$\sin(a-b) =$

$\sin a\cos b - \sin b\cos a$

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

$= \frac{\sqrt{6}-\sqrt{2}}{4}$ ✓

135

$13\sin(2x) - 3 = 3$

$\sin(2x) = \frac{3+3}{13}$

$\sin^{-1}\left(\frac{6}{13}\right) = 0.4797228$

$\pi - \alpha = 2.66186402$

$x = \frac{\alpha}{2} + n\cdot\frac{2\pi}{2}$

$x = 0.2398643190 + n\cdot\pi$

$x = \frac{\beta}{2} + n\cdot\frac{2\pi}{2}$ ✓

$x = 1.3309320 + n\cdot\pi$

136

$C(t) = 15\cos\left(\frac{2\pi}{15}t\right) + 65$

$75 = 15\cos\left(\frac{2\pi}{15}t\right) + 65$

$\frac{10}{15} = \cos\left(\frac{2\pi}{15}t\right)$

$\cos^{-1}(-1) = \pi$

$\pi - \pi = 0$

$\alpha = 180°$

~~$\alpha \times \frac{15}{2\pi}$~~

$75 = -15\cos\left(\frac{2\pi}{15}t\right) + 65$

$\frac{10}{-15} = \cos\left(\frac{2\pi}{15}t\right)$

$\cos^{-1}\left(-\frac{10}{15}\right) = 2.30052398$

$\pi - \alpha = 0.84106867$

$\alpha = 131.810315°$

$\beta = 48.189685°$

$\alpha \times \frac{15}{2\pi} = 5.49209$

137

$I(t) = 1.5\cos\left(\frac{2\pi}{365}t\right) + 4.3$

2° 5.2 kWh/m²·day

$5.2 = 1.5\cos\left(\frac{2\pi}{365}t\right) + 4.3$

$\frac{0.9}{1.5} = \cos\left(\frac{2\pi}{365}t\right)$

$\cos^{-1}\left(\frac{0.9}{1.5}\right) = 0.92729522$

$\pi - \alpha = 2.21429744$

$\alpha \times \frac{365}{2\pi} = 53.8682$

$2\pi - \alpha = 311.131980$ ✓

138

$\cos(x) = -0.35$

$\cos^{-1}(-0.35) = 1.92836$

$\pi - \alpha = 1.21322522$

$2\pi - \alpha = 4.35481788$

$-\pi + \alpha = 1.21322522$

$\alpha = 110.48785$

$\beta = 69.5126$

$\theta = 249.512$

$-\alpha = -110.48785$

$(\pi$ to $4\pi)$ ✓

139

$\cos(165°)$

$\cos(300 - 135)$

$\frac{3\pi}{12} - \frac{4\pi}{12}$

$\cos(a-b) = \cos a\cos b + \sin a\sin b$

$\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{3}}{2} + \left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right)$

