Answer on Question #77063 – Math – Trigonometry

Question

Find an expression for the trigonometric equation:

F= 6 sin 8πt - 8 cos 8πt in the form : R sin (ωt+ α) and investigate its waveform over one cycle.

Solution

Let

$$\varphi = \sin^{-1}\left(\frac{b}{\sqrt{a^2+b^2}}\right) = \cos^{-1}\left(\frac{a}{\sqrt{a^2+b^2}}\right) = \tan^{-1}\left(\frac{b}{a}\right)$$

then

$$a \cdot sin(\theta) \pm b \cdot cos(\theta) = \sqrt{a^2+b^2}\left(\frac{a}{\sqrt{a^2+b^2}} sin(\theta) \pm \frac{b}{\sqrt{a^2+b^2}} cos(\theta)\right)$$
$$= \sqrt{a^2+b^2}(sin(\theta) \cdot \cos(\varphi) \pm cos(\theta) \cdot \sin(\varphi)) = \sqrt{a^2+b^2} \sin(\theta \pm \varphi),$$

and

$$F(t) = R \cdot \sin(\omega t + \alpha) = 10 \cdot \sin(8\pi t - \sin^{-1}(0.8)),$$

where

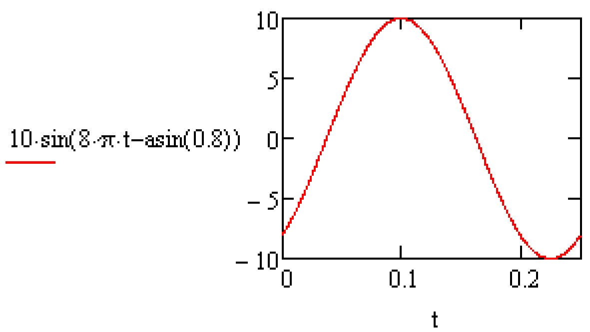
$$\mathrm{R} = \sqrt{6^2+8^2} = 10 - \ amplitude$$

$$\omega = 8 \cdot \pi = 2 \cdot \pi \cdot f - angular\ frequency\ \ \rightarrow f = 4\ sec^{-1} - frequency$$

$$T = \frac{1}{f} = 0.25\,\mathrm{sec}\ -period$$

$$\alpha = \sin^{-1}\left(\frac{8}{10}\right) - \ phase\ shift\ \rightarrow F(0) = 10 \cdot \sin\left(0 - \sin^{-1}\left(\frac{8}{10}\right)\right) = -8$$

Vertical shift is zero:



Answer: $F(t) = R \cdot \sin(\omega t + \alpha) = 10 \cdot \sin(8\pi t - \sin^{-1}(0.8))$

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