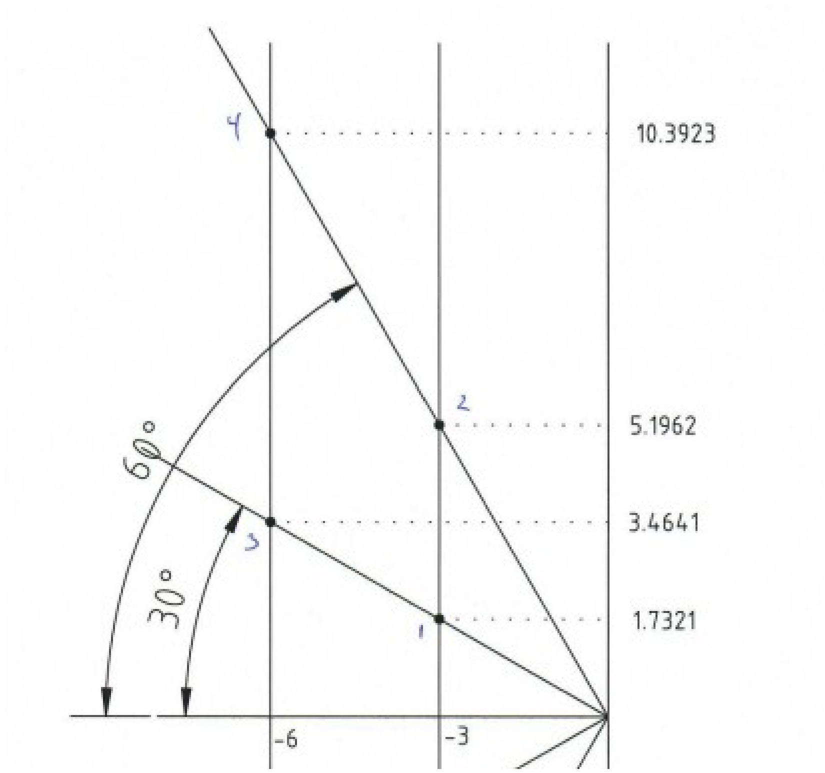
Tenemos el siguiente diagrama



Calcule a los 4 puntos lo siguiente:

1-) Para cada punto $\zeta\omega_n$

2-) Para cada punto $M\,t_{s2\,\%}$

3-) Para cada punto un diagrama de bloques

Punto 1

$$\zeta=\cos(\theta)$$

$$\cos(30°)=\frac{\sqrt{3}}{2}$$

$$3=\zeta\cdot\omega_n \qquad\qquad \omega_n=\frac{3}{\frac{\sqrt{3}}{2}}$$

Por lo tanto

$$\zeta=\frac{\sqrt{3}}{2} \quad \text{y} \quad \omega_n=2\sqrt{3}$$

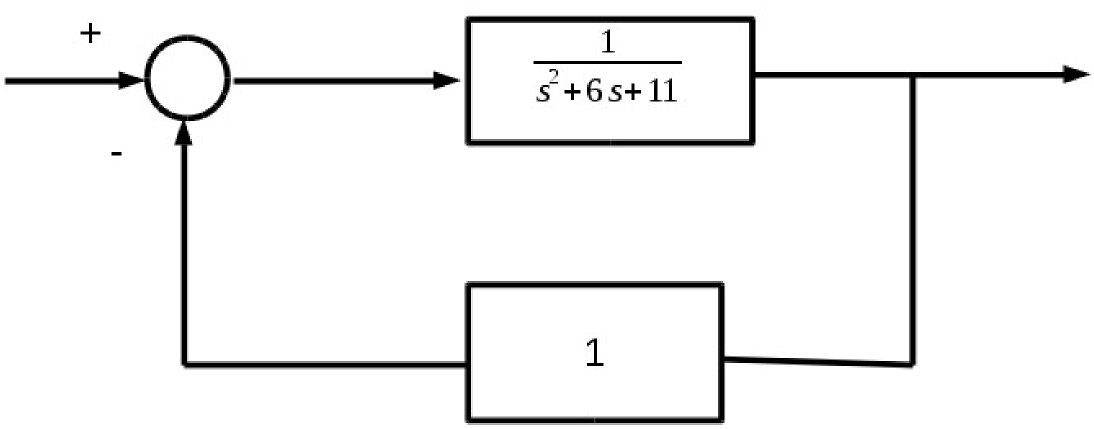
Ahora calculamos:

