Air maths tuition

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Differentiation of sine from first principles

$\sin(A+B) \equiv \sin A \cos B + \cos A \sin B$

Given as $h \to 0$

$\frac{\sin h}{h} \to 1$, $\frac{\cos h - 1}{h} \to 0$

let $y = \sin\theta$

$\therefore y + \delta y = \sin(\theta + \delta\theta)$

$\therefore \delta y = \sin(\theta + \delta\theta) - y$

$\therefore \delta y = \sin\theta\cos\delta\theta + \cos\theta\sin\delta\theta - \sin\theta$

$\therefore \frac{\delta y}{\delta\theta} = \sin\theta\frac{(\cos\delta\theta - 1)}{\delta\theta} + \cos\theta\frac{\sin\delta\theta}{\delta\theta}$

As $\delta\theta \to 0$, $\frac{\delta y}{\delta\theta} \to \frac{dy}{d\theta}$, $\frac{\cos\delta\theta - 1}{\delta\theta} \to 0$, $\frac{\sin\delta\theta}{\delta\theta} \to 1$

$\therefore \frac{dy}{d\theta} = \cos\theta$

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