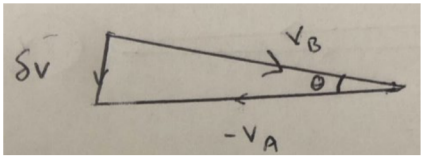
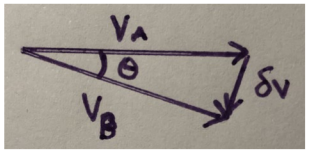
s

Question number	Answer		Mark
16(a)	• Correct vector diagram showing velocity change • Small angle, so $\delta\theta = \delta v / v$ • Use of $\delta\theta / \delta t = \omega$ and $v = R\omega$ • Algebra to show $\delta v / \delta t = v^2 / R$ Example of derivation   Small angle, so $\delta\theta = \delta v / v$ $\delta\theta = \omega\delta t$ $\delta\theta = v\delta t / R$ $v\delta t / r = \delta v / v$ $\delta v / \delta t = v^2 / R$	1 1 1 1	**4**
16 (b)(i)	• Free-body force diagram showing tension and weight only	1	**1**
16(b)(ii)	• Use of $T \cos\theta = mg$ • Use of $T \sin\theta = m\omega^2 r$ • Use of $\omega = 2\pi/T$ • Time for 4 rotations is 3.2 s Example of calculation $T \cos 19° = 0.0052 \text{ kg} \times 9.81 \text{ N kg}^{-1}$ $T = 0.054 \text{ N}$ $0.054 \text{ N} \times \sin 19° = 0.0052 \text{ kg} \times \omega^2 \times 0.054 \text{ m}$ $\omega = 7.9 \text{ radian s}^{-1}$ $t = 4 \times (2\pi/7.9 \text{ radian s}^{-1})$ $= 3.2 \text{ (s)}$	1 1 1 1	**4**
16(b)(iii)	• If vertical, zero horizontal component **Or** must be at an angle for a horizontal component • Must have resultant horizontal component for circular motion, so first student incorrect • If at an angle the radius is greater than before • Since ω the same and r increased, $F = m\omega^2 r$ increased **Or** Since ω the same and r increased, v must increase, so $F = mv^2/r$ increased • Component of tension must be greater so a greater angle is required and the second student is correct	1 1 1 1 1	**5**
	Total for question 16		**14**