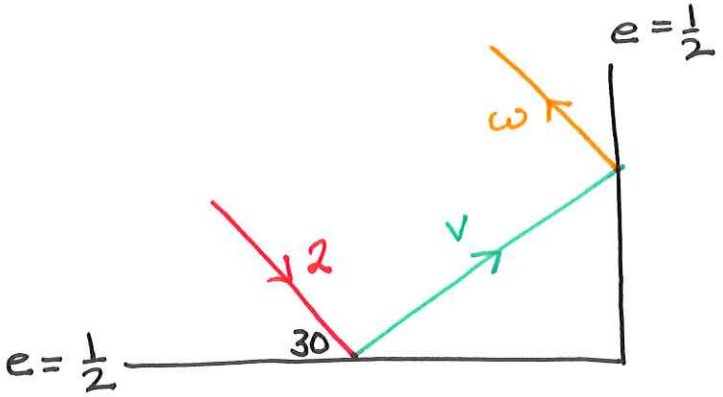
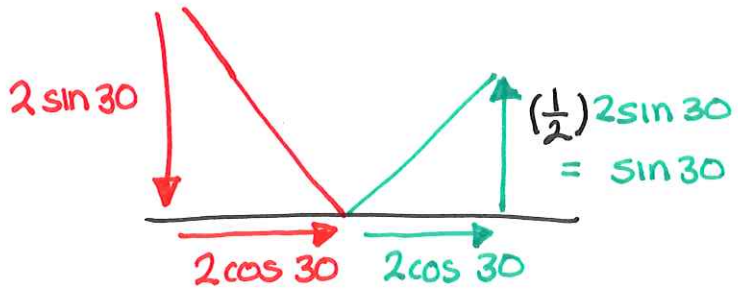
Ex 5B

Q1.



(a)

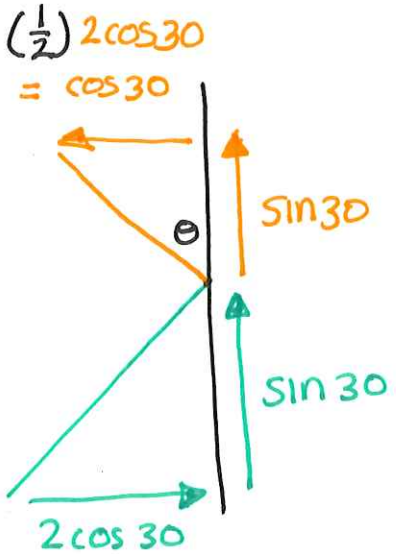


$V^2 = (2\cos 30)^2 + (\sin 30)^2$

$V = \frac{\sqrt{13}}{2} = \underline{1.80}$

$\theta = \tan^{-1}\left(\frac{0.5}{\sqrt{3}}\right) = \underline{16.1^\circ}$

(b)



$\omega^2 = (\cos 30)^2 + (\sin 30)^2$

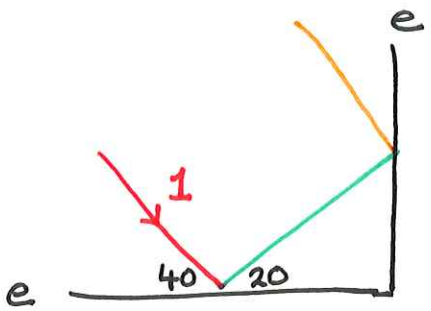
$\omega = \underline{1\ ms^{-1}}$

$\theta = \tan^{-1}\left(\frac{\cos 30}{\sin 30}\right)$

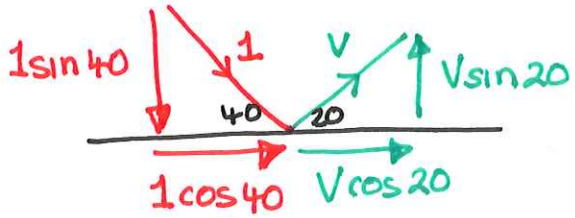
$\theta = \underline{60^\circ}$

Ex5B

Q2.



