1) $f(t) = 2\sqrt{2} \sin\left(1000t + \frac{\pi}{4}\right)$ $g(t) = f(t) + \frac{1}{1000}\frac{df(t)}{dt}$

$\frac{df}{dt} = (2\sqrt{2})(1000) \cos\left(1000t + \frac{\pi}{4}\right)$

$g(t) = 2\sqrt{2} \sin\left(1000t + \frac{\pi}{4}\right) + 2\sqrt{2} \cos\left(1000t + \frac{\pi}{4}\right)$

$\quad = 2\sqrt{2} \cos\left(1000t - \frac{\pi}{4}\right) + 2\sqrt{2} \cos\left(1000t + \frac{\pi}{4}\right)$

$\bar{g} = 2\sqrt{2} \angle -\frac{\pi}{4} + 2\sqrt{2} \angle \frac{\pi}{4} = 2\sqrt{2}\left(\cos\left(\frac{\pi}{4}\right) - j\sin\left(\frac{\pi}{4}\right)\right) + 2\sqrt{2}\left(\cos\left(\frac{\pi}{4}\right) + j\sin\left(\frac{\pi}{4}\right)\right)$

$\bar{g} = 4\sqrt{2} \cos\left(\frac{\pi}{4}\right) = 4\sqrt{2}\left(\frac{1}{\sqrt{2}}\right) = 4 = 4\angle 0°$

$$\boxed{g = 4\cos(1000t)}$$

2) $i(t) = 10\sin(377t)$, $R = 2\sqrt{2}$, $L = \frac{1}{377}$ H   find $V_s(t)$

$\tau = \frac{L}{R} = \frac{1}{2(377)}$

$V_s = Ri + L\frac{di}{dt} = 20\sin(337t) + \frac{(10)(377)}{377}\cos(337t)$

$\qquad = 20\sin(377t) + 10\cos(337t)$

$\qquad = 20\cos\left(377t - \frac{\pi}{2}\right) + 10\cos(377t)$

$\bar{V} = 20 \angle -\frac{\pi}{2} + 10\angle 0 = 20\left(\cos\left(-\frac{\pi}{2}\right) + j\sin\left(-\frac{\pi}{2}\right)\right) + 10\left(\cos(0) + j\sin(0)\right)$

$\bar{V} = 20(0 - j) + 10 = 10 - 20j$

$A = \sqrt{10^2 + 20^2} = \sqrt{500} = 10\sqrt{5}$

$\theta = \arctan\left(\frac{-20}{10}\right) = \arctan(-2)$

$\bar{V} = 10\sqrt{5} \angle \arctan(-2)$ $\boxed{V_s = 10\sqrt{5}\cos(377t - 63.435°)}$