

### 2.7.3 Solutions to 2.6 Homework

#### Answer 1

$$\begin{aligned}\sin(x - 30^\circ) &= \frac{1}{2} \cos x \\ \sin x \cos 30 - \cos x \sin 30 &= \frac{1}{2} \cos x \\ \frac{\sqrt{3}}{2} \sin x - \frac{1}{2} \cos x &= \frac{1}{2} \cos x \\ \frac{\sqrt{3}}{2} \sin x &= \cos x \\ \frac{\sin x}{\cos x} &= \frac{2}{\sqrt{3}} \\ \tan x &= \frac{2\sqrt{3}}{3} \\ x &= 1.155 \\ &= 49.1^\circ, 229.1^\circ\end{aligned}$$

[ 6 marks ]

#### Answer 2

(i)  $\tan 22.5^\circ = \sqrt{2} - 1$

[ 5 marks ]

(ii)

$$\begin{aligned}\cos(x - 45^\circ) &= \cos x \\ \cos x \cos 45 + \sin x \sin 45 &= \cos x \\ \frac{\sqrt{2}}{2} \cos x + \frac{\sqrt{2}}{2} \sin x &= \cos x \\ \text{multiply through by 2} \\ \sqrt{2} \cos x + \sqrt{2} \sin x &= 2 \cos x \\ \sqrt{2} \sin x &= 2 \cos x - \sqrt{2} \cos x \\ \sqrt{2} \sin x &= \cos x (2 - \sqrt{2}) \\ \frac{\sin x}{\cos x} &= \frac{2 - \sqrt{2}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \\ \tan x &= \frac{2\sqrt{2} - 2}{2} \\ &= \sqrt{2} - 1 \\ x &= 22.5^\circ, 202.5^\circ\end{aligned}$$

[ 6 marks ]

**Answer 3**

$$\begin{aligned}
3 \sin (x + 10^\circ) &= 4 \cos (x - 10^\circ) \\
3 \sin x \cos 10 + 3 \cos x \sin 10 &= 4 \cos x \cos 10 + 4 \sin x \sin 10 \\
3 \sin x \cos 10 - 4 \sin x \sin 10 &= 4 \cos x \cos 10 - 3 \cos x \sin 10 \\
\sin x (3 \cos 10 - 4 \sin 10) &= \cos x (4 \cos 10 - 3 \sin 10) \\
\tan x &= \frac{4 \cos 10 - 3 \sin 10}{3 \cos 10 - 4 \sin 10} \\
&= 1.513 \\
x &= 56.5^\circ, 236.5^\circ
\end{aligned}$$

**[ 6 marks ]****Answer 4**

$$\begin{aligned}
\text{LHS} &= \frac{\tan(C + D) - \tan C}{1 + \tan(C + D) \tan C} \\
&= \tan((C + D) - C) \\
&= \tan D \\
&= \text{RHS}
\end{aligned}$$

**[ 5 marks ]****Answer 5**

$$\begin{aligned}
\sin(x - \alpha) &= \cos(x + \alpha) \\
\sin x \cos \alpha - \cos x \sin \alpha &= \cos x \cos \alpha - \sin x \sin \alpha \\
\sin x \cos \alpha + \sin x \sin \alpha &= \cos x \cos \alpha + \cos x \sin \alpha \\
\sin x (\cos \alpha + \sin \alpha) &= \cos x (\cos \alpha + \sin \alpha) \\
\frac{\sin x}{\cos x} &= \frac{\cos \alpha + \sin \alpha}{\cos \alpha + \sin \alpha} \\
\tan x &= 1 \quad \square
\end{aligned}$$

**[ 7 marks ]**