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

$\frac{-\sqrt{6}-\sqrt{2}}{4}$ ✓

$120 + 45$

~~$\frac{\pi}{6} + \frac{\pi}{4}$~~

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

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

140

$7\cos(9x) - 1 = 1$

$\cos(9x) = \frac{1+1}{7}$

$\cos^{-1}\left(\frac{2}{7}\right) = 1.28104463$

$\pi - \alpha = 1.86054803$

$\alpha = 73.3964504°$

$\beta = 106.601550°$

$\theta = 286.601550°$

$\frac{\alpha}{9} + n\cdot\frac{2\pi}{9}$

$\frac{\alpha}{9} + n\cdot\frac{360}{9}$

$x = 8.15538358 + n\cdot 40$

$x = \frac{\beta}{9} + n\cdot\frac{360}{9}$ ✓

$x = 31.8444666 + n\cdot 40°$

144

EARTH → MOON

min → t

$D(t) = -21\cos\left(\frac{2\pi}{29.5}t\right) + 384$

$380 = -21\cos\left(\frac{2\pi}{29.5}t\right) + 384$

$\frac{-4}{-21} = \cos\left(\frac{2\pi}{29.5}t\right)$

$\cos^{-1}\left(\frac{-4}{-21}\right) = 1.3794913$

$\pi - \alpha = 1.76244152$

$2\pi - \alpha = 4.9040368$ ✓

$\alpha \times \frac{29.5}{2\pi} = 6.47$ ✓

147

$H(t) = 12\sin\left(\frac{2\pi}{24}t\right) + 15$

17 kg

$17 = 12\sin\left(\frac{2\pi}{24}t\right) + 15$

$\frac{17-15}{12} = \sin\left(\frac{2\pi}{24}t\right)$

$\sin^{-1}\left(\frac{2}{12}\right) = 1.674$

$\pi - \alpha = 2.97414454$

$2\pi - \alpha = 6.11573723$

$\alpha \times \frac{24}{2\pi} = 0.6396045$

$\beta \times \frac{24}{2\pi} = 11.3604$

148

$\cos(x) = 0.55$

$\cos^{-1}(0.55) = 0.9884$

$\pi - \alpha = 2.15316056$

$-\pi - (\alpha) = -4.13002474$

$\alpha = 56.632987°$

$\beta = 170.4059°$

$\theta = -236.632987$

$\alpha + n\cdot 360$

$-\alpha + n\cdot 360$

150

$\cos\left(\frac{7\pi}{12}\right) = 105°$

~~$240 - 135$~~ $60 + 45$

$\frac{\pi}{3} + \frac{\pi}{4}, \cos(a+b)$

$= \cos a\cos b - \sin a\sin b$

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

$= \frac{\sqrt{2}-\sqrt{6}}{4}$ ✓

151

$20\sin(10x) - 10 = 5$

$\sin(10x) = \frac{5+10}{20}$

$\sin^{-1}\left(\frac{15}{20}\right) = 0.848062$

$\pi - \alpha = 2.29353057$

$\frac{\alpha}{10} + n\cdot\frac{2\pi}{10} = x$

$x = 0.0848062079 + n\cdot\frac{\pi}{5}$

$x = \frac{\beta}{10} + n\cdot\frac{2\pi}{10}$ ✓

$x = 0.229353057 + n\cdot\frac{\pi}{5}$

152

$\cos\left(\frac{19\pi}{12}\right) = 285°$

$240 + 45°, 60 - 45$

$\cos(a+b)$

$150 + 135, 30 + 45$

$(30)s + (45)s, \frac{\pi}{6} + \frac{\pi}{4}$

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

$= \frac{\sqrt{6}-\sqrt{2}}{4}$ ✓

153

$\sin(x) = -1$

$\sin^{-1}(-1) = -\frac{\pi}{2}$

$\pi - (\alpha) = -\frac{\pi}{2}$

$(-\pi, 2\pi)$ ✓

154

$E(t) = 624\sin\left(\frac{2\pi}{365}t\right) + 2736$

$2400 = 624\sin\left(\frac{2\pi}{365}t\right) + 2736$

$\frac{-336}{624} = \sin\left(\frac{2\pi}{365}t\right)$

$\sin^{-1}\left(\frac{-336}{624}\right) = -0.568610900$

$\pi - (\alpha) = 3.71020593$

$\alpha \times \frac{365}{2\pi} = -33.0314561$

$2\pi - \alpha = 6.85179551$

$2\pi + \alpha = 5.71453$

215.53456 → 216 days

155

$8\cos(12x) + 4 = -4$

$\cos(12x) = \frac{-4-4}{8}$

$\cos\left(\frac{-8}{8}\right) = \cos(-1)$

$\cos^{-1}(-1) = \pi$

$\pi - \alpha = 0$

$\alpha + n\cdot 360 = 12x$

$x = \frac{\alpha}{12} + n\cdot\frac{360}{12}$ ✓

$x = 15° + n\cdot 30°$

156

$-4\cos(5x) + 1 = 1$

$\cos(5x) = \frac{1-1}{-4}$

$\cos^{-1}(0) = \frac{\pi}{2}$

$\pi - \alpha = \frac{\pi}{2}$

$2\pi - \frac{\pi}{2} = 1.5\pi$

$x = \frac{\alpha}{5} + n\cdot\frac{2\pi}{5}$ ✓

$x = \frac{\pi}{10} + n\cdot\frac{2\pi}{5}$

157

$18\cos(10x) + 2 = 10$

$\cos(10x) = \frac{10-2}{18}$

$\cos^{-1}\left(\frac{8}{18}\right) = 1.11024234$

$2\pi - \alpha = 5.17294297$

$\frac{\alpha}{10} + n\cdot\frac{2\pi}{10}$

$x = 0.111024234 + \frac{\pi}{5}$ ✓

158

$\tan\left(\frac{19\pi}{12}\right) = 285$

$150 + 135 = 30 + 45$

$\tan(a+b) = \frac{a+b}{1-ab}$