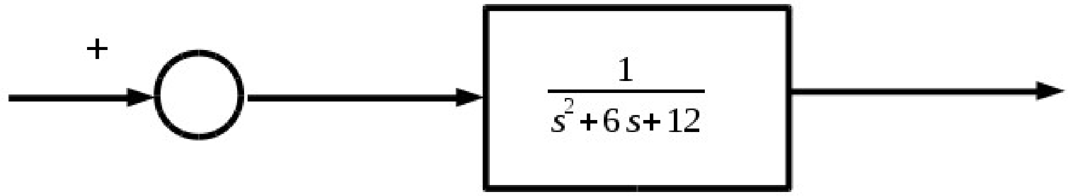
$$M=e^{-\left(\frac{\zeta\pi}{\sqrt{1-\zeta^2}}\right)} \qquad\qquad M=e^{-\left(\frac{\frac{\sqrt{3}}{2}\cdot\pi}{\sqrt{1-\left(\frac{\sqrt{3}}{2}\right)^2}}\right)}\cdot 100=0{,}43\,\%$$

$$t_{2\%}=\frac{4}{(\zeta\omega_n)} \qquad\qquad \frac{4}{3}=1{,}33\ \mathit{segundos}$$

Por último el diagrama de bloques y su comprobacion con Octave

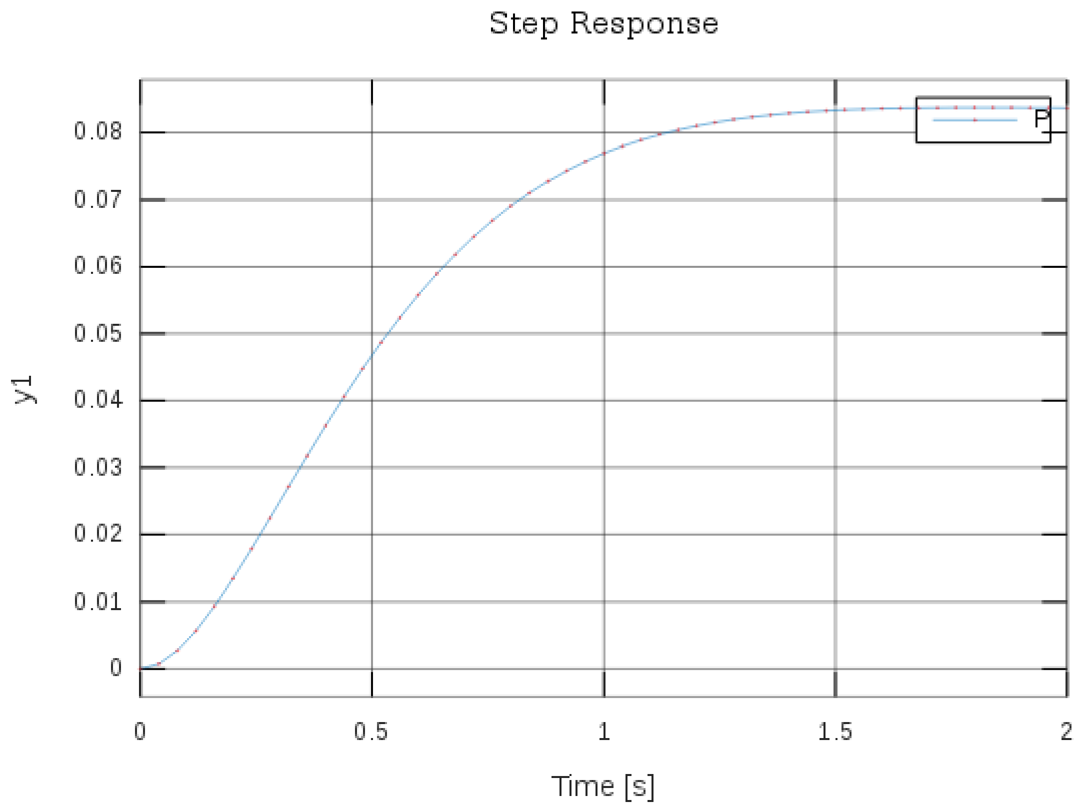
$$\frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2} \quad = \quad \frac{1}{12}\cdot\left(\frac{12}{s^2+6s+12}\right)$$



