$0.5 y''+y+5y=-3\cos(2t)+2\sin(2t)$

$Yp=a \cos(2t) + b \sin(2t)$

Plug into the original eq, and get $a=-1$, $b=0$

So $Yp=-\cos(2t)$. Done with Yp!

For Yh, we solve

$$0.5y''+y'+5y=0$$

Ch. Eq :

$$0.5r^2+r+5=0$$

Quad. Formula

$$r=-1\pm12-4*0.5*52*0.5$$

$r1=-1+3i$, $r2=-1-3i$ (Euler’s formula)

$yh=d1*e-1+3i*t+d2....$
$=d1*e-t*e3it+d2....$
$=d1*e-t*cos3t+isin3t+d2....$

$yh=c1*e-tcos3t+c2*e-t*\sin(3t)$

Answer

$Y=Yp+Yh=$

$$-\cos(2t)+c1e-tcos3t+c2e-t\sin(3t)$$

As t approaches infinity

$Y(t)$ behaves just like $-\cos(2t)$. So, the surviving frequency is $\omega=2$

And it “forgets” its own frequency $\omega=3$