Uniform Circular Motion Proof

$$\vec{s}(t) = \begin{bmatrix} r\cos(\omega t) \\ r\sin(\omega t) \end{bmatrix}$$

$$\vec{v}(t) = \begin{bmatrix} -r\omega\sin(\omega t) \\ r\omega\cos(\omega t) \end{bmatrix}$$

$$\vec{a}(t) = \begin{bmatrix} -r\omega^2\cos(\omega t) \\ -r\omega^2\sin(\omega t) \end{bmatrix}$$

$$|\vec{v}(t)| = \sqrt{(-r\omega\sin(\omega t))^2 + (r\omega\cos(\omega t))^2}$$

$$|\vec{v}(t)| = \sqrt{r^2\omega^2\sin^2(\omega t) + r^2\omega^2\cos^2(\omega t)}$$

$$|\vec{v}(t)| = r\omega\sqrt{\sin^2(\omega t) + \cos^2(\omega t)}$$

$$|\vec{v}(t)| = r\omega\sqrt{1}$$

$$|\vec{v}(t)| = \omega r$$

$$|\vec{a}(t)| = \sqrt{(-r\omega^2\cos(\omega t))^2 + (-r\omega^2\sin(\omega t))^2}$$

$$|\vec{a}(t)| = \sqrt{r^2\omega^4\cos^2(\omega t) + r^2\omega^4\sin^2(\omega t)}$$

$$|\vec{a}(t)| = r\omega^2\sqrt{\cos^2(\omega t) + \sin^2(\omega t)}$$

$$|\vec{a}(t)| = r\omega^2\sqrt{1}$$

$$|\vec{a}(t)| = \omega^2 r$$

$$|\vec{a}(t)| = \frac{(\omega r)^2}{r}$$

$$|\vec{a}(t)| = \frac{|\vec{v}(t)|^2}{r}$$

More Stuff

$$\theta = \omega t$$

$$\frac{d\theta}{dt} = \omega$$