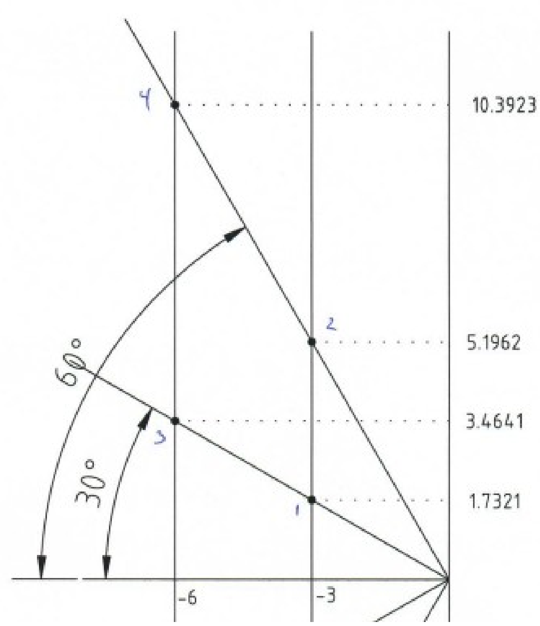



```
octave:1> n=[1];
octave:2> d=[1,6,11];
octave:3> n1=[1];
octave:4> d1=[1];
octave:5> G=tf(n,d)

Transfer function 'G' from input 'u1' to output ...

              1
 y1:  --------------
      s^2 + 6 s + 11

Continuous-time model.
octave:6> H=tf(n1,d1)

Transfer function 'H' from input 'u1' to output ...

 y1:  1

Continuous-time model.


octave:7> P=feedback(G,H)

Transfer function 'P' from input 'u1' to output ...

              1
 y1:  --------------
      s^2 + 6 s + 12

Continuous-time model.
```

```
octave:8> step(P)
```




```
Continuous-time model.
octave:3>
octave:3> [z,p,k]=tf2zp([1],[1,6,12])
z = [](0x1)
p =

  -3.0000 + 1.7321i
  -3.0000 - 1.7321i

k =  1
```



Punto 2

$$\zeta = \cos(\theta) \qquad \cos(60°) = \frac{1}{2} \qquad \zeta = \frac{1}{2}$$

$$3 = \zeta \cdot \omega_n \qquad \omega_n = \frac{3}{\frac{1}{2}} \qquad \omega_n = 6$$

Por lo tanto

$$\zeta = \frac{1}{2} \qquad \omega_n = 6$$

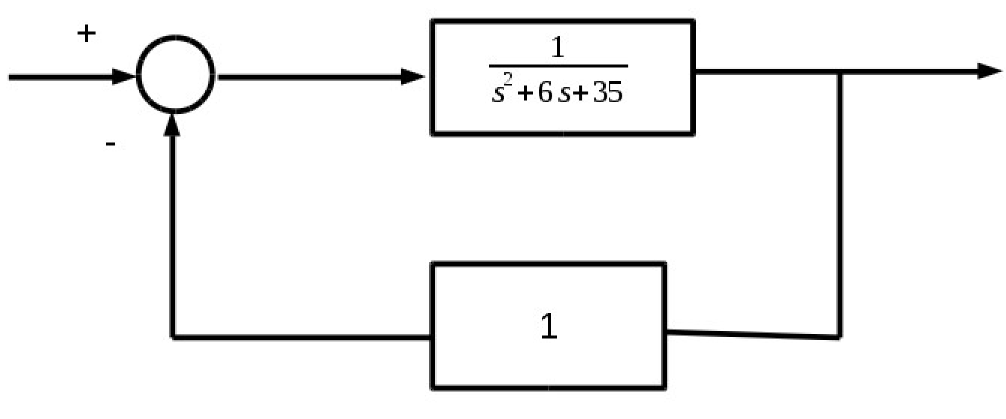
Ahora calculamos:

