

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\sin(2A) = 2 \sin A \cos A$$

$$\cos(2A) = \cos^2 A - \sin^2 A$$

$$= 1 - 2 \sin^2 A$$

$$= 2 \cos^2 A - 1$$

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

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

$$1) \tan(\pi/12) = \tan(15) = \tan(45-30)$$

$$= \frac{\tan 45 - \tan 30}{1 + \tan 45 (\tan 30)} = \frac{1 - \frac{\sqrt{3}}{3}}{1 + 1(\frac{\sqrt{3}}{3})} = \frac{1 - \frac{\sqrt{3}}{3}}{1 + \frac{\sqrt{3}}{3}} = \frac{3 - \sqrt{3}}{3 + \sqrt{3}} \cdot \frac{(3 - \sqrt{3})}{(3 - \sqrt{3})}$$

$$= \frac{(3 - \sqrt{3})^2}{9 - 3} = \frac{(3 - \sqrt{3})^2}{6}$$

$$2) \tan(255) = \tan(210 + ~~210~~ 45)$$

$$= \frac{\tan 210 + \tan 45}{1 - \tan ~~210~~ (\tan 45)} = \frac{\frac{\sqrt{3}}{3} + 1}{1 - \frac{\sqrt{3}}{3}} = ~~\frac{\sqrt{3} + 3}{3 - \sqrt{3}}~~ \frac{\sqrt{3} + 3}{3 - \sqrt{3}} \cdot \frac{(3 + \sqrt{3})}{(3 + \sqrt{3})}$$

$$\frac{(\sqrt{3} + 3)^2}{9 - 3} = \frac{(\sqrt{3} + 3)^2}{6}$$

$$3 \quad \csc(345) = \frac{1}{\sin 345}$$

$$\sin(345) = \sin(300 + 45)$$

$$= \sin 300 \cos 45 + \cos 300 \sin 45$$

$$\left(-\frac{\sqrt{3}}{2}, \frac{\sqrt{2}}{2}\right) + \left(\frac{1}{2}, \frac{\sqrt{2}}{2}\right) = \frac{\sqrt{2} - \sqrt{6}}{4}$$

$$\csc(345) = \frac{4}{\sqrt{2} - \sqrt{6}} \cdot \frac{(\sqrt{2} + \sqrt{6})}{(\sqrt{2} + \sqrt{6})} = \frac{4(\sqrt{2} + \sqrt{6})}{2 - 6} = -(\sqrt{2} + \sqrt{6})$$

$$4 \quad \cot(165) = \frac{1}{\tan 165}$$

$$\tan 165 = \tan(210 - 45) = \frac{\tan 210 - \tan 45}{1 + \tan 210 (\tan 45)}$$

$$= \frac{\frac{\sqrt{3}}{3} - 1}{1 + \frac{\sqrt{3}}{3}} = \frac{\sqrt{3} - 3}{3 + \sqrt{3}}$$

$$\cot(165) = \frac{3 + \sqrt{3}}{\sqrt{3} - 3} \cdot \frac{\sqrt{3} + 3}{\sqrt{3} + 3} = \frac{(3 + \sqrt{3})^2}{3 - 9} = \frac{(3 + \sqrt{3})^2}{-6}$$

$$5 \quad \sec(30 + 45) = \frac{1}{\cos(30 + 45)}$$

$$\cos(30 + 45) = \cos 30 \cos 45 - \sin 30 \sin 45$$

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

$$\frac{\sqrt{6} - \sqrt{2}}{4}$$

$$\sec 75 = \frac{4}{\sqrt{6} - \sqrt{2}} \cdot \frac{\sqrt{6} + \sqrt{2}}{\sqrt{6} + \sqrt{2}} = \frac{4(\sqrt{6} + \sqrt{2})}{6 - 2} = \sqrt{6} + \sqrt{2}$$

$$\begin{aligned}
 6 \quad \cos(285) &= \cos(225+60) \\
 &= \cos 225 \cos 60 - \sin 225 \sin 60 \\
 &= \left(-\frac{\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) - \left(-\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right) \\
 &= \frac{-\sqrt{2} + \sqrt{6}}{4} = \frac{\sqrt{6} - \sqrt{2}}{4}
 \end{aligned}$$

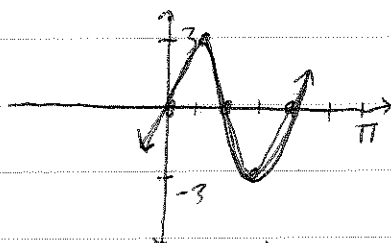
$$\begin{aligned}
 7 \quad \tan\left(\frac{7\pi}{12}\right) &= \tan(105) = \tan(60+45) \\
 \frac{\tan 60 + \tan 45}{1 - \tan 60 \tan 45} &= \frac{\sqrt{3} + 1}{1 - \sqrt{3}} \cdot \frac{(1 + \sqrt{3})}{(1 + \sqrt{3})} = \frac{(1 + \sqrt{3})^2}{1 - 3} = \frac{(1 + \sqrt{3})^2}{-2}
 \end{aligned}$$

