Mathematics revision sheet for class 11 and
class 12 physics

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Differentiation

We have two quantities x and y such that \( y = f(x) \) where \( f(x) \) is some function of \( x \). We may be interested in finding followings things

1. \( \frac{dy}{dx} \)

2. Maximum and Minimum values of \( y \). It can be find with the method of Maxima and Minima

\( \frac{dy}{dx} \) is the called the derivative of \( y \) w.r.t to \( x \)

It is defined as

\[
\frac{dy}{dx} = \lim_{\Delta x \to 0} \left( \frac{\Delta y}{\Delta x} \right)
\]

Some commonly known functions and their derivatives are:-

\[
\frac{d(x^n)}{dx} = nx^{n-1}
\]

\[
\frac{d(sin x)}{dx} = cos x
\]

\[
\frac{d(cos x)}{dx} = -sin x
\]
\[
\frac{d(tanx)}{dx} = sec^2
\]
\[
\frac{d(cotx)}{dx} = -cosec^2
\]
\[
\frac{d(secx)}{dx} = secxtanx
\]
\[
\frac{d(lnx)}{dx} = \frac{1}{x}
\]
\[
\frac{d(e^{x})}{dx} = e^x
\]

Some important and useful rules for finding derivatives of composite functions

1. \( \frac{d}{dx}(cy) = c \frac{dy}{dx} \) where c is constant
2. \( \frac{d}{dx}(a + b) = \frac{da}{dx} + \frac{db}{dx} \) where a and b are function of x
3. \( \frac{d}{dx}(ab) = a \frac{db}{dx} + b \frac{da}{dx} \)
4. \( \frac{d}{dx}(\frac{a}{b}) = \frac{b \frac{da}{dx} - a \frac{db}{dx}}{b^2} \)
5. \( \frac{dy}{dx} = (\frac{du}{dx})(\frac{da}{dx}) \)
6. \( \frac{d^2y}{dx^2} = (\frac{d^2u}{dx^2})(\frac{da}{dx}) \)

**Maximum and Minimum values of y**

**Step 1:** find the derivative of y w.r.t x

\( (\frac{dy}{dx}) \)

**Step2 :** Equate

\( \frac{dy}{dx} = 0 \)

Solve the equation to find out the values of x

**Step3:** find the second derivative of y w.r.t x and calculate the values of

\( \frac{d^2y}{dx^2} \)

for the values of x from step2

if \( \frac{d^2y}{dx^2} > 0 \) then the value of x corresponds to mimina of y then \( y_{min} \) can be
find out by putting this value of x

if \( \frac{d^2y}{dx^2} < 0 \) then the value of x corresponds to maxima of y then \( y_{max} \) can be

find out by putting this value of x

**Integration**

\[
I = \int_{a}^{b} f(x)dx
\]

It reads as integration of function \( f(x) \) w.r.t. x within the limits from \( x=a \) to \( x=b \).

Integration of some important functions are

\[
\int \sin x dx = -\cos x
\]

\[
\int \cos x dx = \sin x
\]

\[
\int \sec^2 x dx = \tan x
\]

\[
\int \csc^2 x dx = -\cot x
\]

\[
\int \frac{1}{x} dx = \ln x
\]

\[
\int x^n dx = \frac{x^{n+1}}{n+1}
\]

\[
\int e^x dx = e^x
\]

Useful rules for integration are

\[
\int cf(x)dx = c \int f(x)dx
\]

\[
\int [f(x) + h(x)] = \int f(x)dx + \int h(x)dx
\]

\[
\int f(x)g(x)dx = f(x) \int g(x)dx - \int (f'(x) \int g(x)dx \) dx
\]

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