Author: Naga Karthik

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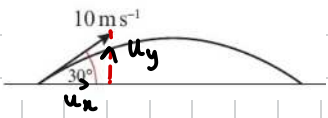
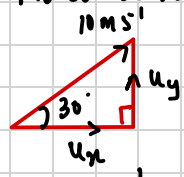
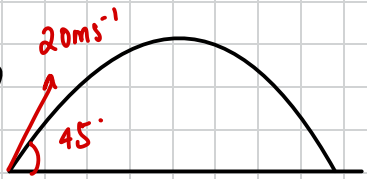
6.2: Horizontal & vertical components

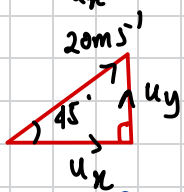
① 



a) $\cos 30^\circ = \frac{u_x}{10} \Rightarrow u_x = 10\cos 30^\circ = 5\sqrt{3}\ ms^{-1}$

b) $\sin 30^\circ = \frac{u_y}{10} \Rightarrow u_y = 10\sin 30^\circ = 5\ ms^{-1}$

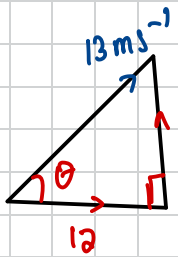
② 



a) $u_y = 20\sin 45^\circ = 10\sqrt{2}\ ms^{-1}$

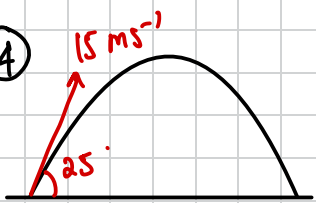
$u_x = 20\cos 45^\circ = 10\sqrt{2}\ ms^{-1}$

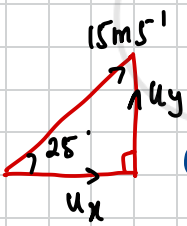
$\Rightarrow (10\sqrt{2}\,i + 10\sqrt{2}\,j)\ ms^{-1}$

③ 

$\tan\theta = \frac{5}{12} \Rightarrow \theta = \arctan\left(\frac{5}{12}\right) = 22.6^\circ$

$\Rightarrow \sqrt{5^2+12^2} = 13\ ms^{-1}$ $\Rightarrow$ 13ms⁻¹ at an angle of 22.6° (3sf) above the horizontal.

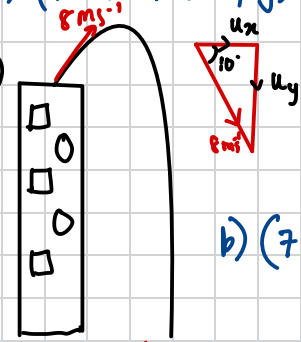
④ 



a) $\sin 25^\circ = \frac{u_y}{15} \Rightarrow u_y = 15\sin 25^\circ = 6.34\ ms^{-1}$ (3sf)

$\cos 25^\circ = \frac{u_x}{15} \Rightarrow u_x = 15\cos 25^\circ = 13.6\ ms^{-1}$ (3sf)

b) $(13.6\,i + 6.34\,j)\ ms^{-1}$ (3sf)

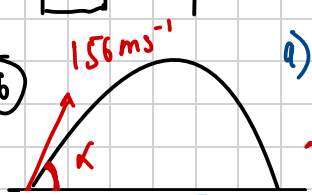
⑤ 

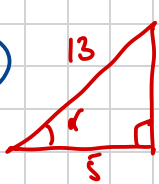
a) $\cos 10^\circ = \frac{u_x}{8} \Rightarrow u_x = 8\cos 10^\circ = 7.88\ ms^{-1}$ (3sf)

$\sin 10^\circ = \frac{u_y}{8} \Rightarrow u_y = 8\sin 10^\circ = 1.39\ ms^{-1}$ (3sf)

b) $(7.88\,i - 1.39\,j)\ ms^{-1}$ (3sf)

↳ below the horizontal

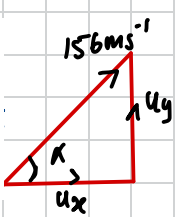
⑥ 

a) 

$\tan\alpha = \frac{12}{5}$

$\Rightarrow \sin\alpha = \frac{12}{13}$

$\Rightarrow \cos\alpha = \frac{5}{13}$



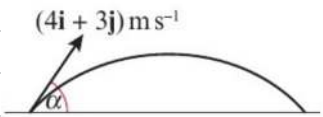
$u_x = 156\cos\alpha$

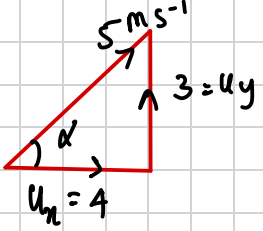
$u_y = 156\sin\alpha$

$\Rightarrow u_x = 156 \times \frac{5}{13} = 60\ ms^{-1}$ $\Rightarrow u_y = 156 \times \frac{12}{13} = 144\ ms^{-1}$

b) $u = (60i + 144j)\ ms^{-1}$

7





$\Rightarrow \sqrt{4^2 + 3^2} = \sqrt{25} = 5$

$\tan\alpha = \frac{3}{4} \Rightarrow \alpha = \arctan\left(\frac{3}{4}\right)$

$\Rightarrow \alpha = 36.9^\circ$ (3SF)

$\therefore$ $5\,\text{ms}^{-1}$ at an angle of 36.9° (3s.f) above the horizontal.