



Air maths tuition

Interact, engage and perform

Small angle approximations for $\sin(x)$, $\cos(x)$ and $\tan(x)$

$\tan \theta = \frac{AB}{r}$
 $\therefore AB = r \tan \theta$

Area $\triangle OAB >$ Area of sector $OAC >$ Area $\triangle OAC$
 $\frac{1}{2} r^2 \tan \theta > \frac{1}{2} r^2 \theta > \frac{1}{2} r^2 \sin \theta$
 $\therefore \tan \theta > \theta > \sin \theta$ ①

<p>From ① $\div \sin \theta$</p> $\therefore \frac{1}{\cos \theta} > \frac{\theta}{\sin \theta} > 1$ <p>as $\theta \rightarrow 0$, $\cos \theta \rightarrow 1$</p> $\therefore \lim_{\theta \rightarrow 0} \frac{1}{\cos \theta} \rightarrow 1$ $\therefore \frac{\theta}{\sin \theta} \rightarrow 1$ $\therefore \sin \theta \approx \theta$	<p>From ① $\div \tan \theta$</p> $\therefore 1 > \frac{\theta}{\tan \theta} > \cos \theta$ <p>as $\theta \rightarrow 0$, $\cos \theta \rightarrow 1$</p> $\therefore \lim_{\theta \rightarrow 0} \frac{\theta}{\tan \theta} \rightarrow 1$ $\therefore \tan \theta \approx \theta$	<p>since $\cos \theta = \sqrt{1 - \sin^2 \theta}$</p> $= (1 - \theta^2)^{1/2}$ $= 1 - \frac{1}{2} \theta^2 - \frac{\theta^4}{8} - \dots$ $\approx 1 - \frac{\theta^2}{2} \text{ for small } \theta$ <div style="border: 1px solid red; padding: 5px; display: inline-block;"><p>for small θ, measured in radians</p>$\sin \theta \approx \theta$$\tan \theta \approx \theta$$\cos \theta \approx 1 - \frac{\theta^2}{2}$</div>
--	---	--

With the acknowledgement of [Exam Solutions](#).
Find lots more revision sheets on [Air Maths Tuition](#).
[This Video](#)



Exam Solutions
maths made easy