1. (b)
2. (c)
3.

$$\begin{aligned}
P_{\text{rms}} &= \sqrt{\int_T dt\ P^2(t)/T} \\
&= \sqrt{\int_T dt\ (I_0\cos(\omega t)V_0\cos(\omega t+\theta))^2/T} \\
&= I_0V_0\sqrt{\int_T dt\ [\cos(\omega t)(\cos(\omega t)\cos(\theta)-\sin(\omega t)\sin(\theta))]^2/T} \\
&= I_0V_0\sqrt{\int_T dt\ [[1-\cos(2\omega t)]\cos(\theta)/2-\sin(2\omega t)\sin(\theta)/2]^2/T} \\
&= (I_0V_0\cos(\theta)/2)\sqrt{\int_T dt\ [1-\cos(2\omega t)-\sin(2\omega t)\tan(\theta)]^2/T} \\
&= I_0V_0\cos(\theta)/2
\end{aligned}$$

4. (a)
5.

$$Z_{\text{circuit}} = \frac{1}{\frac{1}{Z}+\frac{1}{Z}} + Z + \frac{1}{\frac{1}{Z+Z}+\frac{1}{\frac{1}{\frac{1}{Z}+\frac{1}{Z}}+Z}} = \frac{33}{14}Z \qquad (1)$$

6. $Z = Z_L + Z_C + Z_R = i\omega L + 1/i\omega C + IR$, now $dZ/d\omega = iL - 1/i\omega^2 C$ so set $L + 1/\omega^2 C = 0$, and find $\omega = 1/\sqrt{LC}$
7. $V_L(t) = I(t)Z_L = I\sin(\omega t)i\omega L$, $V_C(t) = I(t)Z_C = I\sin(\omega t)/i\omega C$, $V_R(t) = I(t)Z_R = I\sin(\omega t)R$, so we see that $\theta(V_L(t)) = \tan^{-1}(I\sin(\omega t)\omega L/0) = \tan^{-1}(\pm\infty) = \pm\pi/2$, likewise $\theta(V_C(t)) = \mp\pi/2$, and $\theta(V_R(t)) = 0$, all independent of the resonant condition.
8. $Z_{\text{circuit}} = R - i/7\omega C$
9. $V_R(t) = I(t)Z_R = \dfrac{V_0\sin(\omega t)}{R-i/7\omega C}R = V_0R\sin(\omega t)\dfrac{R+i/7\omega C}{R^2+1/(7\omega C)^2}$

   $V_{3C} = I_{3C}(t)Z_{3C} = \frac{3}{7}\dfrac{V_0\sin(\omega t)}{R-i/7\omega C}\frac{1}{3i\omega C} = \frac{1}{7\omega C}V_0\sin(\omega t)\dfrac{1/7\omega C - iR}{R^2+1/(7\omega C)^2}$

   Yes, $V_{3C}(t) = V_{4C}(t)$: they are in parallel!
10. $\theta(V_R(t)) = \tan^{-1}\left(\frac{1}{7R\omega C}\right)$, $\theta(V_{3C}(t)) = \tan^{-1}(-7R\omega C)$