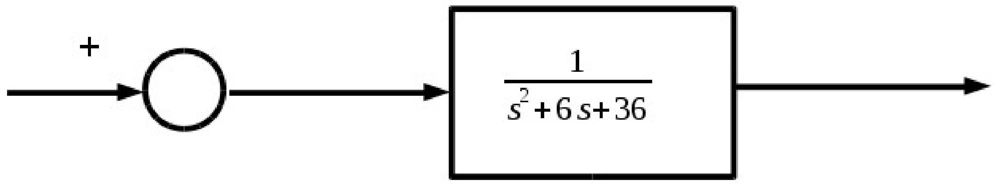
$$M = e^{-\left(\frac{\zeta \pi}{\sqrt{1-\zeta^2}}\right)} \qquad M = e^{-\left(\frac{0{,}5 \cdot \pi}{\sqrt{1-0{,}5^2}}\right)} \cdot 100 = 16{,}3\,\%$$

$$t_{2\%} = \frac{4}{(\zeta \omega_n)} \qquad \frac{4}{3} = 1{,}33\ \mathit{segundos}$$

Por último el diagrama de bloques y su comprobacion con Octave

$$\frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2} \qquad = \qquad \frac{1}{36} \cdot \left(\frac{36}{s^2 + 6s + 36}\right)$$

