## Mathematical Methods

## A Little Practice

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## I. DERIVATIVES

A) Given $x=A \cos (\omega t)$, find:
i. $\frac{d x}{d t}=$
ii. $\frac{d^{2} x}{d t^{2}}=$
B) Is $x=A \cos (\omega t)$ a solution to $\frac{d^{2} x}{d t^{2}}=-\omega^{2} x$ ? Why or why not?
C) Is $x=A \cos (5 t)$ a solution to $\frac{d^{2} x}{d t^{2}}=-3 x$ ? Why or why not?
D) Given $x=A \cos (5 t)$, find:
i. $\frac{d x}{d t}=$
ii. $\frac{d^{2} x}{d t^{2}}=$
E) Given $x=A \cos (\sqrt{k / m} \cdot t)$, find:
iii. $\frac{d x}{d t}=$
iv. $\frac{d^{2} x}{d t^{2}}=$
F) Given $x=A \cos (\omega t+3.5)$, find:
iii. $\frac{d x}{d t}=$
iv. $\frac{d^{2} x}{d t^{2}}=$
G) Is $x=A \cos (\omega t+3.5)$ a solution to $\frac{d^{2} x}{d t^{2}}=-\omega^{2} x$ ? Why or why not?
H) Given $x=e^{-\omega t}$, find:
i. $\frac{d x}{d t}=$
ii. $\frac{d^{2} x}{d t^{2}}=$
I) Is $x=e^{-\omega t}$ a solution to $\frac{d^{2} x}{d t^{2}}=-\omega^{2} x$ ? Why or why not?
J) Given $x=e^{i \omega t}(i \equiv \sqrt{-1})$, find:
i. $\quad \frac{d x}{d t}=$
ii. $\frac{d^{2} x}{d t^{2}}=$
K) Is $x=e^{i \omega t}$ a solution to $\frac{d^{2} x}{d t^{2}}=-\omega^{2} x$ ? Why or why not?

## II. COSINE FUNCTIONS

A) Given $x=4 \cos (\pi t)$,
i. $\quad$ At $t=0$, what will be the value of $x$ ?
ii. Find two values of t for which $\mathrm{x}=0$.
iii. Find two values of t for which $\mathrm{x}=4$.
iv. Find a value of t for which $\mathrm{x}=-4$.
v. Find a value of t for which $\mathrm{x}=2$.
vi. What is the maximum possible value of x ?
B) Given $x=4 \cos \left(2 \pi t+\frac{\pi}{2}\right)$,
vii. When $t=0$, what is the value of x ?
viii. Find a value of t for which $\mathrm{x}=4$.
ix. Find a value of t for which $\mathrm{x}=0$.