(a)



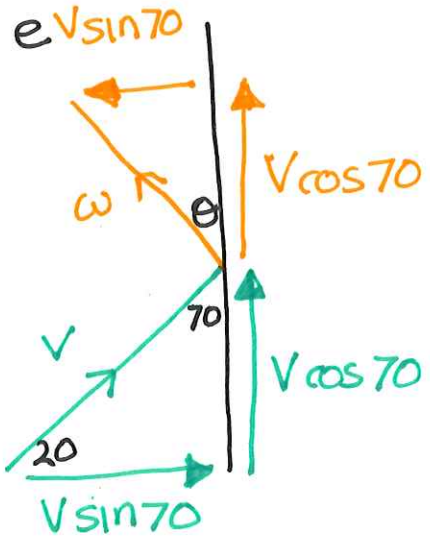
$\cos 40 = V\cos 20$

$V = \dfrac{\cos 40}{\cos 20} = 0.815 \text{ ms}^{-1}$

(b) $V\sin 20 = e\sin 40$

$e = \dfrac{V\sin 20}{\sin 40} = \dfrac{0.815\sin 20}{\sin 40} = 0.434$ (3sf)

(c)



$\omega^2 = (0.35371\sin 70)^2 + (0.815\cos 70)^2$

$\omega = 0.434$ (3sf)

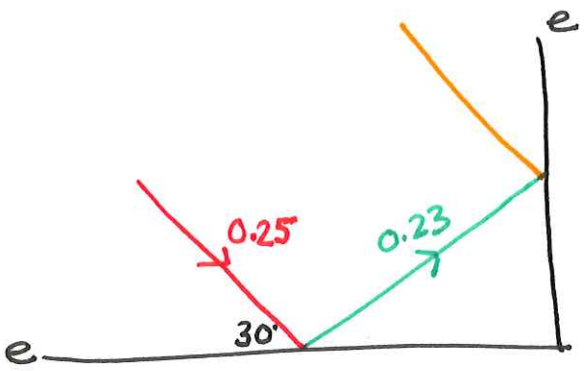
$\theta = \tan^{-1}\left(\dfrac{0.35371\sin 70}{0.815\cos 70}\right)$

$\theta = 50.0°$

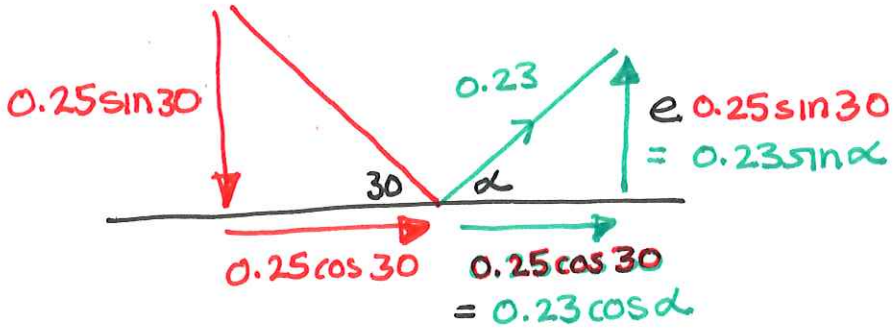
Ex5B

Q3.

$m = 0.1$



(a)



$$0.25\cos 30 = 0.23\cos\alpha$$

$$\cos\alpha = \frac{0.25\cos 30}{0.23}$$

$$\alpha = \cos^{-1}\left(\frac{0.25\cos 30}{0.23}\right) = \underline{\underline{19.7^\circ}} \text{ (3sf)}$$

(b)

$$e\,(0.25\sin 30) = 0.23\sin(19.7)$$

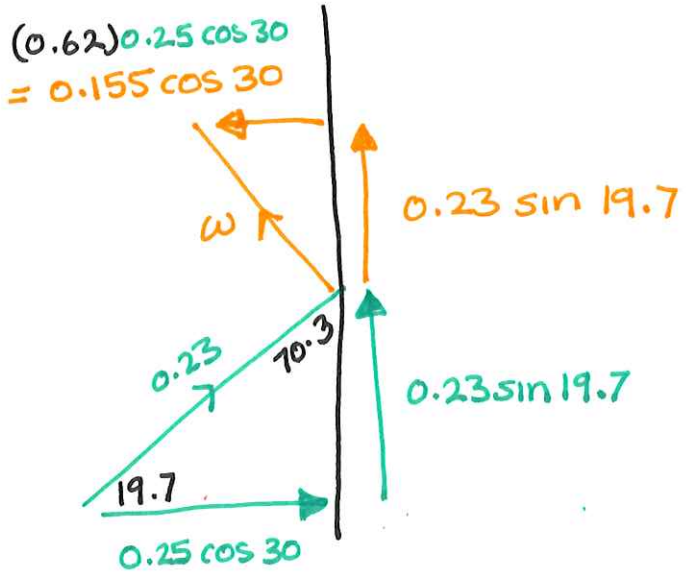
$$e = \frac{0.23\sin(19.7)}{0.25\sin(30)}$$

$$e = \underline{\underline{0.620}} \text{ (3sf)}$$

Ex 5B

Q3.

conti....



