

Half Angle Identities w

$$1) \cos \frac{\theta}{2} = \sqrt{\frac{1 + \frac{12}{13}}{2}} = \sqrt{\frac{25}{26}} = \frac{5}{\sqrt{26}} = \boxed{\frac{5\sqrt{26}}{26}}$$

$$2) \sin \frac{\theta}{2} = \sqrt{\frac{1 - \frac{12}{13}}{2}} = \sqrt{\frac{1}{26}} = \frac{1}{\sqrt{26}} = \boxed{\frac{\sqrt{26}}{26}}$$

$$3) \tan \frac{\theta}{2} = \frac{1 - \frac{12}{13}}{\frac{5}{13}} = \frac{1}{13} \cdot \frac{13}{5} = \boxed{\frac{1}{5}}$$

$$4) \sec \frac{\theta}{2} = \boxed{\frac{\sqrt{26}}{5}} \quad 5) \csc \frac{\theta}{2} = \boxed{\sqrt{26}} \quad 6) \cot \frac{\theta}{2} = \boxed{5}$$

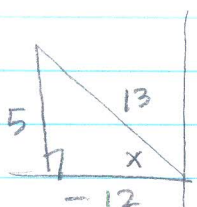
$$7) 2 \sin \frac{\theta}{2} \cos \frac{\theta}{2} = \sin(2 \cdot \frac{\theta}{2}) = \sin \theta = \boxed{\frac{5}{13}}$$

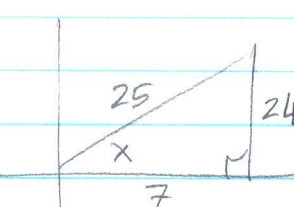
$$8) 2 \cos \frac{\theta}{2} \tan \frac{\theta}{2} = 2 \cos \frac{\theta}{2} \frac{\sin \frac{\theta}{2}}{\cos \frac{\theta}{2}} = 2 \sin \frac{\theta}{2} = 2 \cdot \frac{\sqrt{26}}{26} = \boxed{\frac{\sqrt{26}}{13}}$$

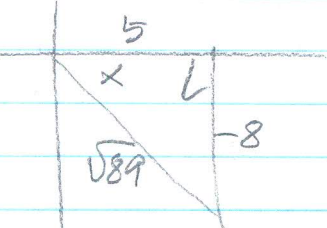
$$9) \sin 112^\circ 30' = \sin \frac{225^\circ}{2} = \sqrt{\frac{1 - \cos 225^\circ}{2}} \\ = \sqrt{\frac{1 - (-\frac{\sqrt{2}}{2})}{2}} = \sqrt{\frac{2 + \sqrt{2}}{2} \cdot \frac{1}{2}} = \boxed{\frac{\sqrt{2 + \sqrt{2}}}{2}}$$

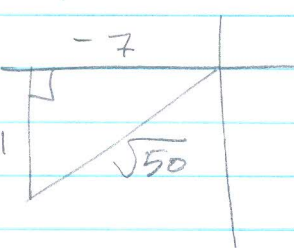
$$10) \cos \frac{\pi}{12} = \cos \frac{\pi/6}{2} = \sqrt{\frac{1 + \cos \frac{\pi}{6}}{2}} = \sqrt{\frac{1 + \frac{\sqrt{3}}{2}}{2}} = \sqrt{\frac{2 + \sqrt{3}}{2} \cdot \frac{1}{2}} = \boxed{\frac{\sqrt{2 + \sqrt{3}}}{2}}$$

$$11) \tan \frac{3\pi}{8} = \tan \frac{3\pi/4}{2} = \frac{1 - \cos \frac{3\pi}{4}}{\sin \frac{3\pi}{4}} = \frac{1 - \frac{-\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}} = \frac{(2 + \sqrt{2})}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} \\ = \frac{(2 + \sqrt{2}) \sqrt{2}}{\sqrt{2} \cdot \sqrt{2}} = \frac{2\sqrt{2} + 2}{2} = \boxed{\sqrt{2} + 1}$$

12)  $\sin \frac{x}{2} = + \sqrt{\frac{1 - \cos x}{2}} = \sqrt{\frac{1 + \frac{12}{13}}{2}} = \sqrt{\frac{25}{13} \cdot \frac{1}{2}} = \frac{5}{\sqrt{26}} = \boxed{\frac{5\sqrt{26}}{26}}$

13)  $\cos \frac{x}{2} = + \sqrt{\frac{1 + \cos x}{2}} = \sqrt{\frac{1 + \frac{7}{25}}{2}} = \sqrt{\frac{32}{25} \cdot \frac{1}{2}} = \sqrt{\frac{16}{25}} = \boxed{\frac{4}{5}}$

14)  $\tan \frac{x}{2} = \frac{1 - \cos x}{\sin x} = \frac{1 - \frac{5}{\sqrt{89}}}{\frac{-8}{\sqrt{89}}} = \frac{\sqrt{89} - 5}{\sqrt{89} \cdot -8} = \boxed{\frac{5 - \sqrt{89}}{8}}$

15)  $\cos \frac{x}{2} = - \sqrt{\frac{1 + \cos x}{2}} = - \sqrt{\frac{1 + \frac{-7}{\sqrt{50}}}{2}} = - \sqrt{\frac{\sqrt{50} - 7}{\sqrt{50}} \cdot \frac{\sqrt{50}}{\sqrt{50}}} = - \sqrt{\frac{50 - 7\sqrt{50}}{50} \cdot \frac{1}{2}} = - \sqrt{\frac{50 - 7\sqrt{50}}{100}} = \boxed{- \frac{\sqrt{50 - 7\sqrt{50}}}{10}}$