28. (a) In Eq. 33-25, we set $q = 0$ and $t = 0$ to obtain $0 = Q\cos\phi$. This gives $\phi = \pm\pi/2$ (assuming $Q \neq 0$). It should be noted that other roots are possible (for instance, $\cos(3\pi/2) = 0$) but the $\pm\pi/2$ choices for the phase constant are in some sense the "simplest." We choose $\phi = -\pi/2$ to make the manipulation of signs in the expressions below easier to follow. To simplify the work in part (b), we note that $\cos(\omega' t - \pi/2) = \sin(\omega' t)$.

(b) First, we calculate the time-dependent current $i(t)$ from Eq. 33-25:

$$\begin{aligned} i(t) &= \frac{dq}{dt} = \frac{d}{dt}\left(Qe^{-Rt/2L}\sin(\omega' t)\right) \\ &= -\frac{QR}{2L}e^{-Rt/2L}\sin(\omega' t) + Q\omega' e^{-Rt/2L}\cos(\omega' t) \\ &= Qe^{-Rt/2L}\left(-\frac{R\sin(\omega' t)}{2L} + \omega'\cos(\omega' t)\right) , \end{aligned}$$

which we evaluate at $t = 0$: $i(0) = Q\omega'$. If we denote $i(0) = I$ as suggested in the problem, then $Q = I/\omega'$. Returning this to Eq. 33-25 leads to

$$q = Qe^{-Rt/2L}\cos(\omega' t + \phi) = \left(\frac{I}{\omega'}\right)e^{-Rt/2L}\cos\left(\omega' t - \frac{\pi}{2}\right) = Ie^{-Rt/2L}\frac{\sin(\omega' t)}{\omega'}$$

which answers the question if we interpret "current amplitude" as I. If one, instead, interprets an (exponentially decaying) "current amplitude" to be more appropriately defined as $i_{\max} = i(t)/\cos(\cdots)$ (that is, the current after dividing out its oscillatory behavior), then another step is needed in the $i(t)$ manipulations, above. Using the identity $x\cos\alpha - y\sin\alpha = r\cos(\alpha + \beta)$ where $r = \sqrt{x^2 + y^2}$ and $\tan\beta = y/x$, we can write the current as

$$i(t) = Qe^{-Rt/2L}\left(-\frac{R\sin(\omega' t)}{2L} + \omega'\cos(\omega' t)\right) = Q\sqrt{\omega'^2 + \left(\frac{R}{2L}\right)^2}\, e^{-Rt/2L}\cos(\omega' t + \theta)$$

where $\theta = \tan^{-1}(R/2L\omega')$. Thus, the current amplitude defined in this second way becomes (using Eq. 33-26 for ω')

$$i_{\max} = Q\sqrt{\omega'^2 + \left(\frac{R}{2L}\right)^2}\, e^{-Rt/2L} = Q\omega e^{-Rt/2L} .$$

In terms of $i_{\max}$ the expression for charge becomes

$$q = Qe^{-Rt/2L}\sin(\omega' t) = \left(\frac{i_{\max}}{\omega}\right)\sin(\omega' t)$$

which is remarkably similar to our previous "result" in terms of I, except for the fact that ω' in the denominator has now been replaced with ω (and, of course, the exponential has been absorbed into the definition of $i_{\max}$).