$$\omega^2 = (0.155\cos 30)^2 + (0.23\sin 19.7)^2$$

$$\omega = 0.155 \text{ (3sf)}$$

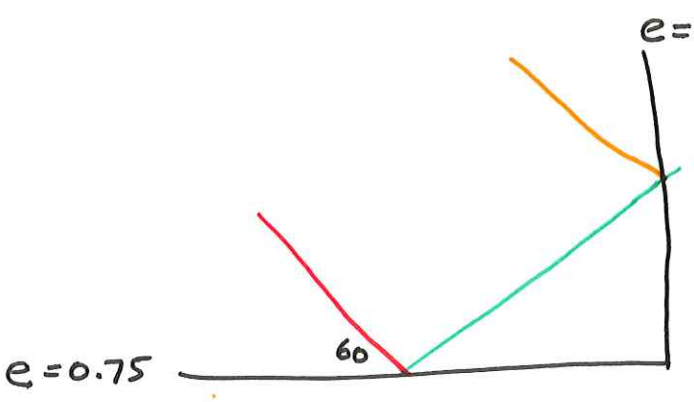
$$\text{KE} = \frac{1}{2}m\omega^2$$

$$= \frac{1}{2}(0.1)(0.155)^2$$

$$= 0.00120 \text{ J (3sf)}$$

Ex5B

Q4.



mass = 2

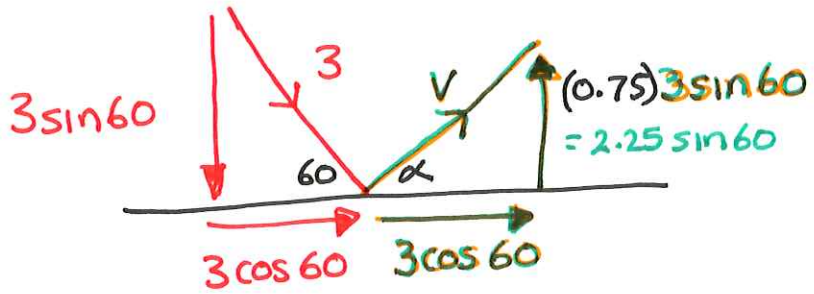
KE = 9J

(a) $KE = \frac{1}{2}mu^2$

$9 = \frac{1}{2}(2)u^2$

$u = 3$

(b)



$V^2 = (2.25\sin 60)^2 + (3\cos 60)^2$

$V = \underline{2.459}\ ms^{-1}$

$\alpha = \tan^{-1}\left(\frac{2.25\sin 60}{3\cos 60}\right)$

$\alpha = \underline{52.4^\circ}$

Ex5B

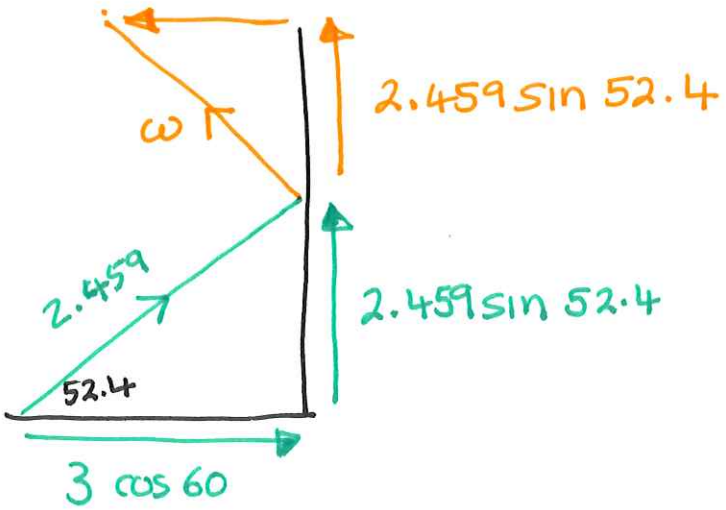
Q4.

conti....

(c)

(0.6) $3\cos 60$

$= 1.8\cos 60$



$$\omega^2 = (1.8\cos 60)^2 + (2.459\sin 52.4)^2$$

$$\omega = \underline{\underline{2.146}}$$

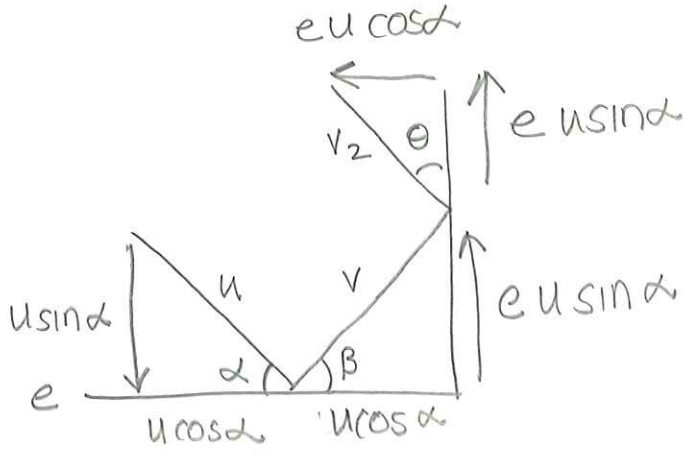
$$\text{KE} = \frac{1}{2}m\omega^2$$

$$= \frac{1}{2}(2)(2.146)^2$$

$$= \underline{\underline{4.61\,\text{J}}}$$

Ex5B

Q5.



