

Derive (9) $\tan (A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

we know that (7) $\sin (A+B) = \sin A \cos B + \cos A \sin B$
 (5) $\cos (A+B) = \cos A \cos B - \sin A \sin B$
 and $\tan A = \frac{\sin A}{\cos A}$

$$\tan (A+B) = \frac{\sin (A+B)}{\cos (A+B)} = \frac{\sin A \cos B + \cos A \sin B}{\cos A \cos B - \sin A \sin B}$$

[Divide each part
by $\cos A \cos B$]

$$= \frac{\frac{\cancel{\sin A} \cancel{\cos B}}{\cancel{\cos A} \cancel{\cos B}} + \frac{\cancel{\cos A} \sin B}{\cancel{\cos A} \cos B}}{\frac{\cancel{\cos A} \cancel{\cos B}}{\cancel{\cos A} \cos B} - \frac{\sin A \sin B}{\cancel{\cos A} \cos B}} = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$