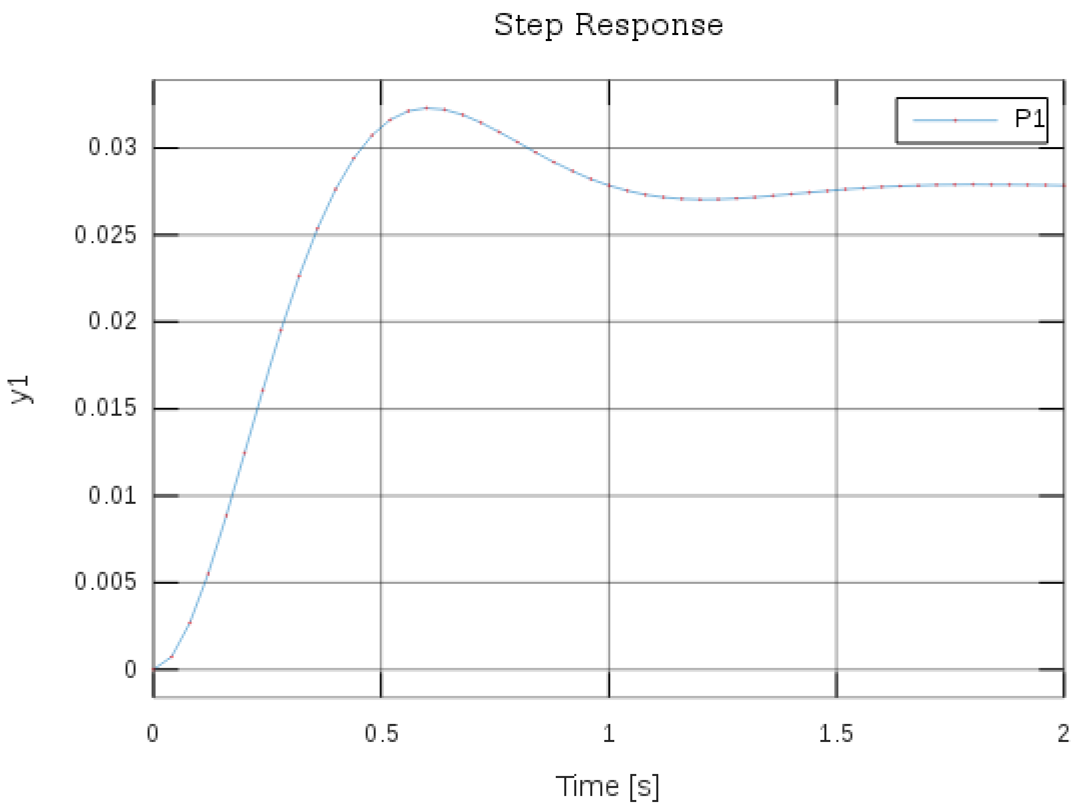




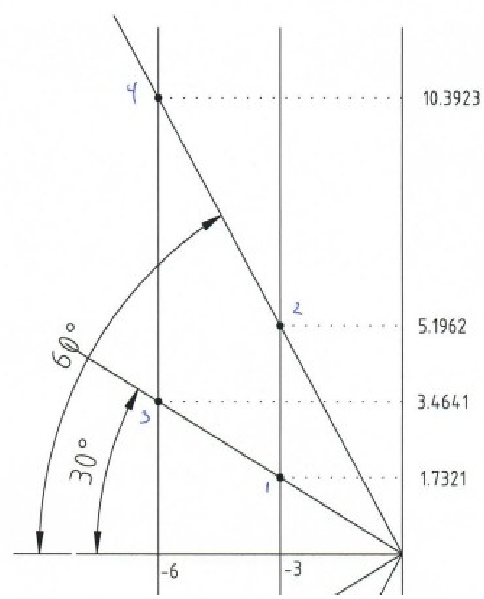

```
octave:1> n=[1];
octave:2> d=[1,6,35];
octave:3> G=tf(n,d)

Transfer function 'G' from input 'u1' to output ...

             1
 y1:  --------------
      s^2 + 6 s + 35

Continuous-time model.
octave:4> n1=[1];
octave:5> d1=[1];
octave:6> H=tf(n1,d1)

Transfer function 'H' from input 'u1' to output ...

 y1:  1

Continuous-time model.
```

```
octave:7> P1=feedback(G,H)

Transfer function 'P1' from input 'u1' to output ...

             1
 y1:  --------------
      s^2 + 6 s + 36

Continuous-time model.
```

```
octave:8> step(P1)
```




```
octave:9> [z,p,k]=tf2zp([1],[1,6,36])
z = [](0x1)
p =

  -3.0000 + 5.1962i
  -3.0000 - 5.1962i

k =  1
```



Punto 3

$$\zeta=\cos(\theta) \qquad \cos(30°)=\frac{\sqrt{3}}{2} \qquad \zeta=\frac{\sqrt{3}}{2}$$

$$6=\zeta\cdot\omega_n \qquad \omega_n=\frac{6}{\frac{\sqrt{3}}{2}} \qquad \omega_n=4\sqrt{3}$$

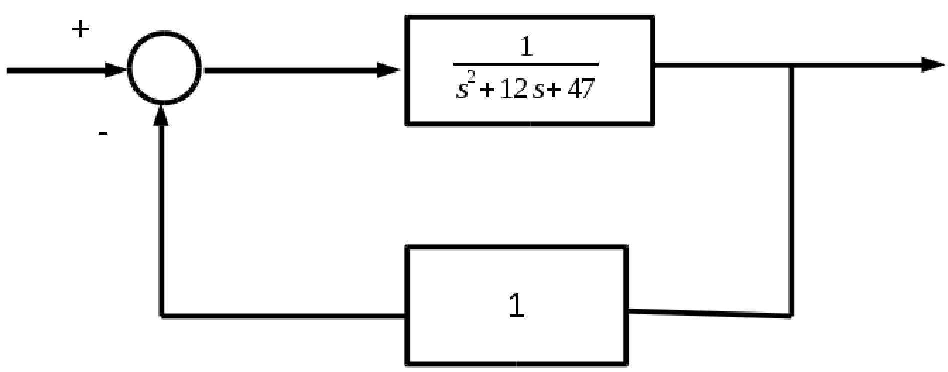
Ahora Calculamos

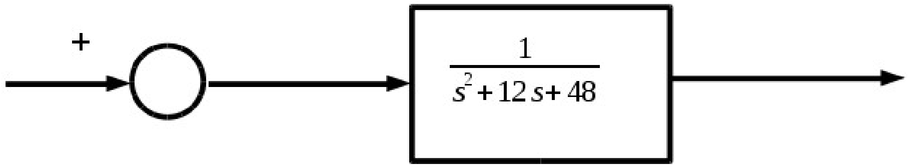
$$M=e^{-\left(\frac{\zeta\pi}{\sqrt{1-\zeta^2}}\right)} \qquad M=e^{-\left(\frac{\frac{\sqrt{3}}{2}\cdot\pi}{\sqrt{1-\left(\frac{\sqrt{3}}{2}\right)^2}}\right)}\cdot 100=0,43\%$$

