$\dfrac{2.78}{75}$ (1) $\quad f(-x) = cg^2(-x) + cg(-4x) = g^2(x) + g(4x) = f(x)$

(2) $\quad g^2x + cg(4x) = g^2(x+T) + g(4x+4T)$

$g^2x - g^2(x+T) = g(4x+4T) - cg(4x)$

$\left[gx - g(x+T) \right]\left[gx + g(x+T) \right] = -2\sin(4x+2T)\sin(2T)$

$-2\sin\left(x+\dfrac{T}{2}\right)\sin\left(-\dfrac{T}{2}\right) \cdot 2g\left(x+\dfrac{T}{2}\right)g\left(-\dfrac{T}{2}\right) = -2\sin(4x+2T)\sin(2T)$

$2\sin\left(x+\dfrac{T}{2}\right)g\left(x+\dfrac{T}{2}\right) \cdot 2\sin\left(\dfrac{T}{2}\right)g\left(\dfrac{T}{2}\right) = -4\sin(2x+T)g(2x+T) \cdot 2\sin T\, g\, T$

$\sin(2x+T)g(T) \pm 4\sin(2x+T)g(2x+T)\sin T\, g\, T = 0$

$\sin(2x+T)g(T)\left[1 + 4g(2x+T)g\, T \right] = 0$

$\downarrow$

$2x+T = 180k \qquad T = 90 + 180k \qquad\qquad \downarrow$

$180 + T = 180k \qquad\quad \downarrow \qquad\qquad 1 + 4g(180+T)g\, T$

$T = 180(k-1) \qquad T = 180k \qquad\quad 1 + 4g^2 T \lessgtr$

$\boxed{T = 180} \qquad\qquad \boxed{T = 180}$