Mystery Sinusoid

Quiz: Mystery Sinusoid
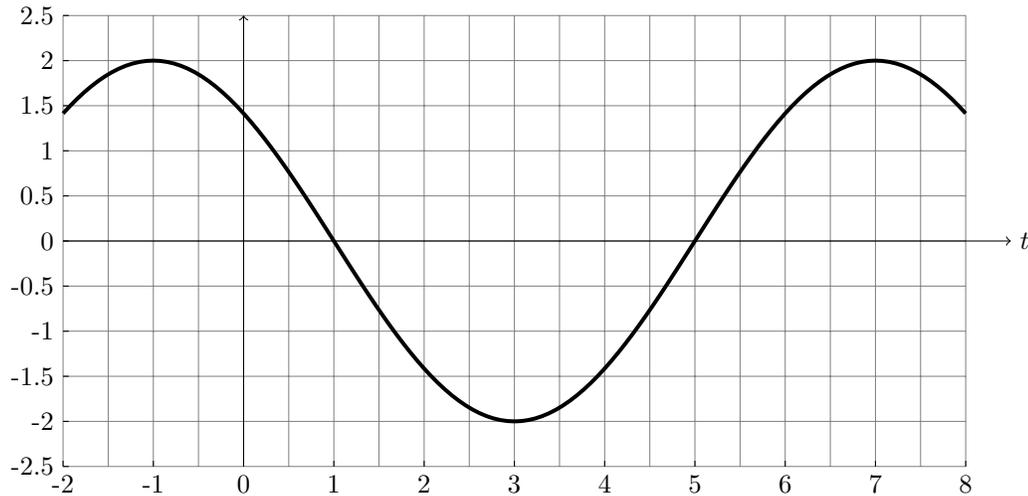
Fig. 1. Mystery sinusoid.

The graph of a sinusoidal function is displayed. The problem is to express it in the *standard form*

$$f(t) = A\cos(\omega t - \phi).$$

Choices:

a) $2\cos\left(4\pi t + \frac{\pi}{4}\right)$ b) $2\cos\left(\frac{\pi}{4}t + \frac{\pi}{4}\right)$ c) $2\cos\left(4\pi t - \frac{\pi}{4}\right)$
d) $2\cos\left(\frac{\pi}{4}t - \frac{\pi}{4}\right)$ e) $2\cos\left(4t + 1\right)$ f) $2\cos\left(4t - 1\right)$

Answer: The answer is (b)

The graph runs vertically between 2 and -2, so the amplitude is $A = 2$.

There are consecutive peaks at -1 and 7, so the period $P = 8$. Therefore, the angular frequency $\omega = 2\pi/P = \pi/4$.

The curve has a time lag of $\tau = -1$ (see the peak at -1). Since $\tau = \phi/\omega$, we have $\phi = -\omega = -\pi/4$.

Hence the equation of the sinusoid is:

$$A\cos(\omega t - \phi) = 2\cos\left(\frac{\pi}{4}t + \frac{\pi}{4}\right).$$

18.03SC Differential Equations
Fall 2011