* A modulator has an input (modulated signal) $x(t)$ and the output is

$$y(t) = x(t)\sin([2\pi f_c]t)$$ AM

where f_c is the carrier frequency.

Is it linear?

$$\omega_c = 2\pi f_c$$

Answer: Yes, it's a linear system

Proof:

Input	⟶	Output
$x_1(t)$	⟶	$y_1(t) = x_1(t)\sin\omega_c t$
$x_2(t)$	⟶	$y_2(t) = x_2(t)\sin\omega_c t$
α_1, α_2	⟶	$\alpha_1 y_1(t) + \alpha_2 y_2(t) =$ $(\alpha_1 x_1(t) + \alpha_2 x_2(t))\sin\omega_c t$
$x(t) = \alpha_1 x_1(t) + \alpha_2 x_2(t)$ linear comb. of inputs	⟶	$y(t) = x(t)\sin\omega_c t$ $= (\alpha_1 x_1(t) + \alpha_2 x_2(t))\sin\omega_c t$