

* let a function be cosinusoid

$$f(t) = \sum_{n=0}^{\infty} a_n \cos(2\pi n t)$$

$\downarrow$ $\downarrow$
 amplitude frequency

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$$\Rightarrow f(t) \cos(2\pi k t) = \cos(2\pi k t) \sum_{n=0}^{\infty} a_n \cos(2\pi n t)$$

$$\Rightarrow \int_0^{\pi} f(t) \cos(2\pi k t) dt = \int_0^{\pi} \sum_{n=0}^{\infty} a_n \cos(2\pi n t) \cos(2\pi k t) dt$$

$$\Rightarrow \int_0^{\pi} f(t) \cos(2\pi k t) dt = \sum_{n=0}^{\infty} a_n \int_0^{\pi} \cos(2\pi n t) \cos(2\pi k t) dt$$

$$= a_0 \int_0^{\pi} \cos(0 t) \cos(2\pi k t) dt + \dots + a_k \int_0^{\pi} \cos(2\pi k t) \cos(2\pi k t) dt + \dots$$