2 Phase of Resonance :

W.K.T. $\tan\alpha = \dfrac{A}{B}$

$$\tan\alpha = \frac{\mu p}{k - mp^2}$$

$$\tan\alpha = \frac{\frac{\mu p}{m}}{\frac{k}{m} - p^2} \quad \text{---} \ (1)$$

(i) Here α is phase difference between natural frequency and resultant forced frequency

At resonance $\frac{k}{m} = p^2$

$$\Rightarrow \omega = p$$

So eq^n (1) becomes

$$\tan\alpha = \frac{\frac{\mu p}{m}}{0}$$

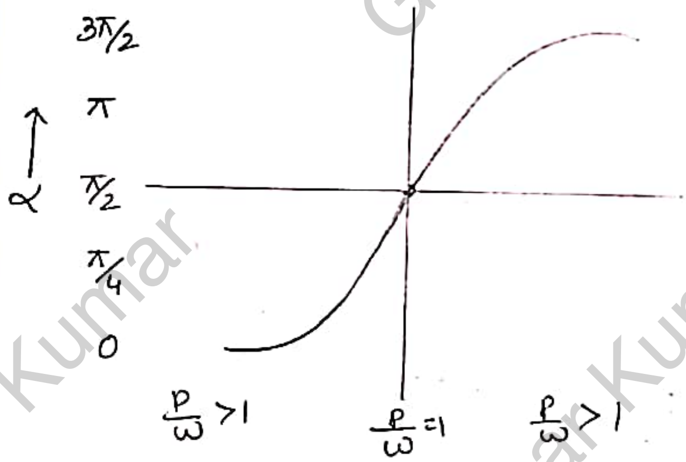
$$\tan\alpha = \infty$$

$$\alpha = \tan^{-1}(\infty)$$

$$\boxed{\alpha = \frac{\pi}{2}}$$

This means that at resonance ~~phas~~ the phase difference is 90°

If we draw the graph α v/s $\frac{p}{\omega}$ then we will get the graph as shown in below



For $\frac{p}{\omega} = 1$, $\alpha = \frac{\pi}{2}$

$\frac{p}{\omega} < 1$, $\alpha < \frac{\pi}{2}$

$\frac{p}{\omega} > 1$, $\alpha > \frac{\pi}{2}$

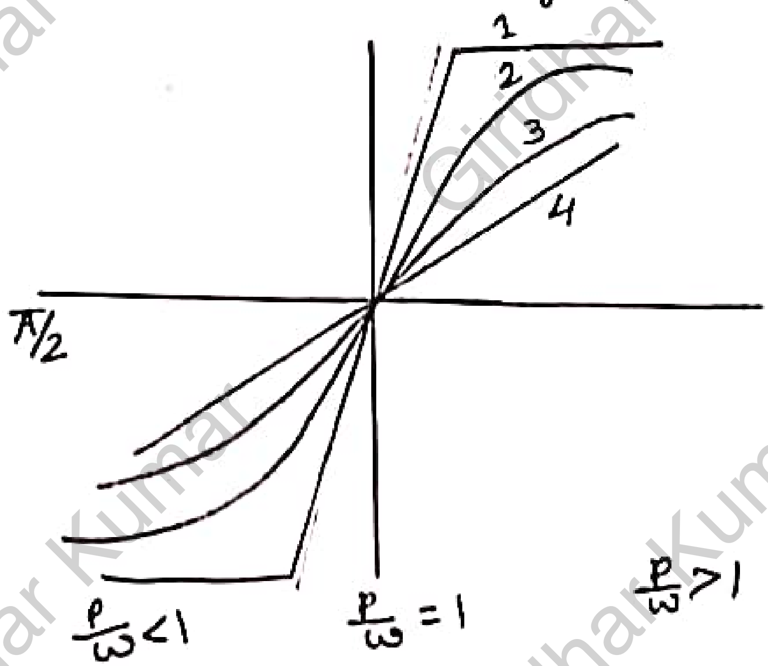
(3) Effect of damping on the phase of forced vibration :

We have the eqn. $\tan\alpha = \dfrac{\frac{\mu p}{m}}{\left(\frac{k}{m} - p^2\right)}$ —— (1)

In above eqn α is the phase difference

From the above eqn we can see that α is directly proportional to μ.

Let us consider a graph α v/s $\frac{p}{\omega}$



* When μ is very less then we will get the curve (1)
* When μ is medium the we will get the curve (2)
* When μ is sufficiently high we will get the curve (4) as shown in the above graph.
* Although the phase difference α will be $\frac{\pi}{2}$ when $\frac{p}{\omega}$ is equals to 1 or $p = \omega$ (forced frequency = natural frequency)