Graph

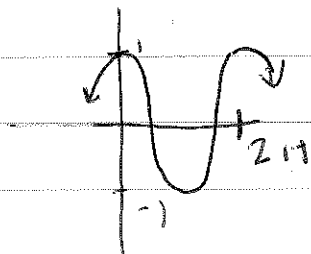
$$\begin{aligned}
 8 \quad y &= 3 \sin x \cos 2x + 3 \cos x \sin 2x \\
 &= 3(\sin x \cos 2x + \cos x \sin 2x)
 \end{aligned}$$

$$y = 3 \sin 3x$$

$$\text{Period} = \frac{2\pi}{3} \quad \text{Incr: } \frac{2\pi}{12} = \frac{\pi}{6}$$

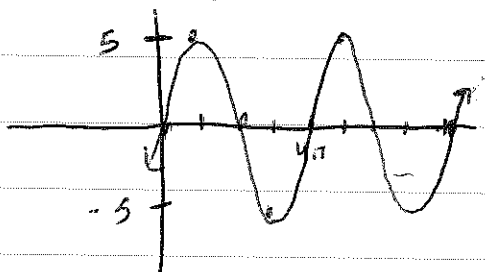


$$\begin{aligned}
 9 \quad y &= \cos^2\left(\frac{x}{2}\right) - \sin^2\left(\frac{x}{2}\right) \\
 y &= \cos\left(2\left(\frac{x}{2}\right)\right) = \cos x
 \end{aligned}$$

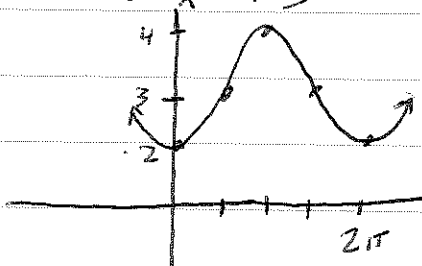


$$\begin{aligned}
 10 \quad y &= 10 \sin(x/4) \cos(x/4) \\
 &= \cancel{10} 5 (2 \sin(x/4) \cos(x/4)) \\
 &= 5 \sin(2x/4) \\
 &= 5 \sin(x/2)
 \end{aligned}$$

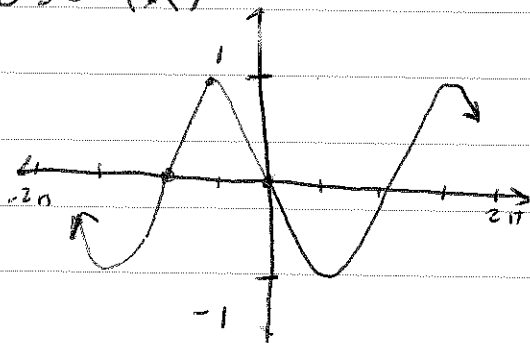
$$\text{Period} = 2\pi \div \frac{1}{2} = 4\pi \quad \text{Increment} = \pi$$



$$\begin{aligned}
 11 \quad y &= 3 - \cos(2x)\cos(x) - \sin(2x)\sin(x) \\
 y &= (-1)(\cos 2x \cos x + \sin 2x \sin x) + 3 \\
 y &= -\cos(2x-x) + 3 \\
 &= -\cos x + 3
 \end{aligned}$$

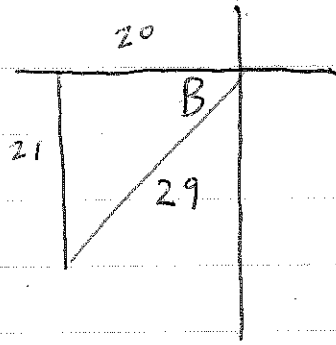
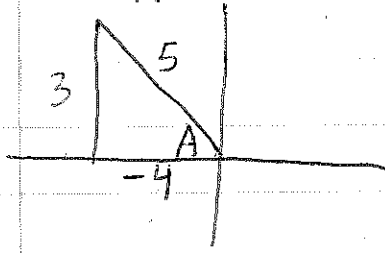


$$\begin{aligned}
 12 \quad y &= 1 / (\cos 3x \sin 2x - \cos 2x \sin 3x) \\
 y &= 1 / \sin(2x-3x) = 1 / \sin(-x) \\
 y &= \csc(-x)
 \end{aligned}$$



$$\cot B = \frac{20}{21} \quad B \in Q3$$

13  $\sin A = \frac{3}{5}$   $A \in Q2$



$$\sin 2A = 2 \sin A \cos A$$

$$2 \left(\frac{3}{5}\right) \left(-\frac{4}{5}\right) = \boxed{-\frac{24}{25}}$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

