

# Is the function $f(x)$ of exponential order?

## What is meant by exponential order?

A function  $f(x)$  is of exponential order if there exist an exponential function that is greater than  $|f(t)|$  as  $t \rightarrow \infty$ .

If a function is piecewise continuous and of exponential order then the Laplace transform of the function exists.

$f(t)$  is of exponential order if there exist finite constant  $M$ ,  $\alpha$  and  $T$  such that  $|f(t)| < Me^{\alpha t}$  for  $t > t_0$

# Examples

The following functions are of exponential order

$$f(t) = \sin(10t) \quad M = 2, t_0 = 0, \alpha = 0$$

$$f(t) = 20t + 1 \quad M = 20, t_0 = 1, \alpha = 1$$

$$f(t) = 2^t \quad M = 1, t_0 = 0, \alpha = 1$$

$$f(t) = e^{10t} \quad M = 1.1, t_0 = 0, \alpha = 10$$

The following functions are NOT of exponential order

$$f(t) = e^{2t^2+1}$$

$$f(t) = 2^{t^3+0.5}$$