$$V_2^2 = e^2u^2\cos^2\alpha + e^2u^2\sin^2\alpha$$

$$V_2^2 = (\sin^2\alpha + \cos^2\alpha)e^2u^2$$

$$V_2^2 = e^2u^2$$

$$V_2 = eu$$

$$\tan\theta = \frac{eu\cos\alpha}{eu\sin\alpha}$$

$$\tan\theta = \frac{1}{\tan\alpha}$$

$$\tan\theta = \tan(90-\alpha)$$

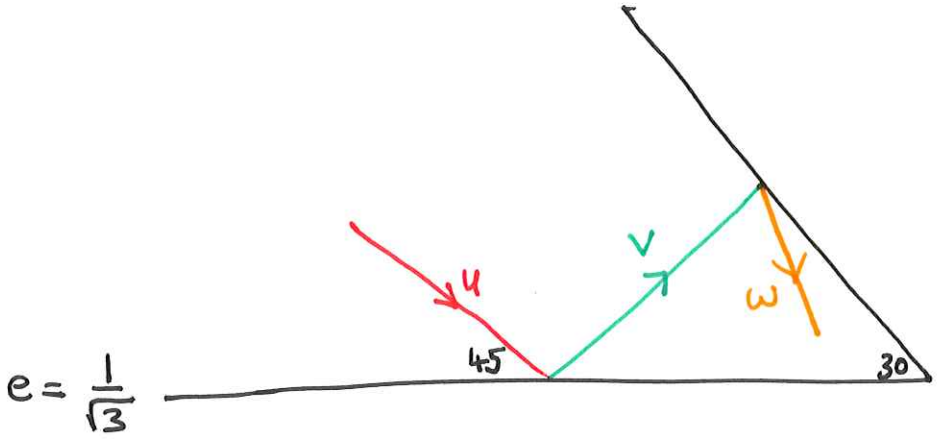
$$\theta = 90-\alpha$$

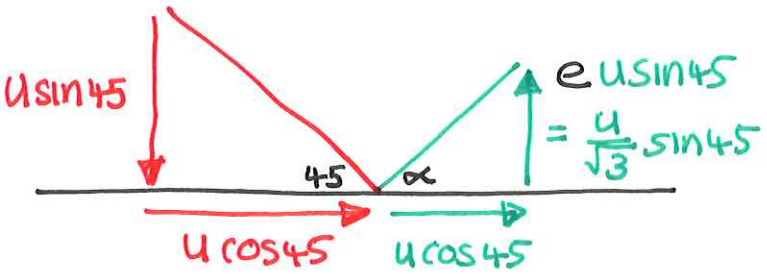
$$\theta + \alpha = 90$$

$\therefore$ same path oppositedirection

Ex5B

Q6.





$$V^2 = (u\cos 45)^2 + \left(\frac{u}{\sqrt{3}}\sin 45\right)^2$$

$$V^2 = \frac{2u^2}{12} + \frac{2u^2}{4}$$

$$V^2 = \frac{2u^2}{3}$$

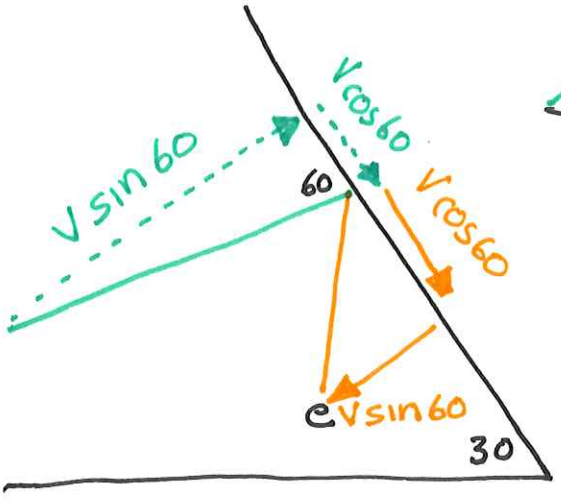
$$\tan\alpha = \left(\frac{\frac{u}{\sqrt{3}}\sin 45}{u\cos 45}\right)$$

