

If  $\tan \theta = \frac{-12}{13}$  when  $\pi < \theta < \frac{3\pi}{2}$ , set up and solve for the following

1.  $\sin \theta =$

$$\frac{-12}{17.7} \approx 0.68$$

$$12^2 + 13^2 = r^2$$

$$144 + 169 = r^2$$

$$\sqrt{313} = \sqrt{r^2}$$

$$r = 17.7$$

$$\cos \theta = \frac{-13}{17.7}$$

2.  $\sin \frac{\theta}{2} = \pm \sqrt{\frac{1 + 0.73}{2}}$

$$= \sqrt{\frac{1.73}{2}} = \sqrt{0.865} = 0.93$$

2.  $\tan \frac{\theta}{2} = \frac{1 - (-\frac{13}{17.7})}{-0.08} \approx -2.55$

1/2 angle is in QII

4.  $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$

$$\left(\frac{-13}{17.7}\right)^2 - \left(\frac{-12}{17.7}\right)^2$$

$$0.54 - 0.46$$

$$0.08$$

5. Simplify

A)  $\cos^2(21^\circ) - \sin^2(21^\circ)$

$$\cos 2(21)$$

$$\cos 42^\circ$$

B)

$$\frac{\tan 3^\circ + \tan 9^\circ}{1 - \tan 3^\circ \tan 9^\circ}$$

$$\tan(3+9)$$

$$\tan 12^\circ$$

C)  $2\sin 76^\circ \cos 76^\circ$

$$\sin 2(76) = \sin(152^\circ)$$

D)

$$\sin 16^\circ \cos 17^\circ + \cos 16^\circ \sin 17^\circ$$

$$\sin(16+17)$$

$$\sin(33^\circ)$$

E)  $2\cos^2(13^\circ) - 1$

$$\cos 2(13)$$

$$\cos 26^\circ$$

F)

$$\frac{\sin 33^\circ}{1 + \cos 33^\circ}$$

$$\tan \frac{33^\circ}{2}$$

or

$$\tan 16.5^\circ$$

6. Express the following as a function of  $\gamma$  alone angles whose functional values are  $\cos(\pi + \gamma)$

$$\begin{aligned} & (\cos \pi) \cos \gamma - (\sin \pi) \sin \gamma \\ & -1 \cos \gamma - 0 (\sin \gamma) \end{aligned}$$

$$\boxed{-\cos \gamma}$$

7. Write the expression  $\sin \frac{7\pi}{12}$  as the sum of angles known and then evaluate

$$\sin \frac{7\pi}{12} = \sin \left( \frac{4\pi}{12} + \frac{3\pi}{12} \right) =$$

$$\sin \left( \frac{\pi}{3} + \frac{\pi}{4} \right) =$$

$$\left( \sin \frac{\pi}{3} \cos \frac{\pi}{4} + \cos \frac{\pi}{3} \sin \frac{\pi}{4} \right)$$

$$\frac{\sqrt{3}}{2} \cdot \frac{\sqrt{2}}{2} + \frac{1}{2} \cdot \frac{\sqrt{2}}{2}$$

$$\frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \boxed{\frac{\sqrt{6} + \sqrt{2}}{4}}$$

8. Verify:  $\cos x \cot x = \frac{1 - \sin^2 x}{\sin x}$

$$\frac{\cos^2 x}{\sin x}$$

$$\frac{\cos \cdot \cos}{\sin}$$

$$\cos x \cdot \cot x \quad \checkmark$$

9. Verify:  $(\tan^2 \theta + 1)(\cos^2 \theta + 1) = \tan^2 \theta + 2$

$$\tan^2 \cos^2 + \tan^2 + \cos^2 + 1$$

$$\frac{\sin^2}{\cos^2} \cdot \cos^2 + \tan^2 + \cos^2 + 1$$

$$\sin^2 + \cos^2 + \tan^2 + 1$$

$$1 + 1 + \tan^2$$

$$2 + \tan^2 =$$

10. Simplify

$$\frac{\tan \frac{\pi}{12} + \tan \frac{\pi}{4}}{1 - \tan \frac{\pi}{12} \tan \frac{\pi}{4}}$$

$$\tan \left( \frac{\pi}{12} + \frac{\pi}{4} \right) = \tan \left( \frac{\pi}{12} + \frac{3\pi}{12} \right) = \tan \left( \frac{4\pi}{12} \right) = \tan \left( \frac{\pi}{3} \right) = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \frac{\sqrt{3}}{2} \cdot \frac{2}{1} = \boxed{\sqrt{3}}$$

11. Verify  $\frac{\cos(\alpha - \beta)}{\sin \alpha \sin \beta} = \cot \alpha \cot \beta + 1$

Left side

$$\frac{\cos \alpha \cos \beta + \sin \alpha \sin \beta}{\sin \alpha \sin \beta}$$

$$\frac{\cos \alpha \cos \beta}{\sin \alpha \sin \beta} + 1$$

$$\cot \alpha \cot \beta + 1 \quad \checkmark$$