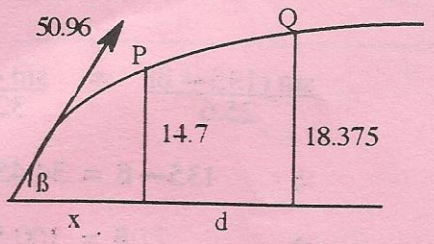
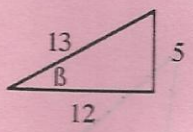
1996

3 (a)





$\vec{r} = 50.96(\cos ß)t\ \vec{i}$ 5

$+ \{50.96(\sin ß)t - 0.5gt^2\}\ \vec{j}$ 5

$= 47.04t\ \vec{i} + \{19.6t - 4.9t^2\}\ \vec{j}$

At P $r_{\vec{j}} = 14.7 \Rightarrow 19.6t - 4.9t^2 = 14.7$

$t^2 - 4t + 3 = 0$

$\Rightarrow t = 1$ 5

At Q $r_{\vec{j}} = 18.375 \Rightarrow 19.6t - 4.9t^2 = 18.375$

$t^2 - 4t + 3.75 = 0$

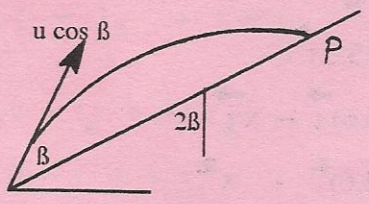
$\Rightarrow t = 1.5$ or $t = 2.5$ 5

When $t = 1$, $x = 47.04(1) \Rightarrow x = 47.04$

When $t = 1.5$, $x + d = 47.04(1.5) \Rightarrow d = 23.52$ 5

When $t = 2.5$, $x + d = 47.04(2.5) \Rightarrow d = 70.56$ 5 30

(b)



$\vec{r} = \{u\cos ß.\cos ß.t - 0.5g\cos 2ß.t^2\}\ \vec{i}$ 5

$+ \{u\cos ß.\sin ß.t - 0.5g\sin 2ß.t^2\}\ \vec{j}$ 5

At P $r_{\vec{j}} = 0 \Rightarrow t = \dfrac{2u\cos ß\sin ß}{g\sin 2ß} = \dfrac{u}{g}$ 5

Range $= u\cos^2 ß.\dfrac{u}{g} - \dfrac{g}{2}\cos 2ß.\dfrac{u^2}{g^2} = \dfrac{u^2}{2g}$ 5 20