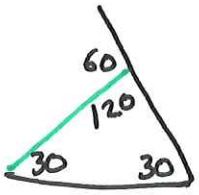
$$\tan\alpha = \frac{1}{\sqrt{3}}$$

$$\alpha = 30^\circ$$

Ex 5B

Q6.
conti





$$\omega^2 = (V\cos 60)^2 + (eV\sin 60)^2$$

$$\omega^2 = \frac{V^2}{4} + \left(\frac{1}{3}\right)V^2\left(\frac{3}{4}\right)$$

$$\omega^2 = \frac{V^2}{4} + \frac{V^2}{4}$$

$$\omega^2 = \frac{V^2}{2}$$

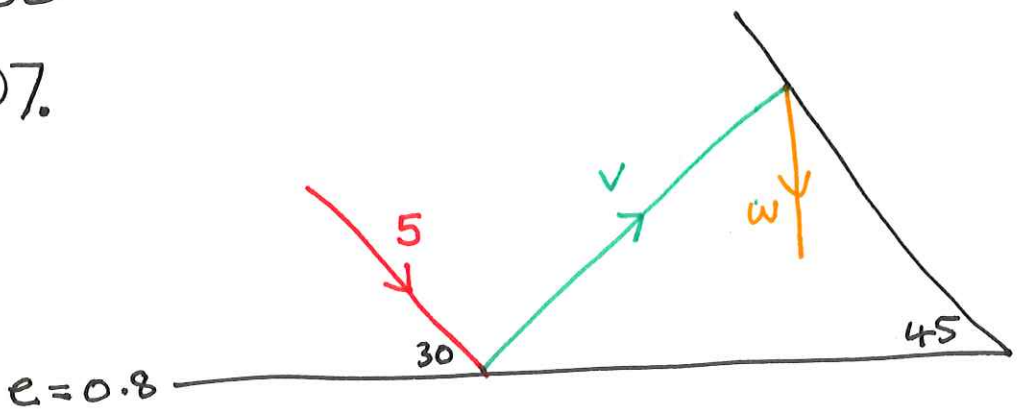
$$\omega^2 = \frac{\frac{2u^2}{3}}{2}$$

$$\omega^2 = \frac{u^2}{3}$$

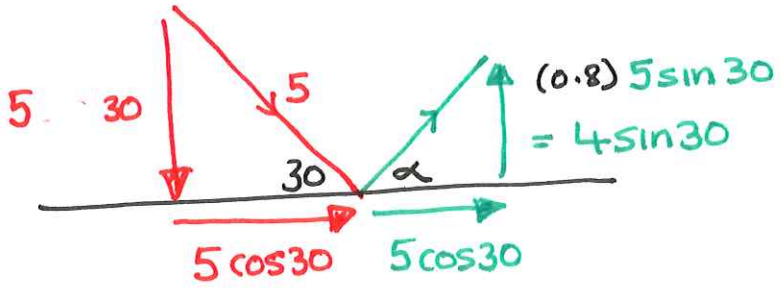
$$\omega = \frac{u}{\sqrt{3}} = \frac{\sqrt{3}\,u}{3}$$

Ex5B

Q7.



(a)



$$V^2 = (4\sin 30)^2 + (5\cos 30)^2$$

$$V = \frac{\sqrt{91}}{2} = 4.77\ ms^{-1}$$

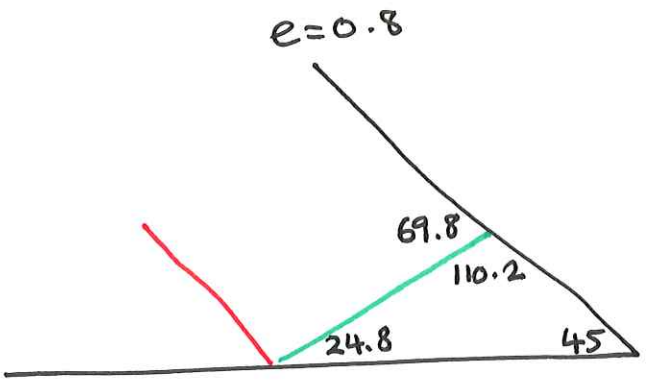
$$\alpha = \tan^{-1}\left(\frac{4\sin 30}{5\cos 30}\right)$$