$$t_{2\%}=\frac{4}{(\zeta\,\omega_n)} \qquad \frac{4}{6}=0,66\,segundos$$

Por último el diagrama de bloques y su comprobacion con Octave

$$\frac{\omega_n^2}{s^2+2\zeta\,\omega_n s+\omega_n^2} \quad = \quad \frac{1}{48}\cdot\left(\frac{48}{s^2+12s+48}\right)$$

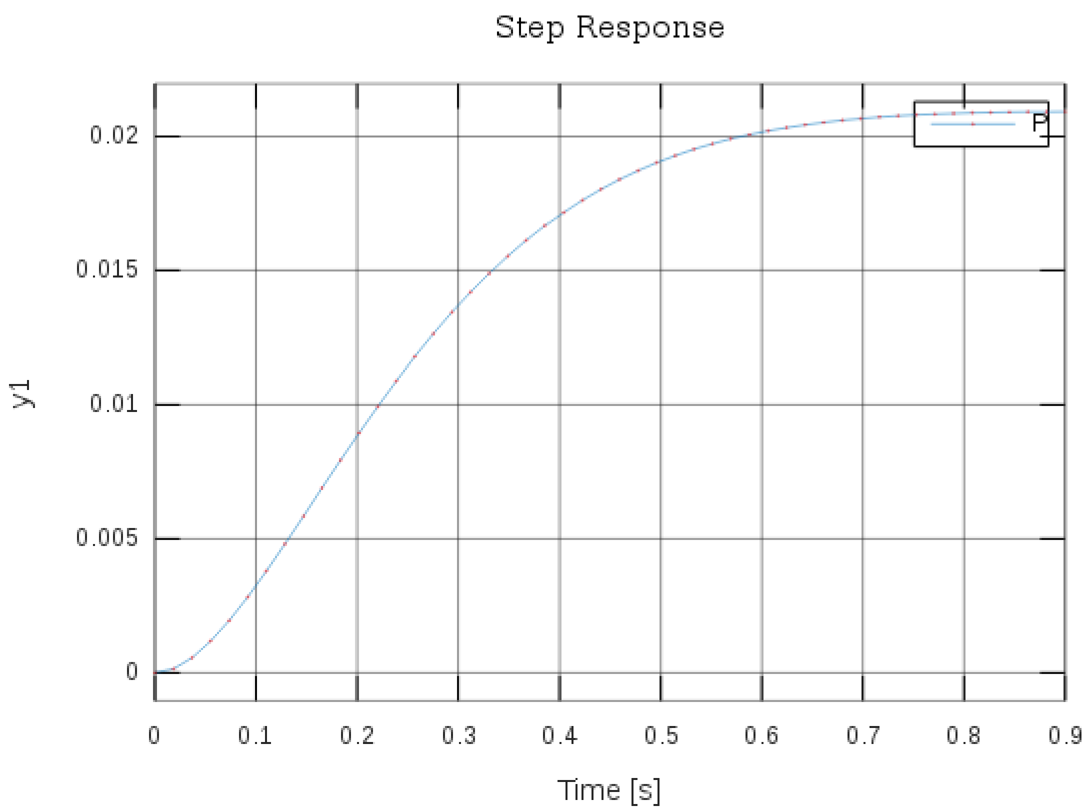




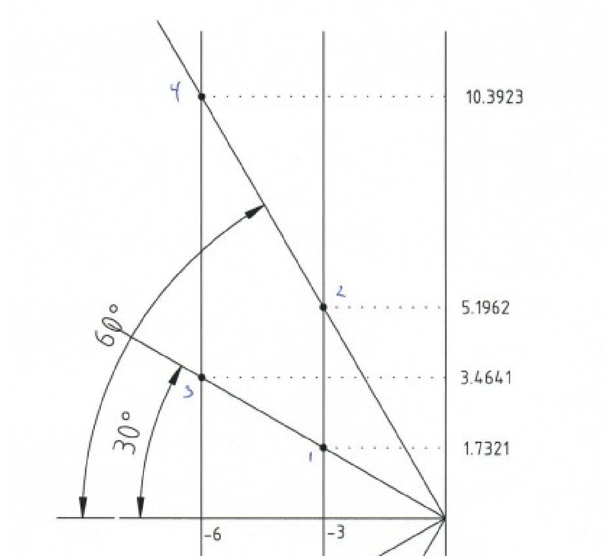

```
octave:1> n=[1];
octave:2> n1=[1];
octave:3> d1=[1];
octave:4> d=[1,12,47];
octave:5> G=tf(n,d)

Transfer function 'G' from input 'u1' to output ...

             1
 y1:  ---------------
      s^2 + 12 s + 47

Continuous-time model.
octave:6> H=tf(n1,d1)

Transfer function 'H' from input 'u1' to output ...

 y1:  1

Continuous-time model.
```

```
octave:7> P=feedback(G,H)

Transfer function 'P' from input 'u1' to output ...

             1
 y1:  ---------------
      s^2 + 12 s + 48

