1. Taylor Series Expansion

If you know a function and all its derivatives at a single point then you can approximate the function at other points near that single point. In simple words we can say that It's an infinite sum of terms that express at a single point in term of its derivatives.

Basically it used to create a guess of what function looks like in other words we can say that its simply shows the estimation of function how it look. **Maclaurin Series** is a special type of Taylor series that uses zero as our single point.

Why we need Taylor Series?

Because it helps to represent the complex function series(infinite series) into an represented way like in single formula to study to properties of difficult function

Suppose $x = a$ where a is a single point and we know all the derivatives of a.
Then from the following formula we can calculate the Taylor series.

$$f(a) + \frac{f'(a)}{1!}(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f'''(a)}{3!}(x-a)^3 + \cdots,$$

For Example:

We have $f(x) = \sqrt{x}$ So for any value of x we can find the answer the only condition is that we must have to known all derivatives of that value.

We can solve the above function by putting x= 9

We first have to take all derivatives of 9.

2. Limits and Continuity

2.1 Limits:

It’s a value in which that an input value approaches to the output. We have two variable in any function one is independent and other is dependent variable.

Suppose,

$$f(x) = y$$

In which x is independent variable means we can put any value on x it didn’t depend on anyone and the other y is dependent variable which is depend on value of x. if we change x then y also change. The limits in between x and y is defined as for value of x how it approaches y an output.

Example:

Solve:

$f(x) = 4x$ for $x=2$.

Answer: $f(2) = 4(2) = 8$

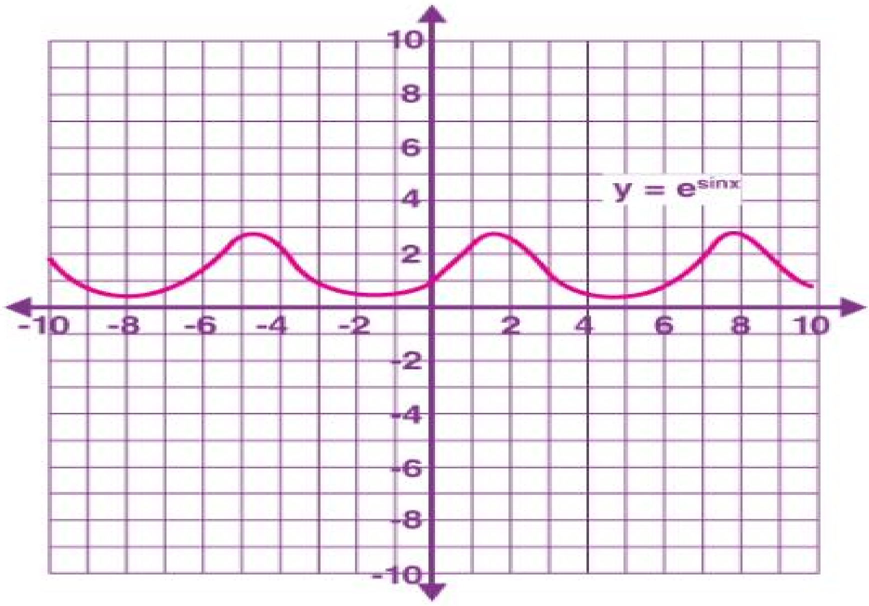
We say it the the limit of f(x) as x approaches to 2 is 8.

2.2 Continuity:

Continuity comes from continuous function if there is no break between a graph then we can say that graph is continuous and have property of Continuity.

Example:

From the Following graph you will be cleared that its continous because the purple line never break in between.



Reference: https://byjus.com/maths/limits-and-continuity/

3. Partial Derivatives

When we have two independent variable to each other. Then we say that the function is partially depends on one variable to the other. For this we must have to take one variable as constant.

Suppose, we have a function f(x,y) where x and y both are independent but we say that they are partially dependent. If we take the derivative of a function means a partial derivatives with respect to x then we must have to take y as constant and vice versa.

$$f_x = \frac{\partial f}{\partial x} = lim_{h \to 0} \frac{f(x+h, y) - f(x,y)}{h}$$

And partial derivative of function f with respect y keeping x as constant, we get;

$$f_y = \frac{\partial f}{\partial y} = lim_{h \to 0} \frac{f(x, y+h) - f(x,y)}{h}$$

Refrence: https://byjus.com/maths/partial-derivative/

What is difference between derivative and partial derivative?

Derivatives used when function has only one variable no other variable.

For example:

f(x) = 5x

X is the only variable used in above function

While Partial derivatives are used when the function has two or more variables. Partial derivative is taken with respect to(w.r.t) one variable,