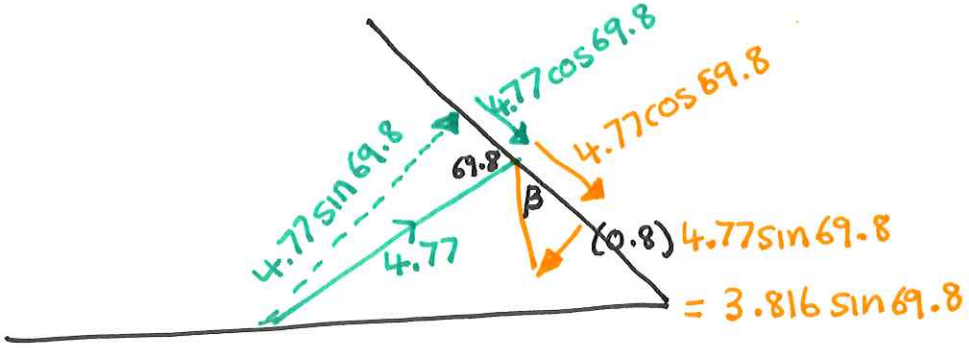
$$\alpha = 24.8^\circ$$

Ex 5B

Q7.

(b)





$$\omega^2 = (4.77\cos 69.8)^2 + (3.816 \sin 69.8)^2$$

$$\omega = 3.94 \text{ (3sf)}$$

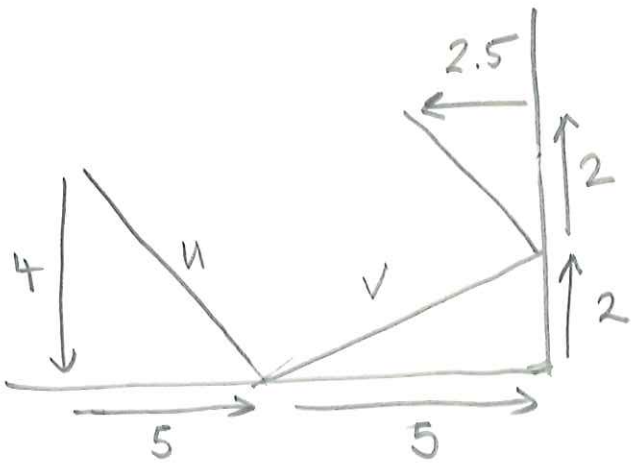
$$\beta = \tan^{-1}\left(\frac{3.816 \sin 69.8}{4.77 \cos 69.8}\right)$$

$$\beta = \underline{\underline{65.3^\circ}}$$

(c) velocity would be greater

Ex5B

Q8.



$e = \frac{2}{4} = \frac{1}{2}$

a) KE before $= \frac{1}{2}mu^2$

$= \frac{1}{2}(m)\left(\sqrt{4^2+5^2}\right)^2$

$= \frac{41m}{2}$

KE after $= \frac{1}{2}mv^2$

$= \frac{1}{2}(m)\left(\sqrt{2.5^2+2^2}\right)^2$

$= \frac{41}{8}(m)$

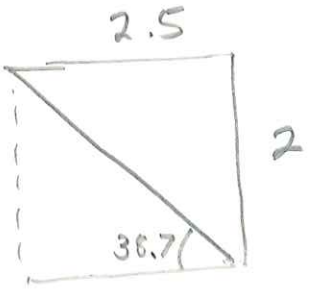
KE Lost $= \frac{41m}{2} - \frac{41m}{8}$

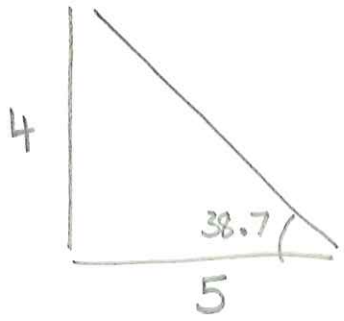
$= \frac{123m}{8}$ mJ

Ex 5B

Q8.

(b)





