Circular Motion MS1

Q1.

1(i)	$T\cos\theta\left(=T\times\frac{0.15}{0.8}\right)=0.3g$	**M1**	Resolve vertically. θ is the angle between the string and the vertical
	$T=16\,N$ **AG**	**A1**	
		2	
1(ii)	$r^2=0.8^2-0.15^2$	**B1**	$r=0.78581...$
	$16\sin\theta\left(=16\times\frac{0.78581...}{0.8}\right)=\frac{0.3v^2}{0.78581...}$	**M1**	Use Newton's Second Law horizontally
	$v=6.416$	**A1**	
		3	

Q2.

3(i)	$r=0.4$ m	**B1**	Use Pythagoras's theorem
	$T\cos\theta=0.4\times5^2\times0.4$	**M1**	Use Newton's Second Law
	$T\times\frac{0.4}{0.5}=4, T=5N$	**A1**	
		3	
3(ii)	$R=0.4g-T\sin\theta$	**M1**	Resolve vertically. Allow for their T for M1
	$R=1N$	**A1**	
		2	

Q3.

2	For A: $T=3mg$ For B: $\uparrow\ T\cos\theta=mg$	**M1**
	Equate: $3mg\cos\theta=mg$ $\cos\theta=\frac{1}{3}$	**A1**
	$\rightarrow T\sin\theta=mr\omega^2$ with $r=(a-x)\sin\theta$	**M1**
	Equate: $3mg=m(a-x)\omega^2$	**A1**
	$x=\frac{a}{4}$	**A1**
		5

Q4.

1	$T=4mg=ma\omega^2$ so $\omega^2=\frac{4g}{a}$	**B1**
	Time per revn $=\frac{2\pi}{\omega}=\pi\sqrt{\frac{a}{g}}$	**B1**
		2

Circular Motion MS1

Q5.

2	At top, tension = 0, so $mg = \frac{mv^2}{a}$ $(v^2 = ag)$	**B1**	
	$\frac{1}{2}mv^2 = \frac{1}{2}mu^2 - mga(1+\cos\theta)$	**M1 A1**	Energy equation
	Substitute for u and v: $ag = \frac{16}{25}.5ag - 2ag(1+\cos\theta)$	**M1**	Eliminate
	$\cos\theta = \frac{1}{10}$	**A1**	
		5	

Q6.

4(a)	$\uparrow N\cos\theta = mg$	**B1**	
	$\leftarrow N\sin\theta = mr\sin\theta\omega^2$	**B1**	
	$\cos\theta = \frac{mg}{N}$ so $\cos\theta = \frac{g}{\omega^2 r}$	**B1**	AG
		3	
4(b)	$\cos\theta = \frac{r-x}{r} = \frac{g}{\omega^2 r}$	**B1**	Using trig of situation: must involve x
	In new situation: $r - 4x = r \times \frac{g}{4\omega^2 r}$	**M1**	Using new situation with $4x$ and 2ω seen
	$r - x = 4(r - 4x)$	**M1**	Combining
	$x = \frac{1}{5}r$	**A1**	
		4	