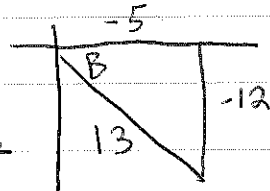
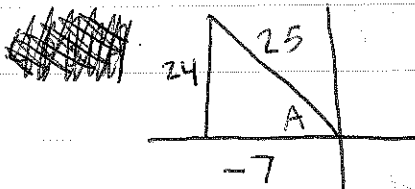
$$\left(-\frac{4}{5}\right) \left(\frac{20}{29}\right) - \left(\frac{3}{5}\right) \left(\frac{21}{29}\right)$$

$$\frac{-80 - 63}{145} = \boxed{-\frac{143}{145}}$$

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B} = \frac{\left(\frac{3}{-4}\right) - \left(\frac{21}{20}\right)}{1 + \left(\frac{3}{-4}\right) \left(\frac{21}{20}\right)}$$

$$= \frac{-\frac{15}{20} - \frac{21}{20}}{1 - \frac{63}{80}} = \frac{-\frac{36}{20} \cdot 80}{\frac{17}{80} \cdot 80} = \boxed{-\frac{144}{17}}$$

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$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$\left(\frac{24}{25}\right) \left(\frac{-5}{13}\right) - \left(\frac{-7}{25}\right) \left(\frac{-12}{13}\right) = \frac{-120 - 84}{325} = \boxed{-\frac{204}{325}}$$

$$\cos(2A) = \cos^2 A - \sin^2 A = \left(\frac{-7}{25}\right)^2 - \left(\frac{24}{25}\right)^2 = \boxed{-\frac{527}{625}}$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} = \frac{\left(\frac{24}{-7}\right) + \left(\frac{12}{5}\right)}{1 - \left(\frac{24}{-7}\right) \left(\frac{12}{5}\right)}$$

$$= \frac{-\frac{120}{35} + \frac{84}{35}}{1 + \frac{288}{35}} = \frac{-\frac{36}{35} \cdot 35}{\frac{323}{35} \cdot 35} = \boxed{-\frac{36}{323}}$$

$$15 \sin(22+23) = \sin(45) = \frac{\sqrt{2}}{2}$$

$$16 \cos(158-38) = \cos(120) = -\frac{1}{2}$$

$$17 \sin(2 \cdot 75) = \sin(150) = \frac{1}{2}$$

$$18 \cos(2 \cdot 112.5) = \cos 225 = -\frac{\sqrt{2}}{2}$$

$$19 \sin\left(\frac{\pi}{15} + \frac{\pi}{10}\right) = \sin(12+18) = \sin(30) = \frac{1}{2}$$

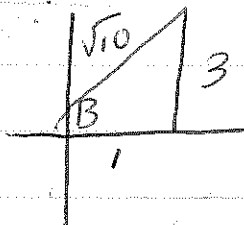
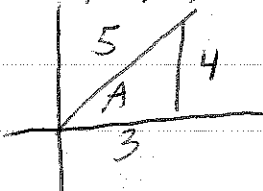
$$20 \cos\left(\frac{\pi}{5} + \frac{19\pi}{30}\right)$$

$$\cos(36+114) = \cos(150) = -\frac{\sqrt{3}}{2}$$

$$21 \tan(2 \cdot 15) = \tan 30 = \frac{\sqrt{3}}{3}$$

$$22 \tan(140-5) = \tan 135 = -1$$

$$23 \arcsin\left(\frac{4}{5}\right) = A \quad \tan^{-1}(3) = B$$

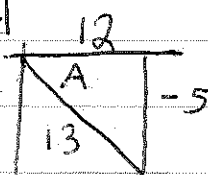
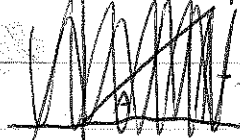


$$\cos(A-B)$$

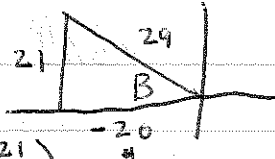
$$= \cos A \cos B + \sin A \sin B = \left(\frac{3}{5}\right)\left(\frac{1}{\sqrt{10}}\right) + \left(\frac{4}{5}\right)\left(\frac{3}{\sqrt{10}}\right)$$

$$= \frac{15}{5\sqrt{10}} = \frac{3\sqrt{10}}{10}$$

$$24 \arcsin\left(-\frac{5}{12}\right) = A$$



$$\arccos\left(-\frac{20}{29}\right) = B$$



$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B} = \frac{\left(-\frac{5}{12}\right) - \left(-\frac{21}{20}\right)}{1 + \left(-\frac{5}{12}\right)\left(-\frac{21}{20}\right)}$$

$$\frac{\frac{-60}{240} + \frac{252}{240}}{\frac{240}{240} + \frac{105}{240}} = \frac{\frac{192}{240}}{\frac{345}{240}} = \frac{192}{345}$$