180° in Me opposite direction

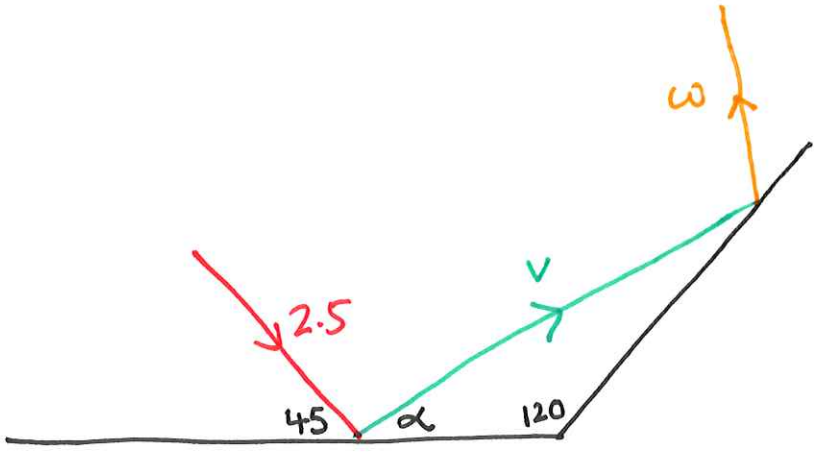
Ex 5B

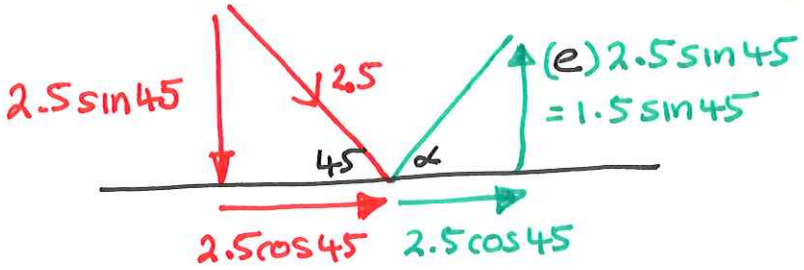
Q9.

(a)

$m = 0.25$

$e = 0.6$





$$V^2 = (1.5\sin 45)^2 + (2.5\cos 45)^2$$

$$V = \frac{\sqrt{17}}{2} = \underline{2.06} \text{ (3sf)}$$

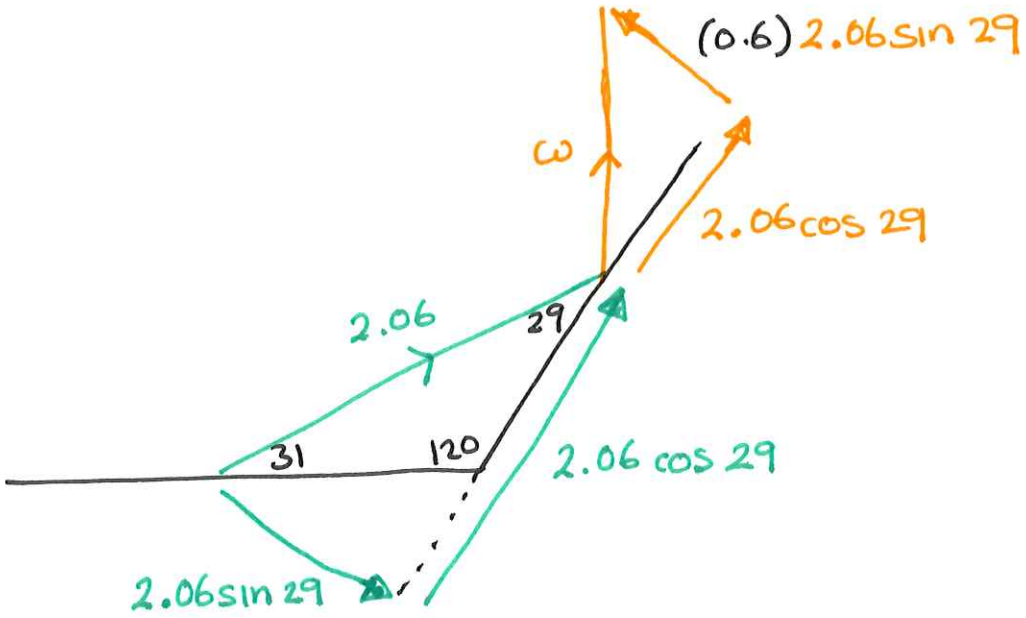
$$\alpha = \tan^{-1}\left(\frac{1.5\sin 45}{2.5\cos 45}\right)$$

$$\alpha = \underline{31.0^\circ}$$

Ex5B

Q9.

(b)



