Question 3 **(25 marks)**

(a) Show that $\dfrac{\cos 7A+\cos A}{\sin 7A-\sin A} = \cot 3A.$

Use formula sum prods on p15 tables

LHS

$$\frac{2\cos\left(\frac{7A+A}{2}\right)\cos\left(\frac{7A-A}{2}\right)}{2\cos\left(\frac{7A+A}{2}\right)\sin\left(\frac{7A-A}{2}\right)}$$

$$= \frac{2\cos 4A\cos 3A}{2\cos 4A\sin 3A}$$

$$= \frac{\cos 3A}{\sin 3A}$$

$$= \boxed{\cot 3A}$$ qed

(b) Given that $\cos 2\theta = \frac{1}{9}$, find $\cos\theta$ in the form $\pm\frac{\sqrt{a}}{b}$, where $a, b \in \mathbb{N}$.

$$\cos^2\theta = \frac{1}{2}(1+\cos 2\theta)$$

$$\cos^2\theta = \frac{1}{2}\left(1+\frac{1}{9}\right)$$

$$\cos^2\theta = \frac{1}{2}\left(\frac{10}{9}\right) = \frac{10}{18} = \frac{5}{9}$$

$$\therefore \cos\theta = \pm\sqrt{\frac{5}{9}}$$

$$= \boxed{\pm\frac{\sqrt{5}}{3}}$$