = 5.6$

$\Rightarrow 21t - 4.9t^2 = 5.6$

$\Rightarrow 4.9t^2 - 21t + 5.6 = 0$ … divide by 0.7

$\Rightarrow 7t^2 - 30t + 8 = 0$

$\Rightarrow (7t - 2)(t - 4) = 0$

$\Rightarrow t = \frac{2}{7}, t = 4$ … bullet will strike bird on the way up

$\Rightarrow t = \frac{2}{7}$ s

**Q. 8.** (i) $u_x = 35\cos A$

$u_y = 35\sin A$

$x = s_x = 35t\cos A$

$y = s_y = 35t\sin A - \frac{1}{2}gt^2$

$250y = 250(\tan A)x - (1 + \tan^2 A)x^2$

$\Leftrightarrow 250\left(35t\sin A - \frac{1}{2}gt^2\right) = 250(\tan A)(35t\cos A) - (1 + \tan^2 A)(35t\cos A)^2$

$\Leftrightarrow 8{,}750t\sin A - 1{,}225t^2 = 8{,}750\tan A\cos A - (1 + \tan^2 A)(1{,}225t^2\cos^2 A)$

$\Leftrightarrow 8{,}750\sin A - 1{,}225t^2 = 8{,}750\sin A - \left(\frac{1}{\cancel{\cos^2 A}}\right)(1{,}225t^2\cancel{\cos^2 A})$

$\Leftrightarrow 8{,}750\sin A - 1{,}225t^2 = 8{,}750\sin A - 1225t^2$ **QED**

(ii) $250y = 250(\tan A)x - (1 + \tan^2 A)x^2$ … let $x = 40$ and $y = 20$

$\Rightarrow 5{,}000 = 10{,}000(\tan A) - (1 + \tan^2 A)(1{,}600)$

$\Rightarrow 1{,}600\tan^2 A - 10{,}000\tan A + 6{,}600 = 0$ … divide by 200

$\Rightarrow 8\tan^2 A - 50\tan A + 33 = 0$

$\Rightarrow (4\tan A - 3)(2\tan A - 11) = 0$

$\Rightarrow \tan A = \frac{3}{4}, \tan A = \frac{11}{2}$