Continuous-time model.
```

```
octave:8> step(P)
```




```
octave:9> [z,p,k]=tf2zp([1],[1,12,48])
z = [](0x1)
p =

  -6.0000 + 3.4641i
  -6.0000 - 3.4641i

k =  1
```



Y el punto 4

$$\zeta=\cos(\theta) \qquad \cos(60°)=\frac{1}{2} \qquad \zeta=\frac{1}{2}$$

$$6=\zeta\cdot\omega_n \qquad \omega_n=\frac{6}{\frac{1}{2}} \qquad \omega_n=12$$

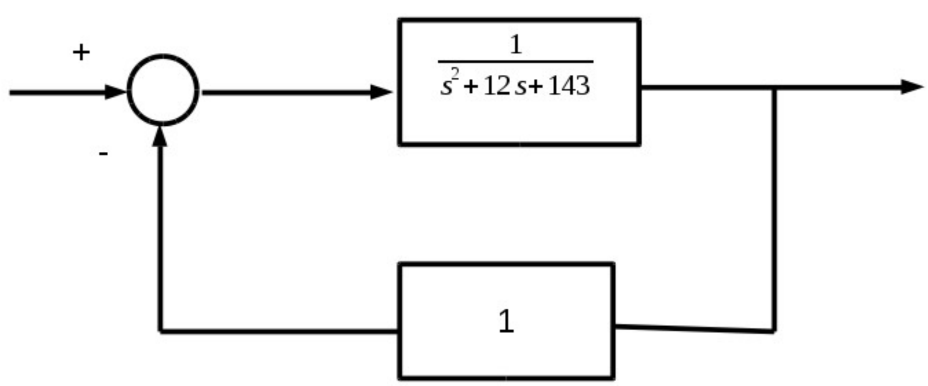
Ahora calculamos

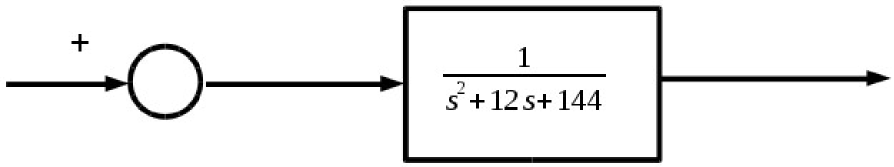
$$M=e^{-\left(\frac{\zeta\pi}{\sqrt{1-\zeta^2}}\right)} \qquad M=e^{-\left(\frac{0,5\cdot\pi}{\sqrt{1-0,5^2}}\right)}\cdot 100=16,3\,\%$$

$$t_{2\%}=\frac{4}{(\zeta\,\omega_n)} \qquad \frac{4}{6}=0,66\,segundos$$

Por último el diagrama de bloques y su comprobacion con Octave

$$\frac{\omega_n^2}{s^2+2\zeta\,\omega_n s+\omega_n^2} \quad = \quad \frac{1}{144}\cdot\left(\frac{144}{s^2+12s+144}\right)$$