$$\omega^2 = (2.06\cos 29)^2 + (1.236\sin 29)^2$$

$$\omega = 1.89875$$

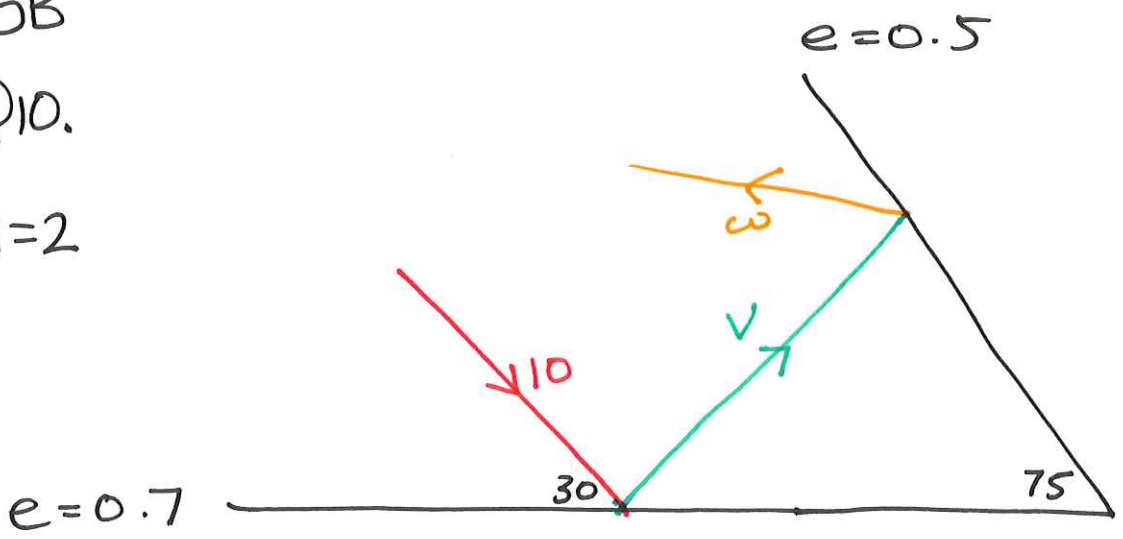
$$KE = \frac{1}{2}(0.1)(1.89875)^2$$

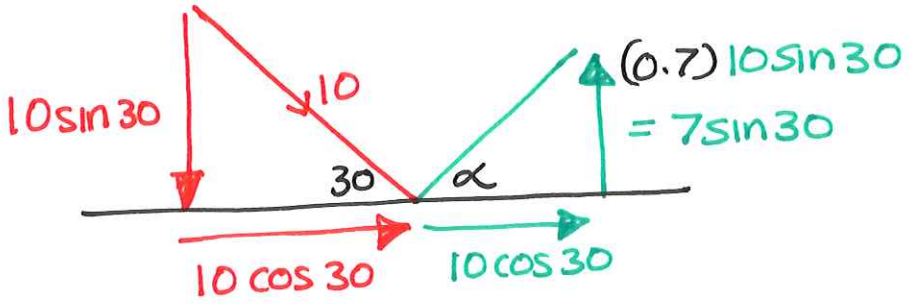
$$= \underline{\underline{0.180\ \text{J (3sf)}}}$$

Ex5B

Q10.

M=2





$$V^2 = (7\sin 30)^2 + (10\cos 30)^2$$

$$V = \frac{\sqrt{349}}{2} = \underline{\underline{9.34}} \text{ (3sf)}$$

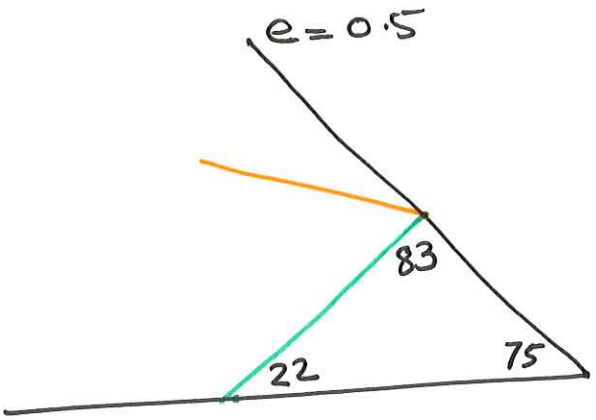
$$\alpha = \tan^{-1}\left(\frac{7\sin 30}{10\cos 30}\right)$$

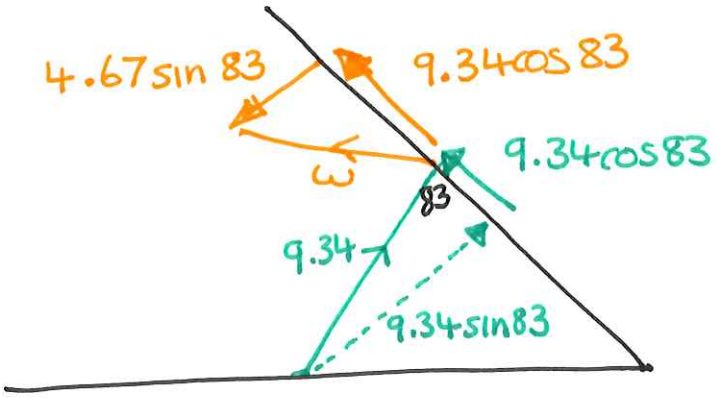
$$\alpha = \underline{\underline{22.0^\circ}}$$

Ex5B

Q10.

conti.





$$\omega^2 = (4.67\sin 83)^2 + (9.34\cos 83)^2$$

$$\omega = \underline{4.77} \text{ (3sf)}$$

$$\text{KE Loss} = \tfrac{1}{2}(2)(10)^2 - \tfrac{1}{2}(2)(4.77)^2$$

$$= \underline{77.2} \text{ J}$$