$\frac{\frac{\sqrt{3}}{3} + 1}{1 - \frac{\sqrt{3}}{3}(1)}$

$\frac{\sqrt{3}+3}{\sqrt{3}-3}$ ✓

159

$M(t) = 21\cos\left(\frac{2\pi}{687}t\right) + 228$

$220 = 21\cos\left(\frac{2\pi}{687}t\right) + 228$

$\frac{-8}{21} = \cos\left(\frac{2\pi}{687}t\right)$

$\cos^{-1}\left(\frac{-8}{21}\right) = 1.96162246$

$2\pi - \alpha = 4.32156285$

$\alpha \times \frac{687}{2\pi} = 214.49713$ ✓

160

$\cos(x) = 0.4$

$\cos^{-1}(0.4) = 1.15927948$

$2\pi - \alpha = 5.12390583$

$\alpha + n\cdot 360°$

$\beta + n\cdot 360°$

$\alpha = 66.4218215°$

$\beta = 293.578178°$ ✓

161

$6\sin(8x) + 2 = -3$

$\sin(8x) = \frac{-3-2}{6}$

$\sin(8x) = \frac{-5}{6}$

$\sin^{-1}\left(\frac{-5}{6}\right) = -0.98511$

$-\pi + (\alpha) = -2.15648187$

$\alpha = -56.442692$

$\beta = -123.557310$

$\frac{\alpha}{8} + n\cdot\frac{360}{8} = x$

$x = -7.05533628 + n\cdot 45°$

$x = \frac{\beta}{8} + n\cdot\frac{360}{8}$ ✓

$x = -1.5444663 + n\cdot 45°$

162

$\cos(x) = -0.7$

$\left(-\frac{\pi}{2}, \frac{5\pi}{2}\right) (-1.57, 7.85)$

$\cos^{-1}(-0.7) = 2.3461982$

$2\pi - \alpha = 3.93699148$

$\alpha = 134.427004°$

$\beta = 225.572996°$

$\alpha + n\cdot 2\pi$

$0 = 2.3461982$

$0 = 3.9369148$

$0 = -2.34619382$

$1 = 3.93699148$ ✓

163

$\tan(15°) = 45 - 30$

$\frac{\pi}{4} - \frac{\pi}{6}$

$= \frac{1-\frac{\sqrt{3}}{3}}{1+1\left(\frac{\sqrt{3}}{3}\right)} = \frac{1-\frac{\sqrt{3}}{3}}{1+\frac{\sqrt{3}}{3}}$

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

~~$135 - 120 = 15$~~

$\tan(15°) = 60 - 45$

$\frac{\pi}{3} - \frac{\pi}{4} = \frac{\sqrt{3}-1}{1+1(\sqrt{3})}$

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

164

$Y(t) = 40\cos\left(\frac{2\pi}{3}t\right) - 71$

$-80 = 40\cos\left(\frac{2\pi}{3}t\right) - 71$

$\frac{-9}{40} = \cos\left(\frac{2\pi}{3}t\right)$

$\cos^{-1}\left(\frac{-9}{40}\right) = 1.79773936$

$2\pi - \alpha = 4.48545594$

$\alpha \times \frac{3}{2\pi} = 0.858357$

$\beta \times \frac{3}{2\pi} = 2.1416$ ✓

165

$\tan\left(\frac{17\pi}{12}\right) = 255°$

$120 + 135 = \frac{\pi}{3} + \frac{\pi}{4}$

$\frac{\sqrt{3}+1}{1-\sqrt{3}(1)} = \frac{\sqrt{3}+1}{\sqrt{3}-1}$ ✓

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$\cos\left(\frac{13\pi}{12}\right) = 195°$

$150 + 45 = \frac{\pi}{6} + \frac{\pi}{4}$

$\cos(a+b) = \cos a\cos b - \sin a\sin b$

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

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

$\cos\alpha = - \quad \sin\alpha = -$

$a = - \quad a = +$

$b = + \quad b = +$

$-\sqrt{6} \quad -\sqrt{2}$ ✓

166

$\sin\left(\frac{11\pi}{12}\right) = 165° = \theta$

$165 = 120 + 45°$

$300 - 135 = 165°$

$\frac{\pi}{6} - \frac{\pi}{4} \quad \sin(a+b) =$

$\sin a\cos b + \sin b\cos a$

$\left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) + \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$

$= \frac{\sqrt{2}+\sqrt{6}}{4} \to 120 + 45$

$\frac{\pi}{3} + \frac{\pi}{4} = \frac{\sqrt{3}}{2}\cdot\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}\cdot\frac{1}{2}$

$= \frac{\sqrt{6}+\sqrt{2}}{4} \to \frac{-\sqrt{2}-6}{4}$ ✓

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

167

$\sin(255°) = \frac{8\pi}{12} + \frac{5\pi}{12}$

$120 + 135 = \sin(a+b)$

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

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

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

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

168

$\cos\left(\frac{5\pi}{12}\right) = \frac{2\pi}{12} + \frac{3\pi}{12}$

$\frac{\pi}{6} + \frac{\pi}{4} = \cos(a+b)$

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

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

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