68. We use $nT/2$ to represent the integer number of half-periods specified in the problem. Note that $T = 2\pi/\omega$. We use the calculus-based definition of an average of a function:

$$
\begin{aligned}
\left[\sin^2(\omega t - \phi)\right]_{\text{avg}} &= \frac{1}{nT/2}\int_0^{\frac{nT}{2}} \sin^2(\omega t - \phi)\,dt \\
&= \frac{2}{nT}\int_0^{\frac{nT}{2}} \frac{1-\cos(2\omega t - 2\phi)}{2}\,dt \\
&= \frac{2}{nT}\left[\frac{t}{2} - \frac{1}{4\omega}\sin(2\omega t - 2\phi)\right]\Bigg|_0^{\frac{nT}{2}} \\
&= \frac{1}{2} - \frac{1}{2nT\omega}\left[\sin(n\omega T - 2\phi) + \sin 2\phi\right] .
\end{aligned}
$$

Since $n\omega T = n\omega(2\pi/\omega) = 2n\pi$, we have $\sin(n\omega T - 2\phi) = \sin(2n\pi - 2\phi) = -\sin 2\phi$ so $[\sin(n\omega T - 2\phi) + \sin 2\phi] = 0$. Thus,

$$\left[\sin^2(\omega t - \phi)\right]_{\text{avg}} = \frac{1}{2} .$$