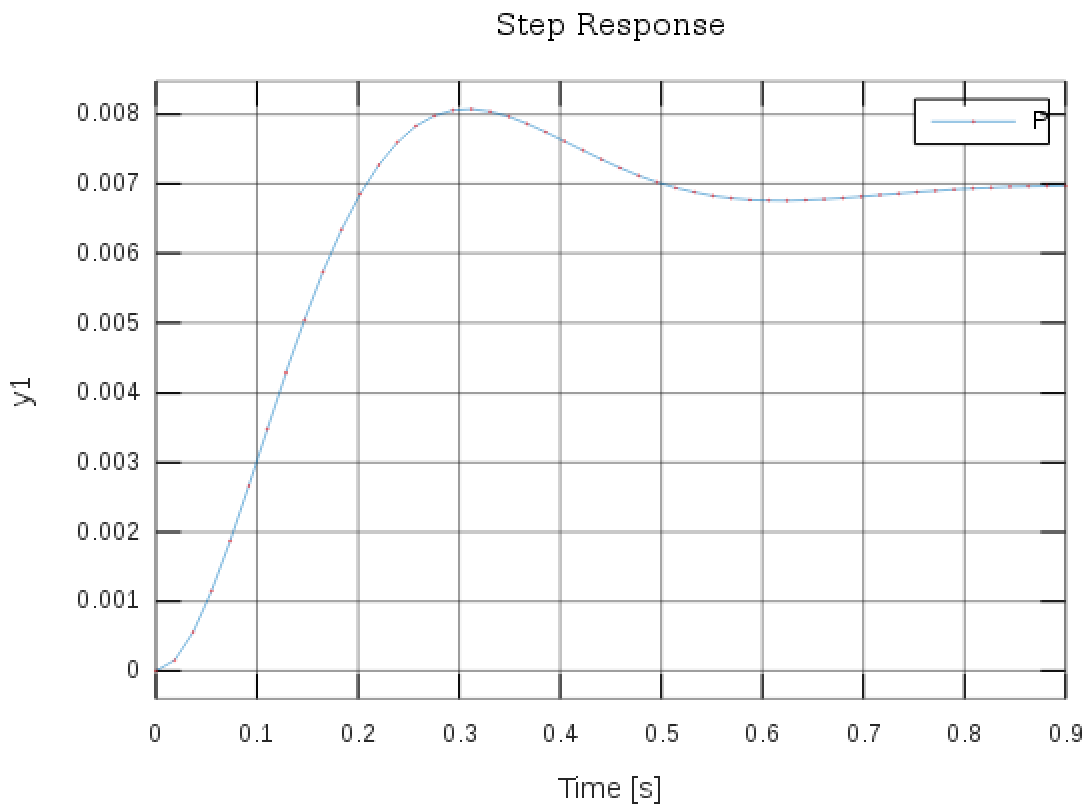





```
octave:26> n=[1];
octave:27> d1=[1];
octave:28> d=[1,12,143];
octave:29> n1=[1];
octave:30> G=tf(n,d)

Transfer function 'G' from input 'u1' to output ...

              1
 y1:  ----------------
      s^2 + 12 s + 143

Continuous-time model.
octave:31> H=tf(n1,d1)

Transfer function 'H' from input 'u1' to output ...

 y1:  1

Continuous-time model.
```

```
octave:32> P=feedback(G,H)

Transfer function 'P' from input 'u1' to output ...

              1
 y1:  ----------------
      s^2 + 12 s + 144

Continuous-time model.
```

```
octave:33> step(P)
```




```
octave:34> [z,p,k]=tf2zp([1],[1,12,144])
z = [](0x1)
p =

   -6.000 + 10.392i
   -6.000